Effect of Prematurity and Temperament on the Mother-Infant Interaction

Taís Chiodelli[1]
Veronica Aparecida Pereira[1]
Olga Maria Piazentin Rolim Rodrigues[2]
Dayana Insfran Jorcuvich[1]

[1]*Universidade Federal da Grande Dourados, Dourados, Mato Grosso do Sul, Brasil*
[2]*Universidade Estadual Paulista Júlio de Mesquita Filho, Bauru, São Paulo, Brasil*

Abstract
We evaluated the effect of prematurity and the infant's temperament on the mother-infant behaviors in the Face-to-Face Still-Face Paradigm (FFSF). The study included 75 mothers and their infants (37 preterm and 38 term) between three and four months of age (corrected age for preterm infants). The mothers responded to a perception scale of the infants' temperament and the dyads were observed in a structured condition (FFSF). The FFSF Paradigm, divided into three episodes, made it possible to analyze the behaviors of: Positive Social Orientation, Negative Social Orientation and Self-comfort. The averages recorded for these categories were analyzed in a Multivariate ANOVA (factors: prematurity and temperament). Temperament had more effect on maternal and infant behaviors, suggesting that this factor may influence mother-infant interaction. The results can guide possible interventions with families.
Keywords: still-face; infant; premature; temperament; mother-child relations.

Efeito da Prematuridade e Temperamento na Interação Mãe-Bebê

Resumo
Buscou-se avaliar o efeito da prematuridade e do tipo de temperamento do bebê sobre a interação mãe-bebê por meio do Paradigma do *Face-to-Face Still-Face* (FFSF). Participaram do estudo 75 mães e seus bebês (37 pré-termo e 38 a termo), entre três a quatro meses de vida (idade corrigida para bebês pré-termo). As mães responderam a uma escala de percepção do temperamento dos bebês e as díades foram filmadas em condição estruturada (FFSF). A filmagem, dividida em três episódios, possibilitou a análise de comportamentos de: Orientação Social Positiva, Orientação Social Negativa e Autoconforto. As médias registradas para essas categorias foram submetidas à Anova Multivariada (fatores: prematuridade e temperamento). O temperamento apresentou mais efeito sobre os comportamentos maternos e dos bebês, sugerindo que esse fator pode influenciar a interação diádica. Os resultados podem nortear possíveis intervenções junto às famílias.
Palavras-chave: Still-Face; Recém-Nascido Pré-termo; Temperamento; Relações Mãe-Filho.

Efecto de la Prematurez y El Temperamento en la Interacción Madre-Bebé

Resumen
Se buscó evaluar el efecto de la prematuridad y el tipo de temperamento del bebé en la interacción madre-bebé a través del Paradigma Face-*to*-Face Still-Face (FFSF). En el estudio participaron 75 madres y sus bebés (37 prematuros y 38 a término), con edades comprendidas entre los tres y los cuatro meses (edad corregida para bebés prematuros). Las madres respondieron a una escala de percepción del temperamento de los bebés y las díadas fueron filmadas en una condición estructurada (FFSF). El rodaje, dividido en tres episodios, permitió analizar los comportamientos de: Orientación Social Positiva, Orientación Social Negativa y Autoconfort. Los promedios registrados para estas categorías fueron sometidos al ANOVA Multivariado (factores: prematuridad y temperamento). El temperamento tuvo más efecto en los comportamientos maternos e infantiles, lo que sugiere que este factor puede influir en la interacción diádica. Los resultados pueden orientar posibles intervenciones con las familias.
Palabras clave: Still-Face; recién nacido; prematuro; temperamento; relaciones madre-hijo.

Introduction

Preterm infants, that is, those born before 37 complete weeks of gestation, require more attention in relation to neonatal health with lower gestational age (Soares, et al., 2017). Considering the high prevalence, between 5 and 18% in the worldwide context (WHO, 2018) and 12% in Brazil (Henriques, et al., 2019), prematurity is considered a public health problem. Among the risk factors associated with prematurity, those related to the health (Righi, et al., 2017) and development of the infant stand out, including difficulties in phonological skills (Souza, et al., 2019) and in the skills of emotional and behavioral regulation, assessed at ages two, four, and nine (Woodward, et al., 2016). These are factors that can have negative effects on the interaction with the mother (Chiodelli, et al., 2020).

Another factor that can affect the mother-infant interaction is the hospitalization of the infant in the Neonatal Intensive Care Unit (NICU), which is

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common among preterm infants. The infant is exposed to painful and stressful procedures that can hinder the establishment of an initial bond with their caregivers (Almeida et al., 2020), affecting their sensitivity to the environment, which includes responding to maternal behaviors during interaction (Hernandez, 2018). According to the author, the opportunities for interaction with the mother and/or other caregiver, limited in this context, deprive the infant of skin-to-skin contact, visual stimulation, breastfeeding and other interactive opportunities that could help in their self-regulation. There is also an impact on the maternal responsive behaviors and emotional health.

Almeida, et al. (2020) investigated the experience of mothers of newborn preterm infants during the first week of hospitalization in the NICU and found reports of sadness, fear that the child would not survive, insecurity in carrying out care activities and feelings generated by uncertainty related to the hospital discharge. These are issues that can persist after the discharge from the hospital. Granero-Molina, et al. (2019) interviewed mothers of extremely premature infants twelve months after leaving the hospital and identified challenges related to living with a child that requires more care and the consequences of this condition for their social, marital and occupational life. Furthermore, the interaction with the infant can be permeated by feelings of maternal guilt, resulting in overprotective and intrusive behavior.

Among the possibilities for studying the mother-infant interaction is the Face-to-Face Still-Face (FFSF) paradigm (Tronick, et al., 1978), an experimental procedure structured in three episodes, of up to three minutes each. Maternal and infant interactive behaviors are observed in two normal episodes (play and reunion) and one of potential stress (still-face). In the first episode (play) the mother is instructed to interact with the infant as she usually does, without using toys or objects. In the second episode (still-face), the mother is instructed to remain looking at the infant, keeping her face neutral, and in the third (reunion) she must resume the interaction as in the first episode (play).

Mesman, et al. (2009), investigated infants' responses to the FFSF, in a meta-analysis study, describing the still-face effect, characterizing it by changes in the infants' behavior, comparing them between the play and still-face episodes. They observed an increase in negative and self-comforting behaviors and a decrease in positive behaviors during the still-face episode, present in different samples and regardless of the infant's characteristics (gender, age) and experimental variations (number of episodes, duration and partner interaction).

Hsu and Jeng (2008) compared the interactive behaviors of full-term and preterm infants, with two months of corrected age, observed from a modification performed in the FFSF (addition of one more still-face and one reunion episode). Infants in the two groups responded differentially to the two still-face episodes. Preterm infants emitted more negative affect (crying or irritation) and for longer, which could suggest difficulty in self-regulating.

Montirosso et al. (2010) compared 50 mothers and preterm and full-term infants, aged between six and nine months. The authors observed that the infants in both groups showed the still-face effect, increasing the emission of negative behaviors in the reunion episode, with the preterm infants showing more distancing from their mothers during the three episodes of the FFSF and increased neutral vocalizations in the reunion episode. Regarding the maternal behavior, no significant differences were found between the mothers of the two groups.

Fuertes, et al. (2011) investigated predictors of infant self-regulation patterns in a sample of preterm infants at three months of corrected age. The infant's gestational age and maternal sensitivity assessed during free interaction were predictors of the Positive Social Orientation pattern.

Yaari, et al. (2018) compared, at four months, the interactive behaviors of dyads with infants divided into three groups: very preterm (gestational age between 24 to 32 weeks), moderately preterm (33 to 36 weeks) and full-term (more than 37 weeks). Age was corrected for the preterm infants. The authors found that the infants born very preterm had more difficulty in emotion regulation skills compared to the moderate preterm infants, who were still less efficient than the full-term infants.

Conversely, Gutierrez (2017) compared the self-regulating behavior of full-term and preterm infants during the still-face episode. The preterm infants presented more self-regulatory behaviors and more adaptive regulatory abilities compared to the full-term infants. Chiodelli, et al. (2020) found results similar to those of Gutierrez (2017) investigating the interaction of 15 mothers and very preterm infants, with three to four months of corrected age. They observed that when the infants were presented with the still-face effect they significantly increased the emission of Positive Social Orientation behaviors (looking at the mother's body and positive motor agitation) in the reunion episode.

Differences in the results found by Hsu and Jeng (2008), Montirosso, et al. (2010), Fuertes, et al. (2011) and Yaari, et al. (2018) and those of Gutierrez (2017) and Chiodelli, et al. (2020) may be due to variations in the gestational age of the infants participating in the studies and in the procedures used. Another hypothesis refers to cultural influences interfering with maternal interaction behavior, as the studies presented were carried out in Taiwan (Hsu, & Jeng, 2008), Italy (Montirosso, et al., 2010), Israel (Yaari, et al., 2018), Portugal (Gutierrez, 2017; Fuertes, et al., 2011) and Brazil (Chiodelli, et al., 2020).

The temperament is also a characteristic of the infant that can determine the dyad's interactive behaviors. However, in studies that evaluated the impact of temperament on the mother-infant interaction, a variety of approaches used to understand it, as well as instruments to assess it, can be observed. Among the approaches, the one by Thomas and Chess (1977) stands out, which defines temperament from observable behaviors organized into nine dimensions: activity level, rhythmicity, approach or withdrawal, adaptability, threshold of responsiveness, intensity of reaction, quality of mood, distractibility, and persistence. Based on these categories, they proposed the temperament classifications of easy, difficult and slow-to-warm-up, differentiating them by regularity in biological functions, quality of responses to new stimuli and mood intensity (Klein, & Linhares, 2010).

Yoo and Reeb-Sutherland (2013) analyzed the temperament characteristics of 85 infants, at five months of age, in a combined procedure of maternal reporting and observation of the mother-infant interaction in the context of the FFSF. The results showed that infants perceived by their mothers as highly negative differed significantly from those identified as having low negative reactivity when interacting with them in the reunion episode. Among them, a significant increase in negative involvement with their mothers was also observed between the play and reunion episode, suggesting a partial carry-over effect, characterized by an increase in negative behaviors and a reduction in positive ones in the reunion episode compared to the play episode. The authors concluded that the infant's temperament can affect the responses they will present to the FFSF procedure.

Mesmen, et al. (2009), in a review study, suggested effects of temperament on infant's recovery after the still-face episode, influencing different responses in the resumption of interaction with the mothers. However, they found only two studies that investigated this issue, which suggests the need for more studies. Tarabulsy, et al. (2003), studying six-month-old infant-mother dyads, found no effect of infant temperament on infant responses to the still-face episode. However, infant difficulty (temperament dimension evaluated) significantly moderated the relationships identified between maternal behaviors (assessed during a home visit, outside the context of the FFSF) and the infant's self-comfort behaviors. Gunning, et al. (2013) found no differences in infants' responses to the FFSF considering their irritability (high reactivity and poor regulation evaluated through the Neonatal Behavioral Assessment Scale – NBAS) shortly after hospital discharge. However, when compared with non-irritable peers, irritable infants emitted significantly more dysregulated behaviors in the reunion episode.

Barbosa, et al. (2019) found few studies on the relationship between temperament and the effects of the FFSF, without consensus among researchers. The authors suggested that infant temperament-related effects on self-regulating behavior during the FFSF may vary according to maternal sensitivity and the quality of the mother-infant interaction. Likewise, neonatal irritability can have an important influence on the dyads' ability to establish good synchrony.

Regarding the relationships between temperament and prematurity, preterm children presented more sleep-related difficulties, lower scores in attention, and higher scores in negative emotionality compared to their full-term peers, in temperament assessments performed at two years (Caravale, et al., 2017). In a review study conducted by Cassiano, et al. (2020) preterm children had lower scores in attention span and persistence and higher activity levels, in studies with the approach of Thomas and Chess (1977), with higher results for extreme preterm infants with less attentional focus in studies that considered the psychobiological approach. They emphasized that preterm children may need the support of their caregivers to regulate their behavior in interactions and to improve attention.

Considering that preterm infants may show differences in their temperament (Caravale, et al., 2017, Cassiano, et al., 2020), investigating these relationships in the context of the FFSF, in which it is possible to identify regulatory responses at an early age, can create conditions for the design of interventions that help parents to regulate their infants' emotions. This expands the possibilities of understanding the individual differences in the responses of infants to the

FFSF procedure and how mothers respond to preterm infants and those with different types of temperament. The temperament concept of the present study is close to that proposed by Thomas and Chess (1977) regarding styles (Easy, Difficult and Slow-to-warm-up).

In this context, the present study sought to evaluate the effect of the birth condition (preterm or full-term) and the infant's temperament type (easy, moderate or difficult) on the mother-infant interaction assessed using the FFSF Paradigm.

Method

The project was approved by the ethics committees of two universities, under authorization No. 11187/46/01/12 and 2.421.209. The mothers that agreed to participate signed a consent form, which explained the conditions of confidentiality, care and responsibility for the data, during and after the study was carried out.

Participants

Study participants were 75 mother-infant dyads (37 preterm and 38 full-term). They were recruited in infant care projects, developed in conjunction with two University Psychology clinics, one in the state of São Paulo and the other in the state of Mato Grosso do Sul, Brazil. Dyads with preterm infants with other complications, such as syndromes or malformations, were excluded.

The preterm infants were born at a mean of 32.73 weeks of gestation (SD=2.76), with a mean birth weight of 1849.57g (SD=490.85). The full-term infants were born at a mean of 38.55 weeks of gestation (SD=1.26), with a mean weight of 3156.46g (SD=419.85). The full-term infants were significantly greater (p<.01) than the preterm infants in terms of gestational age and birth weight. There were 19 girls and 18 boys in the preterm infant group and 20 girls and 18 boys in the full-term group, with no significant differences between the groups regarding gender. Among the preterm infants, 67.6% were hospitalized, with a mean time of 13.29 days (SD=15.52) while 13.2% of the full-term infants were hospitalized for a mean of 0.63 days (SD=1.75), with a significant difference in length of stay (p<.001).

The mean age of the mothers of the preterm infants was 27.57 years (SD=4.97) and that of the mothers of the full-term infants was 28.92 years (SD=5.67), with no significant difference between the groups. Regarding education, the mothers of the preterm infants presented a mean of 12.05 years (SD=3.37) of study and the mothers of the full-term infants 14.42 years (SD=3.50), which was significantly longer (p<.01). Considering the type of delivery, there was a significant difference (p<.01) between the groups, with a higher frequency of cesarean in the full-term dyads. There was no significant difference between the groups of mothers regarding paid work and the number of children.

Instruments

An interview script was used to obtain sample characterization information. A temperament scale and the FFSF analysis protocol were also applied.

The Temperament Scale, developed by Santos, et al. (2005), consists of nine items, scored according to frequency on a Likert-type scale from 1 to 7, with a minimum score of 9 points and a maximum of 63 points. To define the types of temperament obtained from the scale, considering the classification proposed by Thomas and Chess (1977) of easy, difficult or slow-to-warm-up temperament, it was decided to assign the infants using the arbitrary division of points into thirds: up to 24 points, easy temperament; 25 to 36, moderate temperament, and above 37 points, difficult temperament. The responses presented by the 75 participants were submitted to reliability analysis and presented a Cronbach's Alpha of .504, which can be considered a moderate index.

The FFSF Analysis Protocol makes it possible to record behaviors organized into categories for the mothers and infants. For the mothers, the analysis categories were: *Positive Social Orientation (PSO)* (looking the infant, talking to the infant, touching the infant, kissing the infant, tickling the infant, making positive comments about the infant) and *Negative Social Orientation (NSO)* (moving away from the infant, avoiding eye or body contact with the infant, avoiding play with the infant, making negative infant attributions or descriptions of their states, presenting negative social expression, overstimulating the infant, interrupting the infant's activity). For the infants these were: *Positive Social Orientation (PSO*) (looking at the mother's face, smiling, positive or neutral vocalizations, reaching for the mother); *Negative Social Orientation (NSO)* (vocal protests, crying, negative facial expressions, arching the body, pushing away from the mother, excessive motor activity) and *Self-Comfort (SC)* (mother's gazer aversion, closing the eyes, oral objects, oral mouth, squeezing hands against each other, avoiding mother, handling objetcs).

Data collection procedure

The mothers participating in the study, in the second month of the infant's life, completed the Infant's Temperament Perception Scale (Santos, et al., 2005), in printed format, being instructed to answer the questions based on what they observed about the behavior of their infants. The researcher remained available for the mothers if they needed any clarification.

The observational of the interaction took place at three months of life for the full-term infants and at four to five months for the preterm infants (of corrected age). Rugolo (2005) suggests the correction of the age for preterm infants of up to two months, considering the infant's gestational age and the average gestation time of 40 weeks. The dyads were observed on the FFSF Paradigm (Tronick, et al., 1978). In this procedure, the mother and infant were filmed facing each other, with the infant in a feeding chair with height adjustment and the mother in a chair in front of them, so that they were face to face. The image was captured by two cameras, in order to obtain detailed information on the maternal and infant behaviors. The duration was up to nine minutes, divided into three three-minute episodes: Episode 1 (play) the mother was instructed to interact with the infant without using toys or objects; Episode 2 (still-face) – after a sound signal presented by the experimenter, the mother interrupted the interaction, remaining in front of the infant, maintaining only eye contact and an expressionless face, and, Episode 3 (reunion) – there was the resumption of the interaction. Signs of discomfort from the infant, manifested by crying for 15 seconds without stopping, interrupted the filming (in the case of the play or reunion episode) or interrupted the non-interactive episode (still-face episode).

Data analysis procedure

The FFSF episodes, recorded on video, were analyzed and recorded according to the occurrence of behavior related to the categories, every five seconds, generating, at the end of each episode, an mean for the PSO (infant and mother), NSO (infant and mother) and SC (infant) categories. Video analysis was performed by independent judges and with reliability analysis of 30% of the sample, obtaining a good Intraclass Correlation Coefficient (.89) (Miot, 2016). The sample characteristics were compared, considering full-term and preterm infants, using the *t*-test for independent samples, in the case of continuous variables, and the chi-square test, for nominal variables. The influence of the independent variables prematurity and temperament on the dependent variables (FFSF categories) was analyzed using Multivariate Analysis (two-factor ANOVA - temperament and prematurity), with a 95% confidence interval and indication of the effect size, considering the parameters suggested by Cohen (1992), with classifications: from 0.2 to 0.5 - small effect, 0.5 to 0.8 medium effect, and over 0.8 large effect. In order to comply with the ANOVA parameters, homogeneity conditions were analyzed using Levene's test (Pestana, & Cageiro, 2014).

Results

The independent variables, selected as factors for the present study, had a similar formation for the groups, mainly in relation to birth condition (37 preterm and 38 full-term). For temperament type, the following distribution was observed: 25 of Easy Temperament (ET); 28 infants of Moderate Temperament (MT) and 22 infants of Difficult Temperament (DT). The chi-square test, with a 95% confidence interval, indicated values of p=.908 for prematurity and p=.698 for infant temperament, indicating that the groups were similar in their composition regarding the factors indicated for evaluating the effects.

Table 1 presents the descriptive statistics for the behavior of the infants observed during the FFSF, based on the factors prematurity and temperament type. Regarding PSO: the preterm infants identified as having DT presented higher means in the play episode, the ET infants in still-face and the MT infants in the reunion. In the reunion episode, the ET infants resumed showing PSO behaviors in greater proportions and among the MT infants, two did not perform the reunion episode because they did not stop crying during the still-face. For the full-term infants, higher means of PSO were observed for the ET infants in the play and still-face episodes and for the MT infants in the reunion. Concerning NSO behavior, among the preterm infants, the ET infants presented higher means during the three episodes, with an increase in the reunion episode. Among the full-term infants, the DT infants presented higher means, also with an increase in the final episode. For self-comfort behaviors, the preterm infants presented a pattern of higher means in the still-face episode, with higher means for the ET infants. The full-term infants also presented this pattern, however, it was the DT infants that presented higher means during the still-face episode.

Table 2 presents the descriptive statistics for the maternal behavior observed during the FFSF, based on the factors prematurity and temperament type. The mothers that had infants classified as MT presented higher means in the PSO category in both the play and the reunion episodes, regardless of the infant being preterm or not. The proximity of the means between the two episodes, regardless of the factor applied, indicates that the mothers resumed interaction with their infants after the still-face. Regarding the emission of NSO behaviors, the mothers of the preterm infants classified as ET presented higher means in both episodes. The mothers of the full-term infants classified as DT presented higher means in NSO in both episodes, with the

Table 1.
Descriptive statistics of the infant categories based on prematurity and temperament type

		Preterm			Full-term		
FFSF		*n*	M (SD)	Min-Max.	*n*	M (SD)	Min-Max.
PSO play	Easy	15	1.21 (0.51)	0.16 - 2.08	10	1.54 (0.53)	0.55 - 2.13
	Moderate	17	1.24 (0.43)	0.41 - 2.00	11	1.14 (0.58)	0.03 - 1.77
	Difficult	5	1.91 (0.38)	1.33 - 2.36	17	1.42 (0.54)	0.51 - 2.33
PSO still-face	Easy	15	0.87 (0.54)	0.07 - 2.07	10	0.76 (0.58)	0.11 - 2.08
	Moderate	17	0.69 (0.42)	0 - 1.58	11	0.74 (0.46)	0 - 1.69
	Difficult	5	0.56 (0.29)	0.26 - 0.91	17	0.75 (0.40)	0.03 - 1.46
PSO reunion	Easy	15	0.99 (0.61)	0 - 2.36	10	1.00 (0.59)	0.21 - 2.11
	Moderate	15*	1.28 (0.53)	0 - 2.22	11	1.25 (0.47)	0.38 - 1.79
	Difficult	4	1.02 (1.11)	0 - 2.58	17	1.15 (0.69)	0.33 - 2.97
NSO play	Easy	15	0.61 (0.57)	0 - 1.83	10	0.18 (0.25)	0 - 0.83
	Moderate	17	0.24 (0.42)	0 -1.27	11	0.03 (0.05)	0 - 0.14
	Difficult	5	0.07 (0.11)	0 - 0.25	17	0.32 (0.27)	0 - 0.92
NSO still-face	Easy	15	0.74 (0.58)	0 - 2.10	10	0.45 (0.49)	0 - 1.65
	Moderate	17	0.32 (0.41)	0 - 1.44	11	0.37 (0.44)	0 - 1.38
	Difficult	5	0.71 (0.63)	0 - 1.52	17	0.77 (0.44)	0.10 - 1.75
NSO reunion	Easy	15	1.05 (0.79)	0 - 2.92	10	0.51 (0.52)	0 - 1.75
	Moderate	15*	0.39 (0.41)	0 - 1.50	11	0.48 (0.60)	0 - 1.60
	Difficult	4	0.79 (0.89)	0 - 1.71	17	0.92 (0.79)	0 - 2.60
SC play	Easy	15	0.57 (0.41)	0 1.63	10	0.69 (0.30)	0.25 - 1.11
	Moderate	17	0.64 (0.38)	0 - 125	11	0.78 (0.41)	0.08 - 1.25
	Difficult	5	0.89 (0.35)	0.44 - 1.33	17	0.92 (0.46)	0.22 - 1.78
SC still-face	Easy	15	1.29 (0.51)	0.33 - 2.14	10	1.28 (0.48)	0.75 - 0.75
	Moderate	17	0.87 (0.70)	0 - 2.25	11	1.22 (0.60)	0.33 - 2.14
	Difficult	5	1.15 (0.18)	1.02 - 1.47	17	1.37 (0.48)	0.75 - 2.18
SC reunion	Easy	15	0.63 (0.34)	0.22 1.15	10	0.86 (0.28)	0.41 - 1.29
	Moderate	15*	0.53 (0.31)	0 - 1.11	11	0.87 (0.50)	0 - 1.78
	Difficult	4	0.72 (0.37)	0.27- 1.08	17	0.91 (0.63)	0 - 2.29

Source: Prepared by the authors

Note: M = Mean; SD = standard deviation; Min.-Max.= Minimum–Maximum; PSO = Positive Social Orientation; NSO = Negative Social Orientation; SC = Self-Comfort. * The number of participants decreases due to the fact that two infants did not perform this episode. Means were weighted.

mean decreasing in those with MT and DT infants during the reunion, and increasing in those with ET infants.

Table 3 shows the descriptive data on the interaction categories observed for the infants in the episodes that fulfilled the homogeneity of variance criterion during the FFSF. The means and standard deviations, generated from the Multivariate Analysis, are described, considering the effect of temperament, prematurity and the interaction between the factors. The results indicated the effect of temperament on the infant's PSO in the play episode, with significant differences between the MT and DT groups, with higher means for the MT infants [$F(6, 66)=3.207$, $p=.047$, $d=0.56$]. There was no effect for this category in the still-face episode and the reunion episode.

For NSO, in the still-face episode, the temperament effect was inverse, with significantly higher means for the DT infants [$F(6, 66)=1.689$, $p=.042$, d=0.61]. There was no effect in the reunion episode.

In SC, the effects were observed only for the reunion episode, regarding the prematurity factor. The infants in the preterm group presented less self-comfort behaviors than those of the full-term group ($F(2.66)=4.694$, $p=.034$, $d=0.67$).

In relation to the categories of maternal behavior during the FFSF, as shown in Table 4, an effect of prematurity on the PSO of mothers was identified, indicating significantly higher means for the group of full-term infants [$F(1, 66)=7.403$, $p=.008$, $d=0.59$]. For this category, there was no effect in the reunion episode. Regarding the maternal NSO in the reunion episode, there was a significant difference between the means observed for the DT and ET groups, with the presentation of behaviors in this category being more frequent with infants indicated as DT [$F(2, 66)=3.223$, $p=.046$, $d=0.30$]. The integrated effect between temperament and prematurity was also observed, indicating a higher occurrence of maternal NSO in the preterm infants of the ET group [$F(2, 66)=4.087$, $p=.021$, $d=0.33$].

Discussion

The present study aimed to evaluate the effect of the birth condition (preterm or full-term) and the infant's temperament type (easy, moderate or difficult) on the mother-infant interaction, assessed using the FFSF Paradigm. The results obtained, considering the influence of temperament and prematurity on the mother-infant interaction, showed that the infants' temperament, for this sample, influenced the dyad interaction more than the prematurity.

Table 2.
Descriptive statistics of the categories of mothers considering the infant's prematurity and temperament type

		Preterm			Full-term		
		n	M (SD)	Minimum	*n*	Mean	Minimum
PSO play	Easy	15	2.03 (0.48)	1.11 – 2.81	10	2.43 (0.67)	1.18 – 3.16
	Moderate	17	2.50 (0.58)	1.69 – 3.44	11	2.62 (0.51)	2.05 – 3.34
	Difficult	5	2.10 (0.48)	1.66 – 2.92	17	2.50 (0.58)	1.31- 3.71
PSO reunion	Easy	15	2.08 (0.68)	0.59 – 3.36	10	2.43 (1.11)	0.83 – 4.720
	Moderate	15*	2.33 (0.81)	0.00 – 3.22	11	2.47 (0.61)	1.61 – 3.35
	Difficult	4	2.14 (0.57)	1.64 - 2.88	17	2.25 (0.73)	1.46 – 3.88
NSO play	Easy	15	0.55 (0.49)	0.08 – 2.00	10	0.07 (0.11)	0 – 0.38
	Moderate	17	0.28 (0.36)	0 – 1.25	11	0.16 (0.21)	0 - 0.56
	Difficult	5	0.02 (0.03)	0 – 0.07	17	0.54 (0.32)	0 – 1.17
NSO reunion	Easy	15	0.53 (0.36)	0.12 – 1.33	10	0.20 (0.30)	0 – 1.0
	Moderate	15*	0.24 (0.37)	0 – 1.36	11	0.11 (0.09)	0 – 0.22
	Difficult	4	0.02 (0.04)	0 – 0.08	17	0.28 (0.28)	0 – 1.14

Source: Prepared by the authors

Note: M = Mean; SD = standard deviation; Min.-Max.= Minimum–Maximum; PSO = Positive Social Orientation; NSO = Negative Social Orientation. * The number of participants decreases due to the fact that two infants did not perform this episode. Means were weighted.

Table 3.
Effect of the temperament and prematurity factors for the FFSF categories observed for the infants

FFSF Category/Factors	M_1	SD_1	n_1	M_2	SD_2	n_2	*F*	*p*	*d*	Post hoc*
Infant PSO play episode Temperament MT X DT	1.21	0.50	26	1.50	0.53	21	3.207	0.047	0.56	MT>DT
Infant NSO still-face episode Temperament MT X DT	0.32	0.41	26	0.74	0.58	21	1.689	0.042	0.61	MT < DT
SC reunion episode Prematurity Full-term X Preterm	0.88	0.51	38	0.60	0.32	34	4.694	0.034	0.67	PT < FT

Source: Prepared by the authors

Note: Degrees of freedom (df) Temperament - 6.0, Prematurity: 2.0. Sidak post hoc. M_1 = mean 1; SD_1 = standard deviation 1; M_2 = mean 2; SD_2 = standard deviation 2; n_1 = sample size 1; n_2 = sample size 2; Cohen's *d*. Infant PSO = Infant's Positive Social Orientation; Infant NSO = Infant's Negative Social Orientation; SC = Self-comfort; MT = Moderate temperament; DT = Difficult temperament; PT = Pre-term, FT = Full-term.

Table 4.
Effect of the temperament and prematurity factors for the FFSF categories observed for the mothers

FFSF Category/Factors	M_1	SD_1	n_1	M_2	SD_2	n_2	*F*	*p*	*d*	Post hoc*
mother PSO play episode Prematurity FT X PT	2.19	0.54	34	2.52	0.58	38	7.403	0.008	0.59	PT < FT
mother NSO reunion episode										DT > FT
Temperament	0.15	0.08	21	0.36	0.06	25	3.223	0.046	0.30	> PT and
Temperament*prematurity	0.53	0.08	34	0.20	0.09	38	4.087	0.021	0.39	ET

Source: Prepared by the authors

Note: Degrees of freedom (df): Temperament - 2.0, Prematurity: 1.0. Sidak post hoc. M_1 = mean 1; SD_1 = standard deviation 1; M_2 = mean 2; SD_2 = standard deviation 2; n_1 = sample size 1; n_2 = sample size 2; *d* = Cohen's *d*; Mother PSO = Maternal Positive Social Orientation; Mother NSO = Maternal Negative Social Orientation; PT = preterm; FT = full-term; DT = difficult temperament; ET = easy temperament.

The dyads participating in this study showed similarities in terms of birth condition (37 preterm and 38 full-term) and in terms of temperament classification (25 infants with Easy Temperament, 28 with Moderate Temperament, and 22 with Difficult Temperament). In the study by Chiodelli (2016), the most frequent type of temperament presented by the infants, according to the maternal perception, was also moderate temperament, with difficult being the least frequent.

For Thomas and Chess (1977), the classification of easy, slow-to-warm-up or difficult temperament types differs by the higher or lower number of positive approach responses to new stimuli. In the present study, the responses presented during the FFSF could be considered in an analogous way, taking the category of PSO as positive responses and those of NSO as negative responses.

During the FFSF play episode, which simulates a face-to-face interaction with the mother, DT infants presented fewer positive behaviors than their peers with other temperament types. Consequently, in the still-face episode, the DT infants presented more NSO behaviors than the MT infants, that is, the DT infants were more sensitive to the still-face effect (Mesman, et al., 2009). This indicates that these infants became more irritated due to the mother's lack of responses, trying to attract

their attention and resume the interaction and, in the face of failure, started to show NSO behaviors. For the DT infants, it may be that the situation evoked more intense reactions, with more protests, motor agitation and negative facial expressions, also suggesting that these infants are less resistant to the lack of maternal response and need more support from the mother to regulate themselves. Although Tarabulsy, et al. (2003), having identified no effect of temperament on infant responses in the still-face episode, found a marginally significant relationship between the infant's negative affect responses in the still-face episode and the maternal behavior. The authors argued that the most difficult infants depend on maternal support to regulate themselves in stressful situations, such as the still-face condition. Therefore, crying, protesting, agitating (negative behaviors) represented the function of signaling this request for support from the mother. The authors also suggested that the effect of temperament on the infant's responses to stressful situations may vary according to the quality of the mother-infant interaction.

Upon resumption of the interaction with the mother, the DT infants had more self-comforting behaviors than the ET infants. The data differ from those obtained by Yoo and Reeb-Sutherland (2013) in that infants perceived as having higher reactivity engaged more negatively with their mothers in the reunion episode than those perceived as having low negative reactivity. The authors did not observe differences in the comparisons regarding emotion regulation behaviors. In the study by Gunning, et al. (2013), the most irritable infants presented more dysregulated behaviors in the reunion episode than the non-irritable infants. A hypothesis for this data can be formulated together with the result observed for the mothers of these infants, who presented more NSO behaviors in the reunion episode than the mothers of ET infants. It can be assumed that these mothers had difficulties in interpreting their infants' behavior, responding adequately to them and supporting them in their regulatory processes, in order to resume the interaction between the dyad. In this context, the DT infants used their own resources to regulate themselves, such as putting their hands to their mouths and looking away.

In the reunion episode, an effect of prematurity was also observed. The preterm infants presented less self-comfort behaviors than the full-term infants, which means they interacted more with their mothers. This result was different from that found by Yaari, et al. (2018). The analysis of the factors' effect size on the infants' behaviors, through Cohen's *d*, indicated medium effect sizes.

Regarding the maternal behavior, there was a greater frequency of PSO with MT infants, regardless of birth condition, with medium effect size, and a higher frequency of NSO with ET preterm infants in the reunion episode, with small effect size, according to the Cohen's *d* analysis. Regarding the effects of temperament, infants perceived by their mothers as having MT showed more frequent PSO behavior in the play episode when compared to the infants perceived as having DT. Fuertes, et al. (2011), in their sample of preterm infants, did not find relationships between temperament and infant behavior in the FFSF. Concerning the maternal interactive behavior, it was observed in the play episode the dyads with full-term infants presented significantly more PSO behavior. This result confirms what was observed in the review by Korja, et al. (2012), with the studies indicating differences in maternal interactive behaviors according to the infant's prematurity.

In the reunion episode, the effect of the interaction between temperament and prematurity on the NSO behaviors was observed, more frequent with dyads with preterm infants with indications of ET. This was the only result that showed the interaction between the two variables, suggesting that together they have more impact on maternal behavior. There are studies that suggest that mothers of preterm infants have more intrusive behaviors in the interaction (Spairini, et al., 2018), combined with the perception of the infants as having ET, it may be that mothers behave to evoke the infants' behaviors, however, going beyond their limits and being intrusive. Another hypothesis that may explain the fact that mothers of preterm infants have higher means of NOS with ET infants is related to the possible previous experiences of these mothers (fear about survival, hospitalization histories, feelings of guilt and fear). This could cause them to be less sensitive to the identification of their infant's negative behaviors, since what they most wanted was for them to survive and be able to leave the hospital (Montanhaur, 2018).

The present study advances the investigation of the effects of temperament and prematurity on the behavior of mothers and babies in the context of the FFSF and shows that the combined effect of the two variables was more evident for the maternal behavior. Regarding the infants, more differences were found in their behavior when considering their temperament, with greater differences for those identified as

DT infants by their mothers. This result highlights the importance of planning and offering intervention programs focused on the interaction with the infant and with a view to helping mothers in the co-regulation processes.

Some limitations of the study are highlighted, such as the number of participants and the investigation of the infant's temperament based on maternal self-report, since the mother's perception can be influenced by multiple variables, such as aspects related to her life history, her current moment, the context of birth of this infant, and the culture. Prematurity and its consequences (hospitalization, presence of comorbidities, fear of losing the infant) may have led to infants with difficult temperaments being identified less frequently. Future studies may expand the discussion with the use of combined measures to assess temperament (self-report with more than one informant, physiological measures of the infant collected during observation) and longitudinal monitoring.

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About the authors:

Taís Chiodelli – Bachelor's in Psychology (Universidade Federal da Grande Dourados – UFGD), Master's and Doctorate in Developmental and Learning Psychology (UNESP, Bauru). Professor of the Graduate Programs in Psychology at Universidade Federal da Grande Dourados, Dourados-MS, Brazil.
ORCID: https://orcid.org/0000-0002-8586-1111
E-mail: tais.chiodelli@hotmail.com

Dayana Insfran Jorcuvich – Bachelor's in Psychology (UFGD), Master's in Psychology from the Graduate Program in Psychology of Universidade Federal da Grande Dourados, Dourados-MS, Brazil.
ORCID: https://orcid.org/0000-0002-0528-639X
E-mail: dayana-jorcuvich@hotmail.com

Veronica Aparecida Pereira – Bachelor's in Psychology (Unesp), Doctorate in Special Education (UFSCar) Post-doctorate in Psychology (University of Porto-PT). Professor of the Undergraduate and Graduate Programs in Psychology at Universidade Federal da Grande Dourados, Dourados-MS, Brazil.
ORCID: https://orcid.org/0000-0002-9051-7550
E-mail: veronica.ufgd.tci@gmail.com

Olga Maria Piazentin Rolim Rodrigues – Bachelor's in Psychology (Fundação Educacional de Bauru), Doctorate in Experimental Psychology (IP/USP/SP), Full Professor in Developmental Psychology (UNESP, Bauru). Professor of the Graduate Program in Developmental and Learning Psychology, UNESP, Bauru, SP.
ORCID: https://orcid.org/0000-0002-5332-256X
E-mail: olga.rolim@unesp.br

Contact:

Taís Chiodelli
Universidade Federal da Grande Dourados, Curso de Psicologia
Rodovia Dourados-Itahum, Km 12 – Cidade Universitária
Dourados-MS, Brasil
Telefone: (14) 99108-2192