THE EFFECT OF MATERNAL DEPRESSED MOOD ON INFANT EMOTIONAL REACTION IN A SURPRISE-ELICITING SITUATION

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ABSTRACT: The purpose of this study is to examine the claim that an infant’s ability to respond appropriately to an emotional situation varies according to the emotional state of the mother. Surprise expressions in mother and child were examined both in terms of paralinguistic aspects of surprise vocalizations as well as facial expressions. Seventy-two infants and their mothers (mean age = 8 months, range = 5–11 months) were video- and audiotaped in their homes. Half of the infants, matched for age and gender, had mothers who reported depressed mood. Infants of mothers with depressed mood showed significantly fewer components of facial expressions of surprise compared with infants of non-depressed mothers. Mothers with depressed mood exclaimed surprise with a significantly lower pitch (mean \( F_0 = 386.13 \) Hz) compared to non-depressed mothers (mean \( F_0 = 438.10 \) Hz). Furthermore, mothers with depressed mood showed fewer associations between elements of emotional expression than the non-depressed group. Infants’ expressions of surprise are influenced by maternal mood, resulting in reduced expression of the emotion in infants of mothers with depressed mood. These results are discussed in terms of coordination of vocal parameters in mother–infant dyadic interaction.

RESUMEN: El propósito de este estudio es examinar lo que se dice de que la habilidad de un infante de responder apropiadamente a una situación emocional varía de acuerdo con el estado emocional de la madre. Se examinaron expresiones de sorpresa en la madre y en el niño, tanto en términos de los aspectos paralingüísticos de las vocalizaciones de la sorpresa, así como de las expresiones de la cara. Método: Setenta y dos infantes y sus madres fueron grabados en vídeo y auditivamente en sus casas (la edad de los infantes era de entre los 5 y los 11 meses, con un promedio de edad de 8 meses). La mitad de los infantes pareados de acuerdo con la edad y el sexo, tenían madres que reportaron estados de ánimo depresivos. Resultados: Los infantes de madres con estados de ánimo depresivos mostraron significativamente menos componentes de expresiones faciales de sorpresa, comparados con los infantes de las madres no depresivas. Las madres con estados de ánimo depresivos exclamaron sorpresa con un tono significativamente más bajo (promedio \( F_0 = 386.13 \) Hz), comparadas con las madres no depresivas (promedio \( F_0 = 438.10 \) Hz). Es más, las madres con estados de ánimo depresivos mostraron menos asociaciones entre elementos de expresión emocional que las madres del grupo no depresivo. Con-

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From infancy, learning about emotions occurs in social situations (Klinnert, Campos, Sorce, Emde, & Svejda, 1983; Montague & Walker-Andrews, 2001; Sroufe, 1996). Surprise is an emotion which, although spontaneously shown by very young infants (e.g., Lundy, Field, & Pickens, 1996), is only later, i.e., at around 5 months of age, expressed in appropriate contexts (Reissland & Shepherd, 2002). Specifically, the conditions under which to show appropriate expressions of emotion such as surprise are learned in the process of development (Camras, 1994; Charlsworth, 1969; Fridlund, 1994; Reissland & Shepherd, 2002; Wolff, 1987). Since children have to learn the circumstances in which surprise can be expressed appropriately (Camras, 1992), maternal sensitivity between vocal and facial emotional expressions is an important factor in eliciting emotional reactions in their infants (e.g., Soken & Pick, 1999; Walker, 1982).

The precise role played by parental mood state in influencing a child’s emotional development is uncertain (Caplan et al., 1989; Rutter, 1997). Although the mood state of mothers might not lead directly to behavioral disorder in their infants and children (Rutter, 1997), it does influence parent–child interaction and attachment, which in turn might lead to dysfunctional behavior in their children (Dumas, Lemay, & Dauwalder, 2001). According to one study, about three fourths of the children of depressed mothers are emotionally or behaviorally disturbed (Weissman, Paykel, & Klerman, 1972), and other studies have shown that infants of depressed mothers are insecurely attached (Murray, 1992).

One of the possible mechanisms for the effect of depressed mood in the postnatal period on the child might be the way in which mothers with depressive symptoms and nondepressed mothers establish a rhythm of dialogue at an early age (Jaffe, Bebee, Feldstein, Crown, & Jasnow, 2001). Normally, infants’ communicative behavior is well organized and contingently related to maternal communicative behavior (Jaffe et al., 2001; Tronick & Weinberg, 1997). This relationship is important in the behavioral and vocal domains of interaction. Infants whose mothers show surprise in their facial expression as well as in their vocal exclamations react primarily to the vocal expression of surprise (Reissland & Shepherd, 2002).

Infants are sensitive to the relationship between the emotion shown on the face and the specific vocal information of the emotional expression. Infants at 7 months, for example, look longer at facial displays of happy, interested, angry, and sad expressions when they hear concordant rather than dissonant vocal and facial displays (e.g., Soken & Pick, 1999; Walker, 1982). Jaffe et al. (2001) found that vocal-rhythm coordination between mother and child at 4 months predicted attachment and cognition at 12 months. They established, when analyzing coordinated interpersonal timing, that a midrange in the degree of coordination (i.e., neither too high nor too low) between mother–infant vocalizations predicted secure attachment at 12 months. This is similar to Reissland and Stephenson’s (1999) findings on vocal interac-
tions of mothers with their premature and term babies. In their study, mothers of healthy, premature babies controlled vocal interactions by following significantly more often their infants’ vocalizations with an utterance directed at the child in comparison with mothers of term babies of comparable chronological age. Two months later, the infants born at term vocalized more compared with the preterm infants and followed significantly more often their mother’s utterances with a vocalization. Hence, arguably, the very tightly controlled vocalization coordination of mothers of the preterm infants, in contrast to mothers of term babies, led 2 months later to fewer vocalizations by these preterm babies.

Zlochower and Cohn (1996) provided support for the idea that maternal lack of response and the mothers’ inability to repair the interaction might be the reason why infants of depressed mothers fail to achieve coordination in social contexts. They examined the vocal timing of clinically depressed mothers’ responses to their 4-month-old infants’ vocalizations. The results confirmed that the duration of switching-pause in depressed mothers is longer, more variable, and less predictable than the timing mechanism of nondepressed mothers. They argued that depression may play a role in reducing synchrony in babies’ and depressed mothers’ interactions, affecting the mothers’ ability to coordinate their vocal behavior with their babies’ vocalizations or nonverbal behavior. Other research has suggested that moderation is important for optimal infant development. Stifter and Moyer (1991) found that moderately active mothers elicited more smiles in their 5-month-olds compared with mothers who showed more extreme behaviors.

In sum, a number of studies have established interaction coordination between maternal and infant behavior (e.g., Campbell & Cohn, 1997; Cohn & Tronick, 1988, 1989; Jaffe et al., 2001; Reissland & Stephenson, 1999; Zlochower & Cohn, 1996); however, very little research has been done on specific facial expressions of emotions and the paralinguistic aspects accompanying these expressions in relation to maternal mood. Examining facial expressions of emotions, Field, Healy, Goldstein, and Guthertz (1990) suggested that the negative effects of postpartum depression on the infant derive from the interactions with the mother. By 3 months of age, these infants seem to imitate their mother’s predominant emotion. In a more recent study, infants of depressed mothers responded less to the modeling of surprise expressions in comparison with nondepressed mothers (Lundy et al., 1996). Infants received a score from 1 to 9 for their facial expressions, which the experimenter modeled for the child. Infants of depressed mothers received a mean of 2.0 (SD=1.7) for surprise expressions. In contrast, infants of nondepressed mothers received a mean of 3.5 (SD=2.2) when imitating surprise. Although none of the infants responded fully to the emotional expression, infants of depressed mothers already demonstrated at this very early stage a delay in expressing surprise. In sum, depressed maternal mood does have a global effect on infants’ emotional development in terms of how securely they are attached and how they respond to emotional expressions.

Both the timing and the pitch of emotional expressions are important for children’s emotional development (Reissland & Shepherd, 2002). According to Scherer (1986), vocal aspects of child-directed language and the relation between affect and paralanguage have suggested that the affective state of the mother exerts an influence on the prosody of her child-directed speech. This claim is supported by a study by Bettes (1988), which analyzed 2-min maternal speech segments to their 3-to 4-month-old babies by mothers who self-reported mild to moderate depressive mood on the Beck Depression Inventory (BDI; Beck, 1996). Mothers with more symptoms associated with depression (BDI > 10) produced more flat, unmodulated $F_0$ contours, fewer vocalizations in response to infant vocalizations, longer
and more variable latencies to respond to infant vocalizations, and more variable pauses between vocalizations, relative to mothers with fewer symptoms of depression (BDI < 10). Hence, timing and intensity of maternal expression of emotion are important for optimal elicitation of emotional, cognitive, and social development in infants. Since exclamations of surprise are associated with a high pitch level (measured in Hz; Scherer, 1982), we predict differences in maternal surprise vocalizations between nondepressed mothers and mothers reporting depressed mood.

For the purpose of the present study, surprise was judged to be particularly suited to examining the relations of expression of emotion by the infant in relation to maternal mood. Surprise is an emotion elicited by a particular event rather than a general mood state such as pleasure. Following Charlsworth (1969), Camras (1994), and Reissland, Shepherd, and Cowie (2002), it is expected that the majority of infants of nondepressed mothers will show components of facial expressions of surprise in the context of the surprise-eliciting situation. Since maternal mood state has an effect on infants’ expression of emotions (e.g., Kaplan, Bachtowski, & Zarleno-Strouse, 1999; Lundy et al., 1996; Tronick & Weinberg, 1997), it is expected that infants of mothers reporting depressed mood compared with same-age infants of nondepressed mothers will show fewer facial components of surprise in a surprise-eliciting situation. Furthermore, vocal aspects of the expression of surprise will be tested. Following the findings of Bettes (1988) and Kaplan et al. (1999), mothers reporting depressed-mood state are expected to express surprise in a flatter voice, specifically with lower mean frequencies, compared to nondepressed mothers. Following the findings of Reissland, Shepherd, and Herrera (2003), length and loudness of surprise expressions are not expected to differ between the two groups of mothers.

There is some controversy over gender differences and the effects of depression. Some research has suggested that boys compared with girls are more vulnerable to maternal depressive symptoms in the first year of life (e.g., Carter, Garrity-Rokous, Chazan-Cohen, Little, & Briggs-Gowan, 2001; Carter, Mayes, & Pajer, 1990), and others have found no gender differences (e.g., Radke-Yarrow, Nottlemann, Martinez, Belmont, & Welsh, 1993; Rutter, 1990). Therefore, we included gender as a measure in this study.

METHOD

Participants

Mothers living in the Grampian Region were selected from the Aberdeen Maternity and Neonatal Databank depending on the date of birth of their child. A total of 240 mothers of children aged between 17 and 47 weeks were contacted by mail. Of these, 129 mothers (54%) agreed to participate in the study. All mothers were administered the Edinburgh Postnatal Depression Scale (EPDS; Cox, Holden, & Sagovsky, 1987) by postal questionnaire. Shortly following this and before scoring the EPDS, the experimenter videotaped the mother and child in their home. After videotaping, the EPDS was scored, and mothers with an EPDS rating of 9 and higher were identified. This resulted in a total of 36 (28%) mothers who reported depressed-mood states. After videotaping, these mothers reporting depressed-mood states, were matched with mothers not reporting depressive symptoms, based on the gender and age of their infants, years of education, and number of children in the family (EPDS
ratings of nondepressed mothers: $M=4.4$, range=0–8; EPDS ratings of mothers with depressed mood: $M=12.6$, range=9–23). The facial expressions of 2 mothers with depressive symptoms could not be coded and were therefore excluded from the study.

Sixty-eight infants matched for age and gender (mean age=8 months, range =5–11 months; 38 boys and 30 girls), half of whom had mothers with depressive symptoms, were included in the study. All mothers, irrespective of depression status, were monolingual English speakers, middle class, and primary caregivers, with a mean of 14 years of education (range=10–19).

**Procedure**

Mothers and their infants were observed, as part of a study on play interactions in their homes, while playing with a Jack-in-the-box (sides=12 cm). Interaction with the Jack-in-the-box lasted around 2 to 3 min, depending on how mother and infant enjoyed the play. Infants sat in a baby chair or were propped up on a sofa facing their mother. Two cameras, one focusing mainly on the mother with a directional microphone and placed approximately 1 m from the mother and the other placed approximately 1 m from the child and focusing mainly on the child, were used to record the sessions.

Mothers, facing their infants, were instructed to move a handle which activated a mechanism to open the lid of the Jack-in-the-box. Mothers were given no direction as to their own expressions of emotions. The reaction to the first opening of the Jack-in-the-box was measured in terms of facial expressions and vocalizations.

**Coding**

*Maternal acoustic measurements.* For each mother, the first vocal exclamation of surprise (e.g., “oh”) immediately following the opening of the lid of the Jack-in-the-box and which did not contain background noise was coded. The first spontaneous exclamation of surprise, which followed the first opening of the Jack-in-the-box, was selected because none of the mothers had previously seen this particular toy used in this study, and the first exclamation was deemed to be the most “natural” expression of surprise by the mother. In rare instances, the first surprise exclamation could not be used because of extraneous noise (e.g., moving of the tripod), so the next exclamation was used. Only vocalizations free from background noise were analyzed.

All vocalizations selected for analysis were digitized using Signalize (Keller, 1994). This package is designed to analyze the acoustic aspects of speech. The pitch-extraction algorithm (Fast Fourier transform) of this program reports fundamental frequency values ($F_0$) for each 5 ms of voiced speech. For each utterance, the following measures were obtained: minimum, maximum, and mean $F_0$ values measured in Hz. The amplitude was measured by a pitch-synchronous energy calculation. Minimum, maximum, and mean amplitude, measured in dB, were obtained for each utterance. The length of each utterance was measured in seconds.

*Infant gaze direction during the surprise-eliciting situation.* During the opening of the lid of the Jack-in-the-box, infant gaze direction at the mother, the toy, or other was coded frame by frame.

Reliability. Interrater reliability of observational data for gaze direction was calculated for 25% of the infants. There was 100% agreement.

Maternal and infant facial expression. Maternal and infant facial expressions were coded from videotapes by observers blind to the hypothesis and the EPDS rating of the mother. During the surprise-eliciting play with the Jack-in-the-box, facial expressions of pleasure, fear, neutral expression, or surprise were coded separately from three regions of the face (Hiatt, Campos, & Emde, 1979) corresponding to Appearance Change (AC) codes developed by Izard (1979, revised 1995). Only fear, surprise, neutral, and pleasure expressions were coded because previous research (Reissland et al., 2002) has found that infants show fear (rather than anger if they show a negative emotion), pleasure, and surprise. Neutral was coded as a baseline expression. Mothers and infants are credited with AC 20 (surprise in the eyebrow/forehead region) if their brows are raised in the normal contour, but they are curved and high and the skin below the brow is stretched, and/or horizontal wrinkles are visible across the forehead. Mothers and infants are credited with AC 30 (surprise in the eyes/lid region) if the eyelids are open, the upper lid is raised, and the lower lid is drawn down. Mothers and infants are credited with AC 50 (surprise in the nose/mouth region) if the jaw drops open so the lips and teeth are parted, but there is no tension or stretching of the mouth. Mothers and infants are credited with AC 22 (fear in the eyebrow/forehead region) if the brows are lowered and drawn together and/or the wrinkles of the forehead are across the center of the forehead and not the entire forehead or there is thickening in the midregion of the forehead. Mothers and infants are credited with AC 31 (fear in the eyes/lid region) if the upper lid is raised, exposing the sclera, and the lower lid is tensed and drawn up. Mothers and infants are credited with AC 53 (fear in the nose/mouth region) if the mouth is open and the lips are tensed and drawn back or stretched and drawn back. Mothers and infants are credited with AC 0 (pleasure in the eyebrow/forehead region) if the forehead is neutral. Mothers and infants are credited with AC 23 (pleasure in the eyes/lid region) if the upper eyelid corners are raised and crows’ feet wrinkles go outward from the corners of the eyes. Mothers and infants are credited with AC 52 (pleasure in the nose/mouth region) if the corners of the lips are drawn back and up and teeth may or may not be visible. Neutral facial expressions were coded for all three regions of the face if there was no visible movement in these regions of the face. Mother and infant were credited with showing surprise, pleasure, fear, or neutral expressions in no region (=0) or one to three regions of the face.

Reliability. Interrater reliability of observational data for the facial affect coding was obtained on the basis of all codes used and calculated for 25% of the infants and 25% of the mothers. For the infants, the mean percentage of agreement was 82% (Cohen’s κ=0.70–1). For the mothers, the mean percentage of agreement was 80% (Cohen’s κ=0.68–1).

RESULTS

Facial expressions

ANOVA on the expression of each emotion (surprise, pleasure, fear, and neutral facial expressions) by the infants and mothers were carried out with maternal mood state (showing depressive symptoms, nondepressed) and gender of child (boy, girl) as the independent vari-
ables. Expressions were coded across three regions of the face for the infants. The codes ranged from 0 to 3 regions of the face showing the four emotions (see Table 1).

There was a significant main effect of maternal mood on infants showing surprise facial expressions after the lid of Jack-in-the-box opened, $F(1,60)=5.02, p < .02$. Infants of mothers with depressive symptoms showed significantly fewer facial components of expressions of surprise compared with infants of mothers rated as nondepressed on the EPDS. Using the criterion of surprise that two or more regions showed the appropriate components, 41% of infants of mothers with depressive symptoms showed surprise compared with 73% of infants of nondepressed mothers, $\chi^2=7.27, p < .01$. With regard to fear, $F(1,60)=1.89, p = .174$, pleasure, $F(1,60)=.14, p = .70$, and neutral, $F(1,60)=2.40, p = .12$, expressions of the children, there were no significant effects (see Table 1). Mothers with depressive symptoms did not differ from nondepressed mothers in their facial expressions of surprise, $F(1,60)=.01, p = .92$; fear, $F(1,60)=0, p = 0$; pleasure, $F(1,60)=.52, p = .47$; or neutral, $F(1,60)=.48, p = .48$, expressions.

There were no gender differences nor any interactions between mood and gender in the expression of emotions either for the children, surprise: boys, $M=1.63$, girls, $M=1.69$, $F(1,60)=.677, p = .41$; neutral: boys, $M=82$, girls, $M=90$, $F(1,60)=.36, p = .55$; pleasure: boys, $M=08$, girls, $M=20$, $F(1,60)=1.26, p = .26$; fear: boys, $M=45$, girls, $M=37$, $F(1,60)=.19, p = .65$; or their mothers, surprise: mothers of boys $M=2.37$; mothers of girls $M=2.37$, $F(1,60)=.927, p = .34$; neutral: mothers of boys $M=.26$; mothers of girls $M=.30$, $F(1,60)=.06, p = .79$; pleasure: mothers of boys $M=.18$; mothers of girls $M=.33$, $F(1,60) = .87, p = .35$.

**Vocal expressions of surprise**

All mothers vocalized after the Jack-in-the-box opened. ANOVAs were carried out with mood state of the mother (showing depressive symptoms, nondepressed), and gender of child (boy, girl) as the independent variables, and mean fundamental frequency (Hz), amplitude (dB), and

### TABLE 1. Mean Number of Areas (0–3) in the Face Showing Surprise, Fear, Pleasure, and Neutral Emotion During the Surprising Event

<table>
<thead>
<tr>
<th>Maternal (Mood)</th>
<th>Depressed ($n=34$)</th>
<th>Nondepressed ($n=34$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Surprise</td>
<td>Fear</td>
</tr>
<tr>
<td>Emotion components shown by mothers</td>
<td>2.47 (0.896)</td>
<td>0</td>
</tr>
<tr>
<td>Emotion components shown by infants</td>
<td>1.35 (0.849)</td>
<td>0.53 (0.662)</td>
</tr>
</tbody>
</table>

*Note. SDs are given in brackets.*
TABLE 2. Mean Fundamental Frequency, Amplitude, and Length of Surprise Exclamations Depending on Maternal Mood State

<table>
<thead>
<tr>
<th>Maternal Mood</th>
<th>Depressed (n=34)</th>
<th>Nondepressed (n=34)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental frequency (Hz)</td>
<td>386.13 (81.96) (236.73–568.32)</td>
<td>438.10 (100.47) (262.75–661.39)</td>
</tr>
<tr>
<td>Length (s)</td>
<td>0.37 (0.26) (0.16–1.16)</td>
<td>0.45 (0.40) (0.10–1.78)</td>
</tr>
<tr>
<td>Amplitude (dB)</td>
<td>21.45 (10.81) (2.23–40.60)</td>
<td>18.75 (8.72) (3.96–38.82)</td>
</tr>
</tbody>
</table>

Note: SDs are given in brackets.

length (s) of mothers’ surprise exclamation as the dependent variable (see Table 2). Mothers who reported depressed mood exclaimed surprise with a significantly lower mean fundamental frequency than did nondepressed mothers, $F(1,60)=4.88$, $p<.03$. They did not differ in the length, $F(1,60)=.92$, $p=.34$, or amplitude, $F(1,60)=1.06$, $p=.30$, of their surprise exclamations.

Mothers exclaimed surprise in the same way for boys and girls, in terms of mean fundamental frequency, $F(1,60)=.05$, $p=.81$, length, $F(1,60)=.01$, $p=.899$, and amplitude, $F(1,60)=.58$, $p=.448$.

Correlation between maternal and child surprise facial expressions and maternal vocal expressions of surprise

To identify any patterns of association between mother’s facial and vocal expression of surprise and child facial expression of surprise, correlations between the three measures of mothers’ vocal expression and the facial expression of surprise by mothers and their children were run separately for groups classified as depressed on the EPDS and nondepressed groups (see Table 3).

Results in Table 3 show that there was not a significant correlation between the mothers’ and their children’s components of facial expression of surprise for either group. Within the nondepressed group of mothers, the length of surprise exclamation was correlated positively and significantly with loudness and child components of facial expression of surprise, but negatively with mother’s expression of surprise. The pattern for the mothers with depressed mood was different. There were no significant correlations among the three vocal measures of surprise nor were any of these measures correlated significantly with any measure of facial expression of surprise in mothers or children.
Do infants gaze at their mother's facial expression of surprise during the opening of the lid of the jack-in-the-box?

Given that previous findings showed that infants whose mothers show surprise both in their facial expression as well as their vocal exclamations react primarily to the vocal expression of surprise (Reissland & Shepherd, 2002), we analyzed gaze direction of infants in the surprise-eliciting situation. We hypothesized that if infants do not look at their mothers’ face, then they will be reacting primarily to her vocal expression of surprise in relation to the surprise-eliciting event (i.e., the Jack-in-the-box). An inspection of the gaze direction indicated that 84% of the children looked at the Jack-in-the-box when the lid opened; however, whereas all but 1 of the children of nondepressed mothers looked at the Jack-in-the-box, almost one third of the children of mothers who were classified as depressed on the EPDS looked elsewhere. A chi-square analysis of infants’ gaze direction of mothers reporting depressed mood versus nondepressed mood during the opening of the Jack-in-the-box lid was significant, $\chi^2=4.39$, $df=1$, $p<.05$. Significantly more babies of nondepressed mothers looked exclusively at the Jack-in-the-box. In contrast, a significant number of infants of mothers reporting depressed mood did not concentrate on the toy, instead looking at mother or other. To establish whether the children in the group of mothers reporting depressed mood who looked at the mother or

<table>
<thead>
<tr>
<th>Variables</th>
<th>Nondepressed Group</th>
<th>Depressed Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamental frequency of surprise and loudness</td>
<td>0.006</td>
<td>0.139</td>
</tr>
<tr>
<td>Fundamental frequency of surprise and length of surprise exclamation</td>
<td>−0.024</td>
<td>0.198</td>
</tr>
<tr>
<td>Fundamental frequency of surprise and maternal components of facial expression surprise</td>
<td>0.071</td>
<td>0.052</td>
</tr>
<tr>
<td>Fundamental frequency of surprise and child components of facial expression surprise</td>
<td>−0.148</td>
<td>−0.107</td>
</tr>
<tr>
<td>Loudness of surprise exclamation and length of surprise exclamation</td>
<td>0.514**</td>
<td>0.286</td>
</tr>
<tr>
<td>Loudness of surprise exclamation and maternal components of facial expression surprise</td>
<td>0.125</td>
<td>0.113</td>
</tr>
<tr>
<td>Loudness of surprise exclamation and child components of facial expression surprise</td>
<td>0.087</td>
<td>−0.285</td>
</tr>
<tr>
<td>Length of surprise exclamation and maternal components of facial expression surprise</td>
<td>−0.370*</td>
<td>−0.101</td>
</tr>
<tr>
<td>Length of surprise exclamation and child components of facial expression surprise</td>
<td>0.341*</td>
<td>−0.144</td>
</tr>
<tr>
<td>Maternal components of facial expression surprise and child components of facial expression surprise</td>
<td>−0.126</td>
<td>0.054</td>
</tr>
</tbody>
</table>

*p < 0.05.

**p < 0.01.
other did not show surprise while children who looked at the Jack-in-the-box did, we analyzed only the group of children who had mothers reporting depressed mood. An independent sample t test, \( t=1.13, df=32, p=.268 \), was nonsignificant. Hence, the children of mothers with self-reported depressive symptoms who did look at the Jack-in-the-box did not differ in their expressions of surprise from the children of mothers with self-reported depressive symptoms who did not look at the surprise-eliciting toy.

**DISCUSSION**

Mothers reporting depressed mood in the postnatal period exclaimed surprise with a significantly lower mean fundamental frequency compared with nondepressed mothers. The effect of maternal mood also could be observed in infants’ expressions of surprise. Infants of mothers with depressed mood showed significantly fewer components of facial expressions of surprise compared with infants of nondepressed mothers.

Mothers reporting depressed mood and nondepressed mothers in the present study did not differ in their facial expression of surprise, fear, or pleasure. This result mirrors other findings (e.g., Frankel & Harmon, 1996). Examination of the correlations indicated that a distinct pattern emerged for nondepressed mothers. The longer the mother’s exclamation of surprise, the more components of surprise her child displayed; however, for mothers reporting depressed mood, there was no such correlation. Furthermore, for the nondepressed group, the longer the mother’s surprise exclamation lasted, the louder her voice. There was no such correlation for the group of mothers reporting depressed mood. Nondepressed mothers thus showed a higher degree of coordination of vocal expressions of surprise than did depressed mothers.

An analysis of gaze direction showed that all except 1 of the infants of nondepressed mothers looked at the Jack-in-the-box. In contrast, one third of infants of mothers reporting depressed mood did not concentrate on the toy and looked elsewhere. If maternal vocal parameters of surprise were important, then one might expect that the response of infants who looked at the Jack-in-the-box would be influenced by these vocal parameters. Thus, within the “nondepressed group,” where all except 1 baby looked at the Jack-in-the-box, the length of mother’s surprise exclamation was significantly correlated with its loudness and with the child’s components of facial expression of surprise. In contrast, within the “depressed group,” fewer children looked at the surprise event, and there was no correlation among elements of maternal surprise expression.

In the present study, mothers of boys behaved similarly to mothers of girls in their facial and vocal expression of surprise. The fact that mothers reporting depressed mood and nondepressed mothers behaved similarly irrespective of the gender of their child is reflected in some of the literature on normal and depressed samples. According to Rutter (1990), gender differences may not be particularly powerful or pervasive. Radke-Yarrow et al. (1993) found no gender differences in negative affect expressed by depressed and nondepressed mothers to their infants. Gender differences were not reported by Weinberg and Tronick (1994) when analyzing 6-months-old infants’ affective configurations of facial, vocal, gestural, and regulatory behaviors. Bettes (1988), Breznitz and Sherman (1987), Caplan et al. (1989), and Edborogh, Lundh, Seimyr, and Widstrom (2001) also failed to find gender differences. In contrast, Weinberg, Tronick, Cohn, and Olson (1999) found gender differences in 6-month-old infants and their mothers; however, in their study as well as in other studies (e.g.,
Carter et al., 2001; Carter et al., 1990; Malatesta & Haviland, 1982), gender differences might depend upon the behaviors observed. For example, Tronick and Weinberg (2000), after videotaping 6-month-old infants under the still-face condition, found that boys were less likely than girls to express facial expressions of joy and used fewer self-comforting strategies. In contrast, in the present study, surprise facial expressions of infants in reaction to a Jack-in-the-box as well as maternal surprise exclamations did not differentiate boys from girls, but did differentiate between mothers reporting depressed mood and mothers who did not feel depressed.

In sum, this study demonstrated that infants of mothers suffering from depressed mood show less surprise in a surprise-eliciting situation than did infants of nondepressed mothers. Other studies have demonstrated global emotional problems (e.g., Carter et al., 2001; Carter et al., 1990; Weissman et al., 1972). In contrast, the present study highlights that the problem of emotional development is observable not only on a general level of insecure attachment (e.g., Jaffe et al., 2001; Murray, 1992) or behavioral problems in school (e.g., Caplan et al., 1989) but also in the very specific observations of the expression of surprise in a surprise-eliciting situation, which goes beyond the observations of newborns (e.g., Lundy et al., 1996).

In their review of maternal depression and parenting behavior, Lovejoy, Graczyk, O’Hare, and Neuman (2000) concluded that the “strength of the association between depression and parenting behavior varies as a function of the type of behavior observed” (p. 588). In the present study, differences between the groups of “depressed” and “nondepressed” mothers emerged in vocal pitch and the correlation between length of surprise exclamation and loudness of that exclamation as well as infant’s facial expressions of surprise. This is consistent with previous research (Reissland & Shepherd, 2002), which found that variation in maternal pitch was related to the child’s affective responses. Hence, depressed mood, as reported by the mother, seems to have an effect on the quality of the child’s emotional expressions.

One limitation of this study is that length of depression status was not assessed since mothers were asked only once to fill out the EPDS in the days before videotaping took place; however, Chabrol and Teissedre (2004) examined the relation between EPDS scores at 2 to 3 days’ and 4 to 6 weeks’ postpartum and showed that there was a significant correlation between the scores. Furthermore, since infants and mothers were only tested for the expression of surprise the first time they saw the Jack-in-the-box, we could not comment on whether infants might behave differently over longer periods of observation. In a previous cross-sectional study by Reissland et al. (2002), 5- and 9-month-old infants showed significantly more surprise facial expressions in comparison to 3-month-olds in relation to maternal vocal expressions of surprise. Hence, one might expect that if infants of mothers reporting depressed mood are delayed in their facial expressions of surprise, then they might not show surprise at 5 months of age. This question needs to be assessed longitudinally.

REFERENCES


