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At Face Value:

Developmental Trajectories of Emotion Regulation in the Face-to-Face Still-Face  
Paradigm in the First Year of Infancy

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### Abstract

Infant regulatory strategies during the Face-to-Face Still-Face Paradigm (FFSF) were examined at 3 and 7 months as precursors to the development of infant-mother attachment security. Person-centered analyses were conducted to identify individual differences in infant negative and positive affect trajectories across the three episodes (free play, still face, reengagement) of the FFSF. Four classes were found at both 3 and 7 months: (1) a *social-positive oriented class* (3 months = 66%, 7 months = 66%) which was characterized by consistently low negative affect and high positive affect across all three FFSF episodes; (2) the *classic still-face effect class* (3 months = 66%, 7 months = 18%) with an increase in negative and decrease in positive affect during the still face; (3) a *self-comfort oriented class* (3 months = 5%, 7 months = 9%) which exhibited low levels of positive affect with a continuous decrease in positive affect across all three episodes of the FFSF, and (4) a *distressed-inconsolable class* (3 months = 8%, 7 months = 7%) which was characterized by consistently high negative affect and low positive affect across all three FFSF episodes. Class membership changes across 3 and 7 months may reflect developmental changes in infant emotion regulation. Class membership at neither time point predicted infant-mother attachment security at 14 months.

## **At Face Value: Developmental Trajectories of Emotion Regulation in the Face-to-Face Still-Face Paradigm in the First Year of Infancy**

The Face-to-Face Still-Face Paradigm (FFSF) has been used repeatedly to study infant communication patterns, caregiver sensitivity, and infant emotion regulation abilities (Mesman, et al., 2009; Tronick et al., 1978). The FFSF, which has been used with a wide age range from newborn to 9 months (Chiodelli et al, 2020; Weinberg & Tronick, 1994), consists of three, 2-minute episodes: (a) face-to-face play; (b) the “still-face” episode in which mothers hold a neutral face and remain unresponsive to their infant, and (c) re-engaging with the infant (Weinberg & Tronick, 1996). Regulation strategies utilized by infants during the FFSF are often hypothesized to be the developmental precursors to the formation of infant-mother attachment relationships at the end of the first year (Mesman, et al., 2009). Yet, there is mixed evidence supporting this premise (e.g., Cohn, Campbell, & Ross, 1991; Mesman et al., 2009). For example, Jamieson (2001) found a significant association between 4-month-old infants’ levels of negative affect and length of gaze at mother during the FFSF and attachment avoidance at 12 months, whereas another study (Kogan & Carter, 1996) found no association between 4-month-old infants’ responses in the FFSF and attachment security at 12 months. In their meta-analysis, Mesman and colleagues (2009) highlighted these inconsistent findings across studies utilizing the FFSF, which may be due to the manner in which infant affect and regulatory behaviors observed during the FFSF were coded and then analyzed to predict subsequent attachment quality.

Most studies use variable-centered, univariate analytic approaches in which infant affect and regulatory strategies are examined as single predictors of the security of the infant-mother attachment relationship (Mesman et al., 2009). Because not all infants react similarly during the

FFSF (Mesman et al., 2009), recent efforts have used person-centered analytic approaches to capture behavioral and affective profiles during the FFSF that are shared by groups of infants. The purpose of the current study was to add to this literature by using person-centered analyses (Latent Profile Analysis: LPA) to uncover individual differences in positive and negative affective trajectories during the FFSF at two developmental periods (3 and 7 months) in the first year of infancy and then examine the relations between these profiles and the security of the infant-mother attachment relationship at 14 months.

### **Individual Differences in Infant Responses to the Face-to-Face Still-Face**

The FFSF is one of the primary means of assessing the development of infant emotion regulation. The “classic still-face effect” is one in which there is a decrease in positive affect and an increase in negative affect during the still-face episode compared to the initial free play episode and an increase in positive affect again during the reengagement or reunion episode when mothers resume playing with the infant (Mesman et al., 2009; Tronick et al., 1978). Not all infants exhibit a decrease in positive affect and increase in negative affect in the still-face episode (Barbosa, Beeghly, Moreira, Tronick, & Fuertes, 2018; Motiroso et al., 2015; Papoušek, 2007), suggesting that there may be different affective profiles describing changes in infant positive and negative affect over the three episodes. To date, few studies have considered a person-centered approach to reveal individual differences in trajectory profiles of infant negative and positive affect across the episodes of the FFSF. For the few studies that have, multiple groups (or classes) have been found, underscoring individual differences in how infants respond (Barbosa et al., 2018; Motiroso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018). For instance, Barbosa and colleagues (2018) identified three groups at 3 and 9 months: (1) a *social-positive oriented* group that demonstrated high positive affect across the three episodes of the

FFSF, with a slight decrease in positive affect during the still-face episode that then rebounded during the reunion; (2) a *distressed-inconsolable* group of infants who had high negative affect across all episodes of the paradigm, particularly during the still-face episode, and who were unable to calm down during the reunion episode; and (3) a *self-comfort-oriented* group that exhibited avoidant behaviors, such as gaze aversion, with their mothers during the free play and reunion episodes in an attempt to comfort themselves rather than relying on their mothers for regulatory purposes.

Even though the person-centered studies have conducted the FFSF with infants of different ages (2 to 9 months) and have found different numbers of classes (three to five), each study was remarkably similar in identifying consistent patterns of infant negative and positive affect in the FFSF, which guided the present study. Three groups appear to emerge consistently from these person-centered analyses, with the large majority of infants expressing stable positive affect across the free play, still-face, and reunion episodes, with minimal decline or increase in negative affect (Barbosa et al., 2018; Montiroso et al., 2015; Papoušek, 2007). Another substantial number of infants were characterized by high levels of negative affect across the three episodes, with an increase during the still-face episode that did not fully decline during the reunion episode (Barbosa et al., 2018; Montiroso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018), and still others, exhibited low levels of positive and negative affect across all three episodes of the FFSF and relied on themselves for comfort and self-soothing (Barbosa et al., 2018; Montiroso et al., 2015; Papoušek, 2007). Surprisingly, few studies have found a group demonstrating the classic still-face effect, with an increase in negative and decrease in positive affect in the still face episode. In order to add to this literature, the first aim of this study was to use LPA, a person-centered analysis, to identify different classes of infants based on different

trajectories of infant positive and negative affect across the FFSF. LPA is an exploratory analytic tool that identifies unobservable groups (classes) within a sample that share common patterns of change; infants within one class share similar change patterns, but are different from infants in other classes.

### **A Developmental Perspective on the FFSF**

Even though infant emotion regulation is theorized to change significantly over the first year, with a greater reliance on external supports provided by the caregiver early in life and a greater ability to use more self-focused regulation strategies over time (Sameroff, 2009; Sroufe, 1996), there are mixed findings on whether infants behave similarly or differently in the FFSF at different points in the first year (Mesman et al, 2009, Mesman et al., 2013). One would expect older infants to be better regulated than younger infants and perhaps be less distressed by the still-face (Kochanska, Coy, & Murray, 2001). If so, then patterns of infant affect in the FFSF may change from early to later in the first year, meaning that different classes might emerge from the LPA at various timepoints. Only one previous study has utilized person-centered analyses to examine infant trajectories of affective and behavioral profiles using the FFSF at 3 and 9 months (Barbosa et al., 2018), and found that these class profiles were relatively stable across both time points. Therefore, the second aim of this study was to assess stability of class membership in infant affect trajectories observed during the FFSF across 3 and 7 months.

### **Maternal Behavior and Infant Responses in FFSF**

Caregivers play a key role in the development of self-regulation and attachment security as infants shift from mutual regulation to self-regulation across the first year of life and “learn” how to regulate their emotions during interactions with a sensitive caregiver (Sameroff, 2009). A number of studies have found relations with maternal sensitivity and infant responses in the

FFSF (Mesman et al., 2009). For example, Mesman and colleagues (2013) found that maternal sensitivity was negatively correlated with infant dysregulation during both the free play and still face episodes of the FFSF at 3 months, and that maternal sensitivity was associated with decreased positive affect during the still face episode at 6 months for infants rated temperamentally difficult by their mothers. Similarly, Kogan and Carter (1996) found that maternal sensitivity during the free play episode of the FFSF when infants were 4 months old predicted infants' abilities to use their mothers to regulate and calm down during the reengagement episode, whereas less sensitive mothering during the free play episode predicted avoidant and resistant behaviors during the reunion episode of the FFSF.

Montirosso and colleagues (2015) also examined differences in maternal behavior across their different infant profiles using the FFSF at 4 months. For instance, in the *socially engaged group* mothers were high in dyadic behavioral and affective matching and repair throughout the *free play* and *reunion* episodes of the FFSF, indicating that these mothers were the most sensitive and attuned to their infants. Mothers in the *disengaged group displayed* moderate levels of matching dyadic matching during the reunion episode (Montirosso et al., 2015). Thus, there is evidence that maternal caregiving behaviors are associated with infant affect and regulatory behaviors observed in the FFSF. Therefore, the third aim was to examine whether maternal behaviors observed during the episodes of the FFSF differed across the emerging infant profiles that might help explain the different patterns of infant affect.

### **Longitudinal Prediction of Attachment Security using FFSF**

Much of the research looking at the links between infant responses to the FFSF and infant-mother attachment security at the end of the first year have relied on variable-centered approaches (Mesman et al., 2009). For example, a longitudinal study by Braungart-Rieker and

colleagues (2014) conducted the FFSF at 3, 5, and 7 months, and found that infants who were later classified as insecure-ambivalent with their mothers in the Strange Situation Paradigm (SSP) at 12 months demonstrated an increase in positive affect from the still-face to reunion episode—although less of an increase than the infants classified as secure. Further, insecure-ambivalent infants also demonstrated greater levels of self-comforting than the secure group during the reunion episode (Braungart-Rieker et al., 2014). Other studies using variable-centered approaches have successfully predicted infant-mother attachment security at the end of the first year utilizing the FFSF at 3 months (Fuertes, Lopes dos Santos, Beeghly, & Tronick, 2006), 4 months (Braungart-Rieker, et al., 2001; Braungart-Rieker et al., 1999), and 6 months (Cohn et al., 1999; Tronick et al., 1982).

To our knowledge, only two studies have explored the association between trajectory profiles found in the FFSF using person-centered analyses and the security of the infant-mother attachment relationship at 12 months (Barbosa et al., 2020; Qu & Leerkes, 2018). Qu and Leerkes (2018) found that their *highly distressed but regulating* profile at 6 months, characterized by high negative affect, displayed “better” attachment outcomes (i.e., lower scores on avoidance, resistance, and disorganization) and were better able to utilize their caregivers to regulate their emotions during the SSP. The *over-regulated* group, characterized by high negative affect during the FFSF but significant recovery at reunion at 6 months, demonstrated the highest levels of attachment avoidance during the SSP, meaning they were more likely to avoid caregivers than rely on them for soothing during the SSP. Their *resilient-to-distress* profile, characterized by low negative affect during the FFSF at 6 months, had secure attachment outcomes, relying on their caregivers to help them regulate their emotions successfully, whereas their *under-regulated* profile, identified by the highest levels of negative affect across the FFSF



at 6 months, demonstrated the highest level of attachment resistance, actively resisting their caregiver's attempts to aid in their regulation.

Barbosa and colleagues (2020) also found a significant association between the three groups they identified at 3 and 9 months and maternal-infant attachment quality at 12 months. Specifically, their *social-positive group* at 3 and 9 months, characterized by high positive affect during the free play episode of the FFSF, a decrease in positive affect during the still-face episode, and complete recovery during the reunion episode, was associated with secure attachment at 12 months. Their *distressed-inconsolable group* at 3 and 9 months, reacted to the still face episode with negative affect that continued or increased during the reunion episode, was associated with insecure-ambivalent attachment at 12 months, and their *self-comfort group* at 3 and 9 months, identified by avoidance of the mother during the free play and reunion episodes, was associated with insecure-avoidant attachment at 12 months. These findings provide some of the first evidence that profiles of affect and regulation in the FFSF are related meaningfully to security of the infant-mother attachment relationship. However, in most cases, profiles were based on the analysis of negative and positive affect separately, rather than demonstrating how both positive and negative affect change simultaneously across the FFSF. Thus, the final aim of the current study was to examine the links between infant affective profiles identified in the FFSF at 3 and 7 months, and the security of the infant-mother attachment relationship at 14 months.

### **The Current Study**

The current study extended prior research on infant emotion regulation in the FFSF by examining both infant positive and negative affect in combination to create regulatory profiles, and then predict infant-mother attachment security at the end of the first year with four aims: (1)

to use person-centered analyses (LPA) to explore group-based trajectories of infant positive and negative affect across the FFSF at both 3 and 7 months of age; (2) to determine if these profiles were similar or different across the 3 and 7 month timepoints; (3) to examine whether the resulting latent trajectory classes also differed with respect to infant behavioral regulation and maternal behaviors observed during the FFSF; and finally, (4) to relate these trajectory classes at 3 and 7 months with the security of infant-mother attachment at 14 months of age.

**Hypotheses.** Based on the previous person-centered FFSF studies (Barbosa et al., 2018; Montirosso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018), we expected to identify at least four latent profiles using LPA: (1) a *social-positive oriented* group that demonstrated high positive affect across the paradigm with only a slight increase in negative affect during the still-face episode; (2) a “*classic still-face effect*” group characterized by a decrease in positive affect and an increase in negative affect during the still-face episode compared to the initial free play episode, with partial recovery during the reunion episode; (3) a *distressed-inconsolable* group whose distress increases throughout the FFSF episodes; and (4) a *self-comfort oriented* group who will exhibit neutral affect throughout the paradigm and rely mostly on self-comforting behaviors rather than their mother for regulating their distress.

Because emotion regulation abilities theoretically become more organized over time (Schore, 1994; Kopp, 1989), we also hypothesized that membership in the groups may not be stable across 3 and 7 months. Because maternal behavior scaffolds the development of emotion regulation early in life (Sameroff, 2009), we also hypothesized that the resulting profiles would differ with respect to maternal behaviors and should predict attachment security at the end of the first year, but we did not advance directional hypotheses given the limited number of person-centered studies conducted on the FFSF to predict infant-mother attachment security.

## Methods

### Participants

Participants included 154 mother-infant dyads involved in a longitudinal study investigating the effects of maternal perinatal mental health across the first year of infancy. Pregnant women were recruited through obstetric offices affiliated with a large Midwestern university. Women were eligible to participate if they were over 20 years old with no chronic medical conditions, substance dependence or abuse, or diagnosis of eating disorders or bipolar disorder. Potential participants were administered the Structured Clinical Interview for DSM-IV (SCID-IV) by clinicians at 28-weeks prepartum and were eligible for the study if they were not currently depressed but had a history of depression, making them at-risk for future depressive episodes. Women were divided into high-risk (a history of at least one episode of depression) and low-risk (no history of depressive episodes) groups at the time of recruitment but were combined for the current analyses as a non-significant t-test revealed there were no differences across groups on maternal depression. All infants had to be born full-term (> 37 weeks) and have a birth weight greater than 2,500 grams.

Mothers ranged in age from 21 to 43 years,  $M = 30.49$ ,  $SD = 4.96$ . The majority were married (83.8%). Seventy-five percent of the sample identified as White, 6.5% as Asian or Pacific Islander, 9.7% as African American, 4.5% as Hispanic, and 3.9% as other. Most of the mothers had completed college (26.8%) or a graduate degree (35.3%). Forty-nine percent of the mothers were working full-time whereas 19.5% were working part-time. Over 50% had a household income of greater than \$70,000.

Due to attrition, 82 mother-infant pairs remained in the study at 14 months. These women differed significantly from the 154 recruited for the study in that they were significantly older,

$t(82) = 2.06, p = .04$ , had more education,  $\chi^2(4, N = 82) = 21.71, p < .001$ , had higher household incomes,  $\chi^2(20, N = 82) = , p < .05$ , and were more likely to be married,  $\chi^2(4, N = 82) = 0.54, p < .01$ . Participants also differed in the composition of racial group representation at 14 months,  $\chi^2(4, N = 82) = 13.02, p < .05$ , with an increase in the percentage of White participants and a decrease in all other racial groups.

## Procedures

This longitudinal study included multiple time points throughout pregnancy and the postpartum period (see Marcus et al., 2011; Thomason, et al. 2014), but we focus on the three postpartum time points (3 months, 7 months, and 14 months) here as they are the source of information for the current report. The goal of the larger, comprehensive study was to examine the development of infant behavioral and physiological regulation across the first year of infancy and maternal psychosocial and environmental influences. A home visit was conducted at both 3 and 7 months and consisted of three interactive paradigms: (1) a five minute face-to-face free play in which the mother was instructed to play with her infant as she normally would; (2) the FFSF with three two minute episodes (play, still face, reunion), and (3) a three minute teaching task that consisted of the mother attempting to teach the infant to swipe or bat at a ring. When infants were 14 months of age, mothers and infants visited the university laboratory where the Strange Situation Procedure (SSP) was conducted. The current study utilized observational data collected in FFSF at 3 and 7 months, and SSP at 14 months.

## Measures

**Face-to-Face Still-Face Paradigm.** The FFSF is a standard procedure used to evaluate the infant's ability to regulate their emotions (Tronick, Als, Adamson, Wise, & Brazelton, 1978). The protocol used for the FFSF was adapted from the Michigan Family Study, a longitudinal

study of infant emotion regulation (Rosenblum, McDonough, Muzik, Miller, & Sameroff, 2002). The FFSF was conducted during the home visits at 3 and 7 months using a video camera focused on the infant, and a large mirror placed next to the baby that allowed images of both infant and mother to be recorded simultaneously for later coding. Mothers sat on a floor mat facing the infant, who was in an infant seat, and were instructed to play with the infant without using toys for two minutes (free play), then to hold a neutral, unwavering face for two minutes (still-face), then to play with the infant again for two to four minutes (reunion). There were 5-second pauses between these sessions and the paradigm was discontinued if infants became increasingly distressed for more than 30 seconds. Mothers were told that they could stop the session at any time (see Rosenblum et al., 2002).

*Coding of infant and maternal behaviors in the FFSF.* Infant and maternal behaviors during the FFSF were coded using a system adapted by Rosenblum et al. (2002) that provided global ratings of infant and maternal behaviors during the three episodes of the FFSF, using 3-point rating scales from 0 (none) to 3 (predominant) by three trained coders. Maternal and infant behaviors were coded by independent coders, and reliability was calculated on a randomly chosen 25% of the sample using Cohen's Kappa (Cohen, 1968).

For infants, each episode of the FFSF (free play, still-face, and reunion) was rated on eight behaviors and included: (a) *positive affect* ( $\kappa = .766$ ) - pleasant interaction, including smiling and laughing; (b) *negative affect* ( $\kappa = .938$ ) - negative interaction, including crying, whining, and fussing; (c) *arousal* ( $\kappa = .827$ ) - increased protest in response to maternal bids; (d) *avoidance* ( $\kappa = .868$ ) - ignores mother's attempts to engage; (e) *resistance* ( $\kappa = .827$ ) - seems angry or pulls away from mother; (f) *seek maintain* ( $\kappa = .888$ ) - attentive and responsive to mother; (g) *distress regulation* ( $\kappa = .937$ ) - infant's pattern of regulating distress; and (h)

*self/object* ( $\kappa = .777$ ) (coded during the still-face episode only) - infant involvement with self/objects that are not the mother

For mothers, ten maternal behaviors were coded during the free-play and reunion episodes, and included (a) *engagement* ( $\kappa = .74$ ) - successful positive engagement in interaction with the infant; (c) *sensitivity during distress* ( $\kappa = .93$ ) - appropriate and sensitive response to infant distress; (d) *sensitivity during non-distress* ( $\kappa = .604$ ) - appropriate and sensitive interaction with the infant generally; (e) *intrusiveness* ( $\kappa = .813$ ) - rough handling of the infant; (f) *positive affect* ( $\kappa = .749$ ) - smiling, soothing, and positive vocalizations; (g) *tension or anxiety* ( $\kappa = .68$ ) - nervous about her interactions with the baby). For the current analyses, sensitivity to distress and sensitivity to non-distress were averaged to create a more robust composite of maternal sensitivity.

**Strange Situation Procedure.** The SSP (Ainsworth, Blehar, Waters, & Wall, 1978) is a 21-minute procedure that consists of seven 3-minute episodes, in addition to a brief 1-minute introduction, and a series of separations and reunions that is intended to assess the security of the parent-infant attachment relationship. The reunions (episodes 5 and 8) were coded using four 7-point rating scales to assess (a) *proximity seeking* - effort and initiative in seeking physical contact from the mother, (b) *contact maintenance* - effort to maintain physical contact with the mother, (c) *resistance* - resistance to interaction and physical contact with mother, and (d) *avoidance* - efforts to avoid interaction or physical contact with mother, which are used to classify infants into three attachment groups: insecure-avoidant (A = 12, 15%), secure (B = 42, 51%), and insecure-ambivalent (C = 10, 12%). SSP were also coded reliably by two coders for disorganized behaviors and classified as disorganized (D = 18, 22%) or non-D. We considered the association between the profiles generated at 3 and 7 months and the ABCD classifications,

but given the small sample size A, B, and C were collapsed into one insecure group ( $n = 64$ , 78%) and also compared with secure infants ( $B = 18$ , 22%). Interrater agreement was 89.36% and disagreements were resolved through discussion.

### **Data Analysis Plan**

To investigate the development of different negative and positive affective trajectories across the 3- and 7-month FFSF, we used Latent Profile Analysis (LPA), a non-parametric, exploratory, person-centered analysis, to identify groups of infants expressing similar affective profiles (Gibson, 1959; Vermunt & Magidson, 2002). LPA allowed us to determine if similar trajectory patterns reported in earlier FFSF studies using person-centered approaches (Barbosa et al., 2018; Montiroso et al., 2015; Papoušek, 2007) could be replicated in the current study at both 3 and 7 months. LPA is unique in that classes can be estimated based on multiple variables without imposing restriction on the nature of change; LPA allows flexibility in modeling the means on each variable across classes, assumes homogeneity of variances across classes and local independence across variables (e.g., Lazarfeld & Henry, 1968). We focused on both positive and negative affect across the three episodes of the FFSF because they are represented widely in most coding systems of the FFSF, and because it allowed us to examine change in both positive and negative affect across the episodes of the FFSF. LPA analysis allowed a multivariate approach in which infant positive and negative affect were modeled simultaneously across the three episodes of the FFSF rather than analyzing negative and positive affect as independent trajectories or focusing on affect ratings in one episode separate from the other two.

Once the different affective trajectories were revealed, we then conducted repeated measures ANOVAs to examine mean differences in infant behaviors coded during the FFSF across profile classes. This allowed us to consider class differences in infant regulation behaviors

and help provide labels for the different infant profiles of the FFSF. A similar analysis strategy was used to determine whether the resulting infant affective profiles differed with respect to maternal behavior observed across the episodes of the FFSF. Post hoc comparisons were conducted using Tukey's Honestly Significant Difference test and the Games-Howell test for variables that violated homogeneity of variance assumptions. Finally, chi-square analyses were conducted to determine if the different infant profiles were associated across 3 and 7 months, and whether they were associated with the SSP attachment classifications at 14 months.

## Results

### Infant Profiles at 3 months

Profile solutions were evaluated with LPA at both 3 and 7 months for 2-, 3-, 4- and 5-class models. Based on fit indices, results from the LPA indicated that at 3 months, the four-class solution was the best fit (AIC = 1411.7, BIC = 1498.0, LMRT-LRT  $p$ -value = .06, Entropy = .98) compared to the 3-class solution (AIC = 1466.1, BIC = 1534.1, LMRT-LRT  $p$ -value = 0.1, Entropy = 0.93). Although the five-class model (AIC = 1354.9, BIC = 1459.5, LMRT-LRT  $p$ -value = 0.7, Entropy = 0.97) provided the lowest AIC and BIC, there were only two infants in the fifth class which led to our selection of the four-class solution.

Table 1 shows the means and standard deviations of each LPA profile and FFSF episode at 3 months based on infant positive and negative affect. To provide a complete description of each class, we also conducted a 4 (class) x 3 (episode) repeated measures ANOVA, with episode as the repeated measure and class as the between group factor, to assess the main effects of class and FFSF episode using infant regulatory responses as the dependent variables. As shown in Table 1, there were significant main effects for class for infant positive affect, negative affect, distress regulation, avoidance, resistance, and seek maintain behavior; mean differences based on



*post-hoc* comparisons can be found in Table 1. The tests of significance for the repeated measures ANOVAs on the positive and negative variables are presented for completeness but their interpretation is ambiguous because these variables were the same variables used to estimate the classes in the LPA.

The first and largest class ( $n=67$ , 66%) was labeled the *social-positive oriented* class because the parameters were most similar to the class of the same name identified by Barbosa and colleagues (2018). This class was characterized by consistently low negative affect across all three FFSF episodes, with high scores on positive affect that decreased minimally during the still-face episode (see Figure 1). Mean differences were also found for other infant regulatory behaviors; infants displayed significantly higher distress regulation abilities than the other classes, the lowest levels of resistance and highest seek/maintain behaviors when compared with the other classes (see Table 1).

The second profile was labeled as the *classic still-face effect* class ( $n=20$ , 21%) because they expressed the classic still-face trajectory of high positive affect and low negative affect during the free play episode, with a decrease in positive affect and increase in negative affect during the still-face episode and an increase in positive affect during the reunion episodes, with some negative affect spillover from the still-face episode (Mesman et al., 2009; Tronick et al., 1978; see Figure 1). Significant main effects of class for distress regulation and seek/maintain behaviors (see Table 1) also revealed that this class displayed significantly lower levels of distress regulation and seek/maintain behaviors, as well as higher levels of resistance behaviors, than the *social positive oriented* class above (see Table 1).

The third and smallest profile was named the *self-comfort oriented* class ( $n=5$ , 5%), again based on the classifications by Barbosa and colleagues (2018). This class exhibited low

levels of positive affect with a continuous decrease in positive affect across all three episodes of the FFSF. This group was also characterized by low negative affect during the still-face episodes and increased negative affect during the reunion episode (see Figure 1). They exhibited significantly less distress regulation than the *social positive oriented class* but significantly more than the *classic still face class* and the *distressed-consolable class* to be described next, meaning they were able to comfort themselves when distressed (see Table 1).

The fourth class was labeled the *distressed-inconsolable class* ( $n = 7, 8\%$ ) and, as shown in Figure 1, was characterized by consistently high negative affect and low positive affect across all three FFSF episodes, and a decrease in positive affect during the still-face episode. This group displayed significantly lower levels of distress regulation and seek/maintain behaviors, along with the highest levels of arousal and resistance behaviors than the other three classes, suggesting these highly distressed infants were unable to console themselves or use their caregiver to regulate their distress across the FFSF (see Table 1).

A 4 (class) x 2 (episode) repeated measures ANOVA, with episode as the repeated measure and class as the between group factor was also conducted to examine whether classes differed with respect to maternal behaviors observed during the FFSF episodes. There was only one significant effect of class; *post-hoc* comparisons revealed that mothers of infants in the *social positive oriented class*,  $M = 3.64, SD = .671$ , were more engaged in interaction during the free play episode than mothers of *distressed-inconsolable* infants,  $M = 2.89, SD = .928; p < .05$ .

### **Infant Profiles at 7 Months**

At 7 months, LPA also suggested a four-class solution was the best choice (AIC = 1130.13, BIC = 1213.0, LMRT-LRT  $p$ -value = 0.8, Entropy = 0.95) over the three-class (AIC =

1208.21, BIC = 1273.5, LMRT-LRT  $p$ -value = 0.4, Entropy = 0.92) and five-class model (AIC = 1134.61, BIC = 1235.05, LMRT-LRT  $p$ -value = 0.75, Entropy = 0.90).

Table 2 shows the means and standard deviations of each LPA profile and FFSF episode at 7 months based on infant positive and negative affect. A 4 (class) x 3 (episode) repeated measures ANOVA, with episode as the repeated measure and class as the between group factor was conducted to provide more descriptive information in labeling the classes, using infant regulatory behaviors as the dependent variables. As shown in Table 2, there were significant main effects of class for infant negative affect, distress regulation, resistance, and seek/maintain behavior.

The four profiles at 7 months were similar to those found at 3 months and were labeled accordingly (see Figure 2). *Post-hoc* planned comparisons revealed significant mean differences across classes (see Table 2). The first and largest class ( $n=54$ , 66%) was the *social-positive oriented* class and was characterized by consistently low negative affect across all three FFSF episodes, with higher scores on positive affect that decreased minimally during the still-face episode and showed the least resistance and significantly more distress regulation than the other classes.

The second profile was the *classic still-face effect* class ( $n=15$ , 18%) because these infants expressed the classic still-face trajectory of high positive affect and low negative affect during the free play episode, with a decrease in positive affect and increase in negative affect during the still-face episode and an increase in positive affect during the reunion episodes (Mesman et al., 2009; Tronick et al., 1978). These infants also had lower distress regulation, and seek-maintain behaviors, and higher resistance than the *social positive oriented* class.

The third profile was named the *self-comfort oriented* class ( $n=7$ , 9%) and exhibited low levels of positive affect with a continuous decrease in positive affect across all three episodes of the FFSF. This group was also characterized by low negative affect during the still-face episodes and increase negative affect during the reunion episode (see Figure 2). These infants also used similar levels of distress regulation as the *social-positive oriented* infants, but also expressed significantly more resistance than any other class. (see Table 2).

The fourth profile was labeled the *distressed-inconsolable* class ( $n=6$ , 7%) and, as shown in Figure 2, was characterized by consistently high negative affect and low positive affect across all three FFSF episodes, and a decrease in positive affect during the still-face episode. These infants had the lowest levels of distress regulation than other classes and expressed more resistance than the *social-positive oriented* and *classic still face* infants.

Table 4 summarizes the results from the 4 (class) x 2 (episode) repeated measures ANOVA, with episode as the repeated measure and class as the between group factor, and the maternal behaviors observed during the FFSF episodes as the dependent variables. There was a significant main effect of class for maternal engagement, with mothers in the *social-positive oriented* class significantly more engaged in both the free play,  $M = 3.42$ ,  $SD = .700$ , and reunion episodes,  $M = 3.25$ ,  $SD = .751$ , than mothers in the *distressed-inconsolable* class,  $M_{\text{freeplay}} = 2.43$ ,  $SD = .787$ ;  $M_{\text{reunion}} = 2.33$ ,  $SD = .516$ ;  $p$ 's < .05.

### **Stability of Profiles Across 3 and 7 Months**

In order to determine if infants were classified in similar class profiles across the 3- and 7-month timepoints, chi-square analyses were conducted and revealed no significant association across class membership at 3 months and 7 months,  $\chi^2(9, N = 86) = 9.55$ ,  $p = .39$ . For 67 infants categorized as *social-positive oriented* at 3 months, 65% received the same categorization at 7

months. Of the 20 infants categorized as *classic still-face effect* at 3 months, only 10% received the same classification at 7 months. Of the five *self-comfort oriented* infants, 20% received the same categorization at 7 months, and of the nine *distressed-inconsolable* infants, 11% received the same classification at 7 months (see Table 5).

### **Infant Profiles in the FFSF Predicting the Security of Infant-Mother Attachment.**

To examine the association between the FFSF profiles and the security of the infant-mother attachment classification at 14 months, chi-square analyses were conducted to examine the association between each of the four infant affect profiles at 3 and 7 months and the four attachment categories (ABCD). No significant association was found  $\chi^2(9, n = 36) = 2.93, p = .967$ .

We also tested whether there were associations between the emotion regulation profiles when we divided the attachment classifications into secure and insecure (B versus ACD),  $\chi^2(3, n = 36) = 2.93, p = .403$ , or disorganized and non-disorganized (ABC versus D),  $\chi^2(3, N = 36) = 1.26, p = .739$ , but these analyses were all nonsignificant.

### **Discussion**

Given the relevance of early emotion regulation for the formation of secure infant-mother attachment relationships and infant socioemotional development, the primary aim of this study was to examine individual differences in infant affective responses during the FFSF at 3 and 7 months by using a person-centered approach to uncover latent profiles or classes of infants showing similar affective patterns across the FFSF. In an effort to further delineate differences among the affective profiles, we also examined infant regulatory behaviors during the FFSF in order to label the overall pattern of affective and behavioral regulation used by infants in each class, and then examined whether maternal behavior differed across each class based on the

theory that early infant emotion regulation is one of mutual regulation between infant and caregiver before being consolidated into self-regulatory strategies that emerge over the first year (Sameroff, 2009). Finally, we wanted to explore the stability or instability of these groups across 3 and 7 months, and whether these groups predicted infant-mother attachment security at 14 months.

### **Individual Differences in Infant Affect During the FFSF.**

In contrast to many earlier studies using variable-centered approaches, the current study utilized a person-centered approach using LPA in which we analyzed changes in infant positive *and* negative affective across the FFSF simultaneously, rather than independently (see Barbosa et al., 2018; Montirosso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018), as a means of defining profiles of infant emotion regulation. The advantage of conducting the LPA in this manner was so that the resulting classes were based on how both the infants' negative and positive affect changed over time together, in contrast to a focus on either negative or positive affect separately. In line with earlier studies taking a person-centered approach, we hypothesized that there would be at least three groups identified and perhaps as many as five (Barbosa et al., 2018; Montirosso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018). The results from the current study are consistent with several of these previous studies, finding four classes of infants who shared similar trajectories of negative and positive affect across the FFSF. We used similar labels to Barbosa et al. (2018) in defining these groups for ease of interpretation and continuity across studies. The largest groups (67%) at both 3 and 7 months were the *social-positive oriented* group, who demonstrated consistently low negative affect across all FFSF episodes, and were rated highly on positive affect with a slight decrease during the still-face episode. These response patterns suggested that although these infants do register the non-responsivity of their mother

and are confused by this change in interaction, they can successfully regulate their negative affect and seem to trust that their mother will ultimately resume her typical interaction style. The fact that this was the largest group found here and in previous studies (Barbosa et al., 2018; Montirosso et al., 2015; Papoušek, 2007) indicates that this profile showing consistently high positive affect and low negative affect, occurs far more than the classic still face effect described next.

The second group found across both 3 and 7 months was what we referred to as the *classic still-face effect* group (20%) and expressed high positive affect and low negative affect during the free play episode, with a decrease in positive affect and an increase in negative affect during the still-face episode, and an increase in positive affect during the reunion episode. This pattern has been noted in the FFSF literature as the standard response for infants who have experienced sensitive caregiving (Mesman et al., 2009; Tronick et al., 1978), yet not all of the person-centered studies have found this classic effect for the majority of infants in the FFSF. According to the previous hypotheses regarding this group, infants are distressed by the absence of interaction during the still-face episode because this experience is so far removed from their usual interaction with their caregiver. Their engagement of their caregiver again to regulate their affect upon the reunion episode indicates a regulated dyadic response (Tronick et al., 1978).

The third group identified was the *distressed-inconsolable* group (9%) of infants who were distraught across each of the episodes of the FFSF (see also Barbosa et al., 2018), and were unable to use their caregiver to regulate their emotions, underscoring that this group of infants may very well be dysregulated. Mothers of these infants were also significantly less engaged with their infants during the free play and reunion episodes of the FFSF than mothers of the

*social-positive* class, suggesting that mothers may not have provided infants with the necessary scaffolding to assist their infants with emotion regulation.

The final group found was the *self-comfort oriented* group (5%), who demonstrated a continuous decrease in positive affect across all three episodes in conjunction with low negative affect during the still-face episode, where one would expect the withdrawal of the caregiver to be upsetting. Instead, this group was increasingly distressed when their caregiver was interacting with them, which could also indicate dysregulation and disruption in the caregiver-infant relationship.

### **Does Maternal Behavior in the FFSF Relate to Infant Profiles?**

Although we proposed that maternal behaviors should also differ across the different profiles of emotion regulation, we found surprisingly little evidence that mothers behaved differently in the FFSF based on the affective profiles found here. At 3 and 7 months, maternal engagement was significantly higher during FFSF interactions for the *social-positive oriented* class when compared with the *distressed-inconsolable* class. The lack of maternal differences across classes is surprising for many reasons, the first being that there is a robust literature linking maternal behavior and infant regulation (Sameroff, 2009; Schore, 1994). Second, others have found significant differences in maternal behavior across FFSF profiles (Montirosso et al., 2015; Papoušek, 2007). Papoušek (2007) found significant differences between groups on maternal depressive symptomology, with depressed mothers demonstrating a lack of eye contact, smiling, positive facial expressions and responsiveness, which they hypothesized lead to infants showing little reaction to the still-face episode because there was seemingly no change in the mothers' behavior.



Although Montirosso and colleagues (2015) did not find such differences in maternal depressive symptomology in their sample, they did find that mothers of their *socially engaged* and *disengaged* groups exhibited higher levels of positive social-emotional behaviors and affect during interaction than mothers of their *negatively engaged* group. Barbosa and colleagues (2018; 2020) did not examine differences in maternal behaviors among their three groups, however, two studies that utilized their coding system, with different samples, did find that maternal behavior was significantly related to FFSF group assignment (Costa Ribeiro et al, 2020; Fuertes et al, 2020). Costa Ribeiro and colleagues (2020) found that, at 3 months, infants of mothers who demonstrated more sensitive behaviors during the free play episode were more likely to be categorized as *social-positive oriented*, while infants of mothers who demonstrated more control-intrusiveness behavior during the free play episode of the FFSF were categorized in the *self-comfort oriented group*. Fuertes and colleagues (2020) also found that, at 3 months, mothers of infants in the *social-positive oriented group* showed increase maternal sensitivity, mothers of infants in the *self-comfort oriented group* showed increased maternal control, and mothers of infants in the *distressed-inconsolable group* were more unresponsive than mothers in the two other groups.

The lack of differences in maternal behaviors across profiles in our study could be due to the small number of infants in two of our groups, the *self-comfort oriented group* ( $n = 5$ ) and *distressed-inconsolable group* ( $n = 9$ ), which may have decreased variability and the power to detect class differences in maternal behaviors. We also conducted the FFSF during home visits instead of the laboratory, and the more familiar home environment may have affected how mothers interacted with their infants. Different results may have been found had we used independent assessments of maternal caregiving outside the context of the FFSF such as

unstructured mother-infant interaction in naturalistic observations (Belsky et al., 1984), or even in lengthier and more structured laboratory observations of mothers during free-play interaction (Crugnola et al., 2013). Future research may need to look beyond maternal behavior in the FFSF to investigate the link between maternal behavior and infant affective and behavioral regulation during the FFSF.

### **Group Stability in Longitudinal Analysis of Infant Behavior in the FFSF**

We wanted to explore the stability or instability of the profiles at 3 and 7 months because according to Bowlby (1969), the 3- and 7-month time points span two different phases in the formation of attachment relationships in the infant's first two years. The second phase of attachment, defined by "discriminating sociability" occurs during the first 2 to 6 months of life and is a period when infants begin to show preference for specific adults, but have not yet developed separation anxiety. The third phase of attachment, aptly referred to as "attachment", begins at 6 months and extends to 24 months and is a time when attachment relationships become solidified. These differing relational phases are why we speculated that different profiles may be found at 3 and 7 months, and that infants' classification in these profiles may not be stable over time. Even though we found similar profiles at 3 and 7 months with respect to the infants' affective expression and regulation, we did not find stability in membership over this period of time suggesting that infants did indeed change how they responded to the episodes of the FFSF from 3 to 7 months in line with developmental expectations.

Only one previous study explored the stability of profiles longitudinally at 3 and 9 months (Barbosa et al., 2018), finding three similar classes, *social-positive oriented*, *distressed-inconsolable*, and *self-comfort oriented*, with the majority of infants (88.3%, 84.2%, and 64.3, respectfully) remaining in the same groups across time. In the current study, we also identified

four similar classes at 3 and 7 months, but, unlike Barbarosa et al. (2018) we did not find that the majority of infants remained in the same group across time. It appears, then, that infants in the current study, changed in their affective and regulatory patterns during the FFSF conducted during home visits at 3 and 7 months.

There are several possible explanations for this discrepancy across the two studies. First, our study administered the FFSF at home, whereas Barbosa and colleagues (2018) conducted the FFSF with mother-infant dyads in the lab. It is possible that being in the lab versus being at home are two very different emotional experiences for infants and their mothers — just being in the novel environment of the lab may be a stressor that the infant has to cope with in addition to the FFSF paradigm, and thus eliciting more negative affect that might be more stable over time. Perhaps mothers and infants felt more comfortable and less stressed in their every-day home environment. Conducting the FFSF in the home may also explain why the majority of infants were classified in the *social-positive oriented* class and did not appear to be distressed during the SF episode, but remained fairly high in positive affect with a very slight decrease during the still-face episode. The more familiar home environment may have created a less stressful context and in turn less distress and need for distress regulation in the FFSF. However, others have also found a large *social-positive oriented class* when conducting the FFSF in the lab so these context differences alone cannot explain the lack of stability found here (Fuertes et al., 2021). Future research may want to consider contextual variables further and how infant behaviors in the FFSF may vary as a function of where (lab versus home) and when (age) the FFSF is conducted. Finally, Barbosa and colleagues utilized The Coding System for Regulatory Patterns in the FFSF (Fuertes & Lopes dos Santos, 2009) which categorizes the infants *a priori* into three main groups, while our study relied on LPA which is data driven and uncovers profiles within the

sample by classifying infants exhibiting similar patterns of affect across the FFSF. These differences in methodology could also account for our divergent results.

### **Do Emotion Regulation Profiles at 3 and 7 Months Predict Infant-Mother Attachment?**

The final aim of this study was to determine whether the FFSF profiles of infant affect at 3 and 7 months were associated with infant-mother attachment security at 14 months. Previous research has been inconsistent in this regard, with Braungart et al., (2014) finding links between changes in positive affect in FFSF at 3, 5, and 7 months and security of infant-mother attachment at 12 months, while Cohn, Campbell, and Ross (1991) studied infants at 2, 4, and 6 months and only found an association between positive affect and mother-infant attachment security at 6 months. One reason for these inconsistencies (see also Mesman et al., 2009) is that the majority of studies examining the link between the FFSF and attachment classifications have utilized a variable-centered approach, examining each behavior in the FFSF as a predictor of the infant's attachment classification (Mesman et al., 2009) or looking at profile differences based on the overall ratings of avoidance and resistance during the episodes of the SSP, but not at the level of the attachment classification (Qu & Leerkes, 2018). In an effort to classify infant-mother attachment security, it is the *pattern* of infants' affective and attachment-related behaviors (e.g., distress, approach, avoidance) across the multiple episodes of the SSP that are ultimately utilized to classify infants into the three organized groups: secure, insecure-avoidant, and insecure-ambivalent (Ainsworth et al., 1978). Latent profile analysis (LPA) inherently looks for patterns or profiles based on the similarities among infants in a group so a person-centered analysis of the FFSF reflects a similar approach and one might expect would increase the likelihood of finding prediction across the FFSF and the SSP.

Of the four studies using person-centered analyses to examine classes of infants during the FFSF (Barbosa et al., 2018; Montirosso et al., 2015; Papoušek, 2007; Qu & Leerkes, 2018), both Qu & Leerkes (2018) and Barbosa et al (2020) have linked their FFSF groups to attachment outcomes at 12 months using the SSP, but using different analytic strategies. Qu & Leerkes (2018) found their FFSF groups predicted ratings of avoidance and resistance during reunion episodes of the SSP, but did not report results comparing their FFSF groups and attachment classifications. Their *highly distressed but regulating* group had high scores on ratings of attachment resistance, although the *resilient to distress* group was judged to be most “secure-like” because they had the lowest ratings on avoidance and resistance during reunions. The *over-regulated* group had the highest ratings on avoidance, whereas the *under-regulated* group were rated the highest on resistance. Barbosa and colleagues (2020) recently reported significant relations between their three FFSF profiles and mother-infant attachment security. Infants in the *social-positive oriented groups* at both 3 and 9 months were more likely to be classified as secure, whereas those infants in the *self-comfort oriented group* were more likely to be classified as insecure-avoidant and those in the *distressed-inconsolable group* more likely to receive an insecure-ambivalent classification.

The current study did not find a significant association between the FFSF profiles at either 3 or 7 months, and classifications of infant-mother attachment security. The inconsistent findings across different studies, including our own, may be due to the variety of different procedures used to conduct the FFSF, the location (lab versus home), ages of assessment, and the substantially different coding systems used by researchers to rate both infant and parent behaviors. Other subtle differences in analytic and procedural strategies across studies may be sufficient in accounting for inconsistent findings. For instance, Qu & Leerkes (2018) did not rate

disorganized attachment behaviors, and Barbosa et al (2020) only had three infants classified as disorganized, who were dropped from analyses because their mothers violated the FFSF protocol. Therefore, it is unclear how disorganized attachment may or may not be related to FFSF trajectories.

### **Strengths and Limitations.**

This study is unique in that it is a longitudinal person-centered analysis of the FFSF at two times in the infant's first year (3 and 7 months) with a focus on modeling trajectories of both infant positive and negative affect simultaneously across the three episodes of FFSF, and then determining whether maternal behavior differs across profiles, how these profiles are related over time in the first year, and whether they predict infant-mother attachment outcomes.

However, there are several limitations that should be noted. First, our use of LPA only included positive and negative affect when looking at infant regulation patterns. Our sample was relatively small compared to the recommended sample size for LPA (Tein, Coxe, & Cham, 2013), so we were limited as to the number of variables included in analyses and chose to start with positive and negative affect because these variables are used consistently in almost every FFSF study.

Still, we need to acknowledge that it is possible that if we included the infant regulatory profiles that would have been more stable over time and more likely to predict SSP classifications. The FFSF was also administered in the home, versus the lab, providing a very different environment. Infants may be more comfortable in their own homes and because of that, less stressed by the paradigm. There was also attrition across timepoints, which may have affected the stability of class membership across 3 and 7 months and their association with infant-mother attachment at 14 months.

### **Recommendations for Future Directions in FFSF Research.**

Based on the current results, there are three critical issues that should be considered in future research on the links between infant affect regulation in the FFSF and the security of infant-mother attachment in the SSP. The first issue is that the FFSF has been administered at various time points across the first year of development, anywhere from days after birth to 9 months (Barbosa et al., 2018; Bigelow & Power, 2018), without any theoretical justification for the choice of those ages. Because emotional development is so varied during the first 12 months, it is necessary to consider these studies in a developmental context, and perhaps pair these periods with the developmental phases of emotional development and attachment formation outlined by Bowlby (1969). For example, at 3 months infants express positive affect by smiling and cooing, while at 7 months, positive affect may be demonstrated through babbling and gestures indicating social bids (Kopp, 1989), so infant behavior in the FFSF may not reflect similar underlying constructs across different time points in the first year. Therefore, future studies need to consider the meaning of infant affect and behavior in the FFSF from a developmental framework and acknowledge that affective profiles, even if similar on the surface, may not reflect the same underlying regulatory mechanisms based on the rapid maturation of emotional responsiveness in the first year.

Another issue for future research using the FFSF is that unlike the SSP, there is no standardized, validated, agreed-upon coding system for the assessment of infant affect and behavior in the FFSF. There appear to be as many different coding systems as there are studies utilizing the FFSF with both micro- (second by second) and macro-level (global ratings) coding schemes. Without a consensus among researchers and a consistently reliable coding system that demonstrates both concurrent and predictive validity, it is difficult to know what is being measured reliably in the FFSF, how these different coding schemes compare across studies, and

how these differences account for the findings. Thus, are differences uncovered across studies due to differences in infant affective regulation and developmental change or to differences in research design, measurement and analysis strategy. Because the SSP relies on a standard coding system that requires both training and consistent application to classify infants, perhaps the most critical recommendation for the future is creating a systematic, psychometrically-sound coding system for the FFSF so researchers can begin to have a reliable and valid means of interpreting affect and behavior in the FFSF. This would then allow researchers to design studies with the goal of replicating results across studies. Because of these vast differences in measurement and design in the FFSF literature, the research reported here was also by necessity exploratory. With the development of more reliable and consistently applied coding systems, future research using the FFSF can move from being exploratory to more confirmatory.

One final constraint of the FFSF in comparison to the SSP is the lack of categories based on infant responses during the paradigm. The Strange Situation yields three organized attachment classifications; secure, avoidant, and ambivalent, and a disorganized classification, which allows researchers to link these categories with additional constructs as well as examining the longitudinal implications of these classifications, and the ability to compare results across studies. This does not necessarily mean we should be classifying infants based on their FFSF behavior, but the lack of such consensus means we are less likely to replicate findings and, in the end, have less reliable and valid measures of infant emotion regulation. More person-centered studies of the FFSF may prove valuable and if consistent classes continue to be found across studies, these profiles be the basis for determining whether classifications of the FFSF may be feasible. In sum, the findings of the current study, taken together with previous person-centered studies of the FFSF literature, uncovered four different profiles of infant affective regulation that



replicated those found in other studies. Yet, there are many questions still left unanswered with a future open to further investigation.

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Table 1. Repeated Measures ANOVA of Face-to-Face Still Face Paradigm Behaviors for Four Classes of Infants at Three Months

Infant Behaviors	Social-positive oriented (n=67)		Classic still-face effect (n=20)		Self-comfort oriented (n=5)		Distressed-inconsolable (n=9)		<i>F</i>	Total (n=101)		
	M	SD	M	SD	M	SD	M	SD		M	SD	
<b>Positive Affect</b>												
Free Play	2.58	.924	2.75	.967	1.80	.837	1.67	1.00	3.529*	2.50	.976	
Still-Face	1.68 <sub>a</sub>	.903	1.45	.759	1.60	.894	1.13 <sub>b</sub>	.354	1.215	1.58	.849	
Reunion	2.28	.897	1.79	.918	1.40	.548	2.00	1.16	3.802*	2.11	.931	
<b>Negative Affect</b>												
Free Play	1.07 <sub>a</sub>	.265	1.35 <sub>b</sub>	.489	3.20 <sub>c</sub>	.447	3.33 <sub>d</sub>	.500	153.488**	1.44	.830	
Still-Face	1.11 <sub>a</sub>	.312	3.45 <sub>b</sub>	.510	1.00 <sub>a</sub>	.000	3.38 <sub>b</sub>	.518	260.163**	3.38	.518	
Reunion	1.36 <sub>a</sub>	.817	2.40 <sub>c</sub>	1.27	1.80	1.30	3.14 <sub>c</sub>	.900	11.246**	1.74	1.11	
<b>Distress Reg.</b>												
Free Play	3.94 <sub>a</sub>	.239	3.65 <sub>b</sub>	.587	2.40 <sub>c</sub>	1.140	1.89 <sub>d</sub>	.333	81.430**	3.62	.760	
Still-Face	3.91 <sub>a</sub>	.292	1.80 <sub>b</sub>	.523	3.60 <sub>a</sub>	.894	1.63 <sub>b</sub>	.518	183.044**	3.28	1.053	
Reunion	3.70 <sub>a</sub>	.738	2.55 <sub>b</sub>	1.276	3.20	1.304	2.00 <sub>b</sub>	.816	13.204**	3.30	1.081	
<b>Self-Object</b>												
Free Play	2.30	.985	2.30	1.031	1.80	.837	2.44	1.130	.473	2.29	.993	
Still-Face	2.98	.673	2.45	.945	2.80	1.10	2.75	1.035	12.187	2.85	.804	
Reunion	2.33	.944	2.00	1.000	2.20	.837	2.29	1.113	.567	2.25	.956	
<b>Avoidance</b>												
Free Play	2.37	.885	2.25	.851	2.60	.548	2.56	.726	.392	2.38	.847	
Still-Face	2.62 <sub>a</sub>	.804	2.65	.933	2.60	.548	3.13 <sub>b</sub>	.354	3.458*	2.66	.799	
Reunion	2.48	.808	2.40	.821	1.80	.837	2.57	.787	1.150	2.43	.813	
<b>Resistance</b>												
Free Play	1.33 <sub>a</sub>	.637	1.65 <sub>a</sub>	.813	2.20	.837	2.67 <sub>b</sub>	1.118	5.536**	1.55	.830	
Still-Face	1.63 <sub>a</sub>	.821	2.95 <sub>b</sub>	1.099	1.40 <sub>b</sub>	.548	2.13 <sub>ab</sub>	1.126	11.658**	1.93	1.038	
Reunion	1.56 <sub>a</sub>	.827	2.37 <sub>b</sub>	1.212	2.20	1.304	2.29	1.380	2.864	1.82	1.037	
<b>Seek Maintain</b>												
Free Play	3.30 <sub>a</sub>	.578	3.15	.745	2.80	.837	2.56 <sub>b</sub>	.527	4.463**	3.18	.654	
Still-Face	3.09 <sub>a</sub>	.631	2.25 <sub>b</sub>	.716	3.00	.707	2.25 <sub>b</sub>	.886	10.280**	2.85	.765	
Reunion	3.10	.569	2.74	.872	2.80	1.304	2.57	.976	1.407	2.97	.733	

Notes. Subscripts indicate significant differences.

\*  $p < .05$ , \*\*  $p < .01$

Table 2. Repeated Measures ANOVA of Face-to-Face Still-Face Paradigm Behaviors for Four Classes of Infants at Seven Months

Infant Behaviors	Social-positive oriented (n=60)		Classic still-face effect (n=16)		Self-comfort oriented (n=8)		Distressed-inconsolable (n=7)		<i>F</i>	Total (n=91)	
	M	SD	M	SD	M	SD	M	SD		M	SD
<b>Positive Affect</b>											
Free Play	2.67	.896	2.31	.793	2.50	.756	2.71	.756	.794	2.59	.856
Still-Face	1.46	.713	1.50	.816	1.38	.744	1.50	.837	.055	1.47	.731
Reunion	2.52	.841	2.07	.961	1.88	.835	1.83	.983	2.669	2.33	.899
<b>Negative Affect</b>											
Free Play	1.00	.000	1.00	.000	2.00 <sub>a</sub>	.000	3.57 <sub>b</sub>	.535	792.667**	1.29	.735
Still-Face	1.11 <sub>a</sub>	.312	3.00 <sub>b</sub>	.516	2.00	1.07	3.17 <sub>b</sub>	1.17	64.424**	1.69	.997
Reunion	1.58 <sub>a</sub>	.969	2.47	1.19	2.88 <sub>b</sub>	.991	3.17	1.17	7.247*	1.99	1.16
<b>Distress Reg.</b>											
Free Play	4.00	.000	4.00	.000	2.86 <sub>a</sub>	.378	2.14 <sub>b</sub>	.900	142.402**	3.77	.619
Still-Face	3.91 <sub>a</sub>	.288	2.00 <sub>b</sub>	.632	3.14 <sub>c</sub>	.900	2.17 <sub>b</sub>	.983	73.955**	3.36	.949
Reunion	3.61 <sub>a</sub>	.763	2.93 <sub>ac</sub>	.961	2.14 <sub>cd</sub>	.900	1.67 <sub>d</sub>	.516	24.025**	3.22	1.006
<b>Self-Object</b>											
Free Play	3.07	.634	2.94	.680	3.25	.463	2.86	.690	.764	3.04	.631
Still-Face	3.73	.447	3.44	.727	3.50	.756	3.83	.408	1.689	3.66	.545
Reunion	2.87	.754	2.93	.799	2.63	.916	2.50	.837	.526	2.83	.778
<b>Avoidance</b>											
Free Play	2.97	.410	2.75	.577	2.88	.354	3.14	.378	1.634	2.93	.442
Still-Face	3.27	.447	3.19	.403	2.88	.354	3.17	.408	1.996	3.21	.437
Reunion	2.83	.575	2.67	.724	2.75	.463	3.00	.000	.582	2.81	.573
<b>Resistance</b>											
Free Play	1.25 <sub>a</sub>	.704	1.13 <sub>a</sub>	.500	2.50 <sub>b</sub>	1.07	2.71 <sub>b</sub>	.951	15.053**	1.45	.885
Still-Face	1.46 <sub>a</sub>	.830	2.81 <sub>b</sub>	.750	2.50	1.07	1.46	.830	12.880**	1.87	1.027
Reunion	1.56 <sub>a</sub>	.925	1.87 <sub>ab</sub>	1.06	3.38 <sub>b</sub>	.518	2.83 <sub>b</sub>	.753	22.532**	1.88	1.075
<b>Seek Maintain</b>											
Free Play	2.93	.482	3.00	.730	2.75	.463	2.43	.787	1.208	2.89	.567
Still-Face	2.70	.570	2.38	.719	2.88	.354	2.33	.816	2.106	2.63	.614
Reunion	2.98 <sub>a</sub>	.495	2.93	.704	2.50	.535	2.33 <sub>b</sub>	.816	3.699*	2.88	.593

Notes. Subscripts indicate significant differences.

\*  $p < .05$ , \*\*  $p < .01$

Table 3. *Repeated Measures ANOVA of Face-to-Face Still-Face Paradigm Maternal Behaviors for Four Classes of Infants at Three Months*

Maternal Behaviors	Social-positive oriented (n=66)		Classic still-face effect (n=20)		Self-comfort oriented (n=5)		Distressed-inconsolable (n=9)		F	Total (n=100)	
	M	SD	M	SD	M	SD	M	SD		M	SD
<b>Engagement</b>											
Free Play	3.64 <sub>a</sub>	.671	3.40	.940	3.40	.894	2.89 <sub>b</sub>	.928	2.751*	3.51	.785
Reunion	3.55	.723	2.79	1.13	3.60	.894	2.57	1.27	3.307	3.32	.941
<b>Sensitivity</b>											
Free Play	3.38	.489	3.50	.513	3.60	.548	3.44	.464	.631	3.42	.490
Reunion	3.37	.520	3.45	.468	3.30	.671	3.43	.535	.851	3.38	.511
<b>Positive Affect</b>											
Free Play	3.26	.538	3.15	.489	3.20	.447	2.78	.667	2.184	3.19	.547
Reunion	3.20	.542	2.89	.567	3.20	.447	2.71	.756	2.611	3.10	.575
<b>Tension/Anxiety</b>											
Free Play	1.11	.312	1.15	.366	1.20	.447	1.00	.000	.599	1.11	.316
Reunion	1.10	.303	1.42 <sub>a</sub>	.607	1.60	.894	1.14	.378	1.893	1.20	.453
<b>Intrusiveness</b>											
Free Play	2.73	.735	2.25	.967	2.20	.837	2.33	.866	2.049	2.57	.820
Reunion	2.74	.772	2.63	.761	2.20	.837	2.43	.535	.205	2.66	.760

*Notes.* Subscripts indicate significant differences.

\* $p < .05$ , \*\*  $p < .01$

Table 4. *Repeated Measures ANOVA of Face-to-Face Still-Face Paradigm Maternal Behaviors for Four Classes of Infants at Seven Months*

Maternal Behaviors	Social-positive oriented (n=59)		Classic still-face effect (n=16)		Self-comfort oriented (n=8)		Distressed inconsolable (n=7)		F	Total (n=90)	
	M	SD	M	SD	M	SD	M	SD		M	SD
<b>Engagement</b>											
Free Play	3.42 <sub>a</sub>	.700	3.25	.775	3.38	.744	2.43 <sub>b</sub>	.787	4.009*	3.31	.759
Reunion	3.25 <sub>a</sub>	.751	2.67	1.113	2.88	1.126	2.33 <sub>b</sub>	.516	5.386*	3.05	.890
<b>Sensitivity</b>											
Free Play	3.37	.522	3.31	.602	3.62	.518	3.29	.488	.708	3.38	.532
Reunion	3.28	.438	3.167	.362	3.29	.372	3.00	.316	1.010	3.23	.413
<b>Positive Affect</b>											
Free Play	3.20	.581	3.13	.500	3.38	.518	3.00	.577	.638	3.19	.559
Reunion	3.25	.615	3.00	.845	3.25	.707	2.67	.516	1.812	3.17	.674
<b>Tension/Anxiety</b>											
Free Play	1.11	.310	1.13	.352	1.13	.354	1.57	.787	.751	1.15	.390
Reunion	1.16	.373	1.13	.352	1.13	.354	1.67	.816	.755	1.19	.424
<b>Intrusiveness</b>											
Free Play	2.76	.727	2.94	.574	2.75	.886	2.71	.951	.170	2.79	.727
Reunion	2.87	.771	2.80	.775	3.13	.641	3.17	.408	2.016	2.90	.738

Notes. Subscripts indicate significant group differences.

\* $p < .05$ , \*\*  $p < .01$



Table 5. *Stability of LPA Classes at 3 and 7 Months.*

	<b>Social-Positive</b> 7 Months (n=60)	<b>Classic Still-Face</b> 7 Months (n=16)	<b>Self-Comfort</b> 7 Months (n=8)	<b>Distressed-Inconsolable</b> 7 Months (n=7)
<b>Social-Positive</b> 3 Months (n=67)	39	10	7	3
<b>Classic Still-Face</b> 3 Months (n=20)	10	2	0	3
<b>Self-Comfort</b> 3 Months (n=5)	2	2	1	0
<b>Distressed-Inconsolable</b> 3 Months (n=9)	4	2	0	1

Figure 1. Means and standard errors for infant positive and negative affect during each episode of the Face-to-Face Still-Face Paradigm for affective profiles at 3 months.

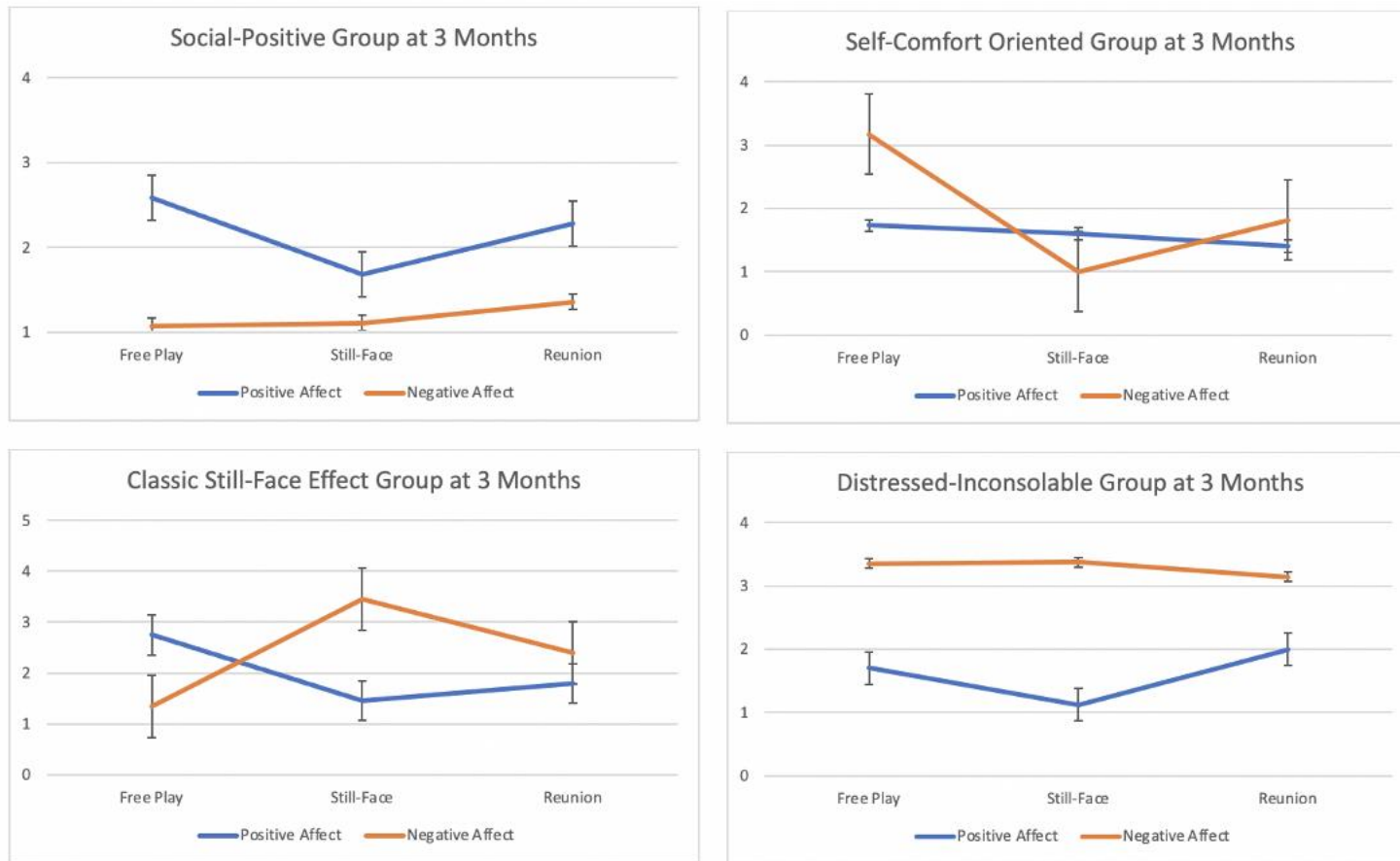


Figure 2. Means and standard errors for infant positive and negative affect during each episode of the Face-to-Face Still-Face Paradigm for affective profiles at 7 months.

