Depressed Mothers' Touching Increases Infants' Positive Affect and Attention in Still-Face Interactions

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PELÁEZ-NOGUERAS, MARTHA; FIELD, TIFFANY M.; HOSSAIN, ZIARAT; and PICKENS, JEFFREY. *Depressed Mothers' Touching Increases Infants' Positive Affect and Attention in Still-Face Interactions.* CHILD DEVELOPMENT, 1996, **67,** 1780–1792. The effects of depressed mothers' touching on their infants' behavior were investigated during the still-face situation. 48 depressed and nondepressed mothers and their 3-month-old infants were randomly assigned to control and experimental conditions. 4 successive 90-sec periods were implemented: (*A*) normal play, (*B*) still-face-no-touch, (*C*) still-face-with-touch, and (*A*) normal play. Depressed and nondepressed mothers were instructed and shown how to provide touch for their infants during the still-face-with-touch period. Different affective and attentive responses of the infants of depressed versus the infants of nondepressed mothers were observed. Infants of depressed mothers showed more positive affect (smiles and vocalizations) and gazed more at their mothers' hands during the still-face-with-touch period than the infants of nondepressed mothers, who grimaced, cried, and gazed away from their mothers' faces more often. The results suggest that by providing touch stimulation for their infants, the depressed mothers can increase infant positive affect and attention and, in this way, compensate for negative effects often resulting from their typical lack of affectivity (flat facial and vocal expressions) during interactions.

Early interaction disturbances place infants of depressed mothers at risk for later affective and socioemotional disorders (Field, 1992; Gaensbauer, Harmon, Cytryn, & McKnew, 1984; Zahn-Waxler, Cummings, McKnew, & Radke-Yarrow, 1984). Having a depressed mother increases by three times a child's risk of developing the abnormalities characteristic of depressed mothers (Weissman et al., 1984). Numerous studies have documented the negative impact of maternal depression on early infant interactions and development and have identified the behavior patterns of depressed mothers as unresponsive, insensitive, ineffective, noncontingent, emotionally flat, negative, disengaged, intrusive, avoidant of confrontation, and generally less competent and uninvolved with their infants (e.g., Campbell, Cohn, & Meyers, 1995; Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Cohn & Tronick, 1983; Field, 1984, 1986; Lyons-

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Ruth, Zoll, Connell, & Grunebaum, 1986; Peláez-Nogueras, Field, Cigales, Gonzalez, & Clasky, 1994).

Infants of depressed mothers, in turn, appear to develop a depressed mood style as early as 3 months. The "depressed" infants typically exhibit less attentiveness, fewer smiles, more fussiness, more gazing away, and lower activity levels when interacting with their depressed mothers than infants of nondepressed mothers (Cohn, Campbell, Matias, & Hopkins, 1990; Gelfand & Teti, 1990; Goodman, 1992). Moreover, maternal depression has been significantly associated with attachment insecurity among infants and preschoolers (Teti, Gelfand, Messinger, & Isabella, 1995). Infants of depressed mothers, however, do not necessarily generalize their "depressed mood" to other adults. When the infants of depressed mothers interacted with their nondepressed nursery teachers, the infants' behavior recovered, and their activity levels and positive affect rates were higher than when interacting with their depressed mothers (Peláez-Nogueras et al., 1994).

In general, depressed mothers and their infants appear to *share* their behavior states, spending more time in negative attentive/affective behavior states than nondepressed mother-infant dyads (Field, Healy, Goldstein, & Guthertz, 1990). Different profiles of behavior have been identified, including disengaged mothers (withdrawn and passive) and intrusive mothers (e.g., angry facial expressions and intrusive poking of the infant) (Field et al., 1990; Malphurs, Raag, Field, Pickens, & Peláez-Nogueras, 1996). But despite the variability observed in the mothers' interaction styles, the infants of both disengaged and intrusive mothers are usually uniformly distressed. Also, whether experiencing postpartum or chronic depression (Campbell et al., 1995), the common finding in the literature is that the depressed mothers' negative mood states and lack of affective responses negatively affect the child's behavior. In this way, the infants of depressed mothers begin to show growth and developmental delays at 1 year if their mothers remain depressed over the first year. Normally, the developmental delays are manifested by inferior performance on Bayley Mental and Motor Scales at 1 year of age, but other behavioral deficits have also been noted, including heightened emotionality and a lower level of symbolic play (Field, 1984; Gaensbauer et al., 1984; Sameroff & Seifer, 1983; Whiffen & Gottlib, 1989).

Researchers have prospectively studied infants and toddlers of depressed mothers to analyze the processes and mechanisms whereby depression may affect infant behavior. Diverse mechanisms have been hypothesized to produce the negative outcomes observed in infants and children of depressed mothers (e.g., Beardslee, Bemporad, Keller, & Klerman, 1983; Cummings & Cicchetti, 1990; Hammen, 1992). However, elucidation of the mechanisms and processes involved in the transmission of socioemotional behavioral problems from depressed mothers to their infants is still a major challenge for developmental researchers. This is because early development of infant depression may result from the interaction of *multiple influences*, including biological factors and psychosocial factors. Several models of early development of depression have been proposed, including mutual regulation (Tronick & Gianino, 1986), multivariate cumulative risk (Field, 1992), and temperament and genetic predisposition (Whiffen & Gottlib, 1989). These models have focused on the effects of multiple factors that include prenatal influences and postnatal experiences. An infant showing a depressed-mood pattern could be (*a*) biologically predisposed to depression due to prenatal exposure to the depressed mother's physiological imbalance and hormonal status or due to a potentially congenital predisposition or (*b*) environmentally affected due to continuing maternal depressed behavior patterns, like unresponsiveness and flat affect. Thus, multiple factors seem to be affecting both mothers' depression and infants' behavioral patterns denoting "depression," and there are multiple interactions between these underlying affective, perceptual, physiological, and biochemical processes.

The objective of the present study was to determine whether depressed mothers can improve their infants' attentive and affective responses by providing touch stimulation during still-face interactions. Touch, as a source of stimulation, has received little attention in the mother-infant interaction literature. The studies reported below suggest that tactile stimulation is a significant contributor to infant growth and social development.

Touch Stimulation in High Risk Populations

Studies involving touch of premature infants and neonates have reported improvements in physiological growth, motor/reflex,

cognitive/language, and visual/auditory development (see Ottenbacher et al., 1987). For example, an intervention program of stroking and passive limb movements three times daily for a total of 45 min per day led to increased weight gain, increased wakefulness and activity level, and improved performance of preterm infants on the Brazelton scales of orientation, motor, and range of state behavior (Field, Schanberg, et al., 1986). A follow-up study suggested continuing advantages for the stimulated infants, including better growth and development (Scafidi et al., 1990).

Touch during Face-to-Face Interactions

Face-to-face interactions are a primary way behavior disorders seem to be transmitted from mother to infant (Cohn et al., 1986; Field, Vega-Lahr, Scafidi, & Goldstein, 1986). The quality of infant behavior has been related to the unresponsiveness and emotional unavailability of their mothers during these interactions (Sameroff & Seifer, 1983; Tronick & Gianino, 1986). Only a few studies have investigated the effects of maternal touch during face-to-face interactions with their infants or the use of touch interventions to facilitate better interactions between mothers and their infants (e.g., Field, 1977; Malphurs et al., 1996; Peláez-Nogueras et al., 1996; Stack & Muir, 1990, 1992).

For example, Peláez-Nogueras et al. (in press) found that touch can reinforce and maintain high rates of infant eye contact responses, vocalizations, and smiles during face-to-face interactions. In that study, using a *synchronous-reinforcement* operant procedure, touch stimulation (gentle rubbing of the infant's arms, legs, and feet) was provided by a caregiver while the infant was making eye contact with her. After several conditioning sessions, the infants showed preferences for the reinforcing stimulation that included touch, as shown by the fact that they smiled and vocalized more and made more eye contact with the caregiver. Those findings suggest that infants' attention and positive affect can be reinforced and maintained by an adult providing *contingent* tactile stimulation during face-to-face interactions.

Infants' affective responses to stressful events like the *still face* of their mothers during interactions have also been investigated (Cohn & Tronick, 1983; Tronick, Als, Adamson, Wise, & Brazelton, 1977). In the still-face procedure, the mother's behavior is manipulated by having her adopt a stationary, expressionless poise. The still-face procedure has been used to study mother-infant interactions and to examine the effects of maternal behavior on infant affect and attention (e.g., Gusella, Muir, & Tronick, 1988; Lamb, Morrison, & Malkin, 1987; Mayes & Carter, 1990; Toda & Fogel, 1993) and on infant social referencing (Gewirtz & Peláez-Nogueras, 1992). During the still-face situation the continuation of maternal gaze toward the infant, coupled with her lack of responding and lack of touch, may lead to an infant reacting with negative affect and other coping behaviors. Stack and Muir (1990) found that when mothers were asked to be facially unresponsive, silent, and not to touch their infants during the still-face episode, infants displayed more grimacing and less smiling compared to periods of normal interaction. However, when touch was introduced during the still-face period, infants' positive affect and attention was higher. It remains to be determined, however, whether infants of depressed mothers are more sensitive to maternal touch than infants of nondepressed mothers. As yet, no studies have investigated the effects of touch by depressed mothers using the still-face procedure.

The present study was designed to test the hypothesis that depressed mothers can reduce the negative effects elicited by their still faces by providing additional touch for their infants. We thought it important to examine if touch provided by depressed mothers can help their infants to regulate affect behavior and increase their attention. The rationale was that infants of depressed mothers would not be as distressed as the infants of nondepressed mothers during the still-face-with-touch situation because they were used to seeing their mothers with flat affect. We expected that for these infants, touch could minimize (or compensate for) the lack of stimulation from the other sources (i.e., voice and face). On the other hand, the infants of nondepressed mothers were expected to be more difficult to soothe, even after touch was introduced in a still-face-with-touch period, because their mothers' continuous still face was so unexpected and atypical in their experience.

The main assumption was that, for the depressed group only, even when mothers continue displaying flat affect, their use of touch could decrease the negative effects of the still-face condition. Due to their history of repeated exposure to unresponsive maternal behavior, it was thought that infants of depressed mothers would respond more

positively than infants of nondepressed mothers when optimal touch (mild strokes/movements) was introduced in the still-face situation. Thus, maternal behavior was manipulated, touch was standardized, and the main grouping (independent) variable was maternal depression score. By standardizing touch we minimized differences in depressed and nondepressed mothers' kinds of touch and were able to assess whether maternal depression could account for the differences in infant behavior.

Method

Subjects

Forty-eight 3-month-old infants (mean age = 13.5 weeks, SD = 1.2) and their mothers (mean age = 19.1, SD = 2.7) participated in this study. All infants were healthy, born at gestational age (M = 38 weeks), were of normal birthweight, and had no history of medical complications. Subjects were recruited from a longitudinal study sample of low socioeconomic status based on the two-factor Hollingshead Index. Mothers were primiparous black (53%), Hispanic (40%), or Caucasian (7%), and were single (86%) adolescents, and their infants were normal full term infants. Three mother-infant dyads needed to be rescheduled because the babies were fussy and sleepy.

Mother-infant dyads were assigned to one of four groups: Depressed Mothers-Experimental (N = 16), Nondepressed Mothers-Experimental (N = 16), and Depressed Control and Nondepressed Control (N = 16). The Beck Depression Inventory (BDI) scores defined the depressed and the nondepressed groups (depression classification is described in detail in the following section). The groups did not differ on demographic variables, including age, ethnicity, marital status, and SES, resulting in a homogeneous sample. To ensure group equivalence, infants and their mothers were assigned to control or experimental groups through a random stratification procedure, stratifying in accordance to maternal depression score.

Procedure

Maternal depression assessment.—Assignment to the depressed groups was based on cutoff scores on the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mach, & Erbaugh, 1961). The 21 BDI items are scored on a four-point scale indicating absence/presence and severity of depressed feelings, behaviors, and symptoms. The scale is among the commonly employed instruments in research on nonclinically depressed samples. This self-report scale was used rather than a diagnostic interview because Cohn and Campbell (1992) have reported that depressed mothers' interaction behaviors are more highly correlated with self-report depression scores than they are with diagnostic interview measures. Mothers with BDI scores of 13 or greater (cutpoint of depression in most research protocols) were assigned to the depressed group and mothers with scores of 9 or less were assigned to the nondepressed group. We administered the BDI to 61 mothers to yield our sample of 24 depressed mothers. In previous studies with this population, approximately 30% of the mothers sampled received scores greater than 16 on the BDI (e.g., Field et al., 1990). The mean BDI score for all depressed mothers in our sample was 21 (SD = 9.1), ranged from 13 to 52, and for the nondepressed mothers was 4.1 (SD = 2.7), ranged from 1 to 9. Mothers with BDI scores of zero, 10, 11, and 12 did not participate in this study. The BDIs were administered 15 min before the interaction in a waiting room next to the laboratory by a research assistant.

Apparatus and setting.—Infants were seated in an infant seat facing their mothers at a distance of approximately 15 inches. Mothers were seated directly facing their infants at eye level. Two cameras, located on either side of the mother-infant dyad, were connected to a video recorder and a special effects generator to yield a split-screen image. One camera recorded the frontal view of the infant, and the second camera recorded the mother's face and hands. A time-date generator connected to the monitor was used to time the duration (in minutes, seconds, and milliseconds) of each period for subsequent coding.

Design.—A repeated-measures between-groups design was implemented: two groups (depressed vs. nondepressed) × two conditions (control vs. experimental) × four successive periods: (*A*) 90-sec normal interaction, followed by (*B*) 90-sec still-face-no-touch, (*C*) 90-sec still-face-with-touch, and finally, (*A*) 90-sec normal interaction. Sixteen additional mother-infant dyads were used as a no-still-face control group. Mothers in the control condition only received the normal interaction instructions across the four consecutive periods of the study. The design compares the 16 controls (half depressed and half nondepressed) to the 32 experimental (half depressed and half nondepressed). The order of the periods was not

counterbalanced because the purpose was to have a still-face-no-touch period preceding a still-face-with-touch period specifically to induce distress in order to increase the chances of getting an effect and thus to compare the depressed and nondepressed dyads' performances.

Instructions.—The total procedure required approximately 8 min. During the four 30-sec intervals between the four periods all mothers were given instructions. Instructions were standard for all mothers. To address the question of whether infants of depressed and nondepressed mothers respond differentially to touch when their mothers pose a still face, it was important to reduce variability in mothers' behavior during the still-face situation. For this reason, we imposed still-face instructions to all mothers in the experimental condition.

Before the first normal play period of interaction, mothers in the experimental condition were instructed to play with their infants as they would normally do at home. For the second period (still-face-no-touch), these mothers were instructed to look/gaze at their infants with a neutral expression, and to refrain from speaking, smiling, and touching the infant during this period. For the third period of interaction (still-face-with-touch) instructions were given to look/gaze at the infant with a neutral expression, to refrain from speaking and smiling, but to touch the infant as modeled. In the last normal period, mothers received the same instructions as in the first normal period.

To ensure that mothers maintained a still face throughout the still-face periods, continuous monitoring was conducted by the second research assistant observing the interaction from the observation room. The observer constantly checked that mothers were complying with instructions and were not making any change in facial expressions, thus, maintaining their "neutral" still face while gazing at the infant. In addition, we monitored that mothers were not cooing or vocalizing and that their touch was the same as instructed. All mothers in both groups complied with instructions (> 90% of the time). In those cases where mothers were not following instructions and smiled, vocalized, or touched their infants incorrectly, the session was interrupted and postponed for a second visit when further training was provided. If an infant was showing signs of being distressed during any of the four experimental periods or cried consistently for more than 15 sec, the session was interrupted and rescheduled. A total of five mother-infant dyads needed to be retrained and rescheduled for a second visit.

Touch procedure.—Just before the still-face-with-touch period, all mothers in the experimental condition received a brief demonstration of optimal touch. The "optimal" touch procedure involved a mother stroking and rubbing rhythmically the infants' arms, legs, and feet using the five fingers of both hands for the duration of the still-face period (90 sec). The experimenter modeled gentle pressure in slow circular motions at a rate of approximately one circular rub per sec. Negative touch was avoided. Negative touch involves rough tickling, poking and tugging while interacting with the infant, including poking the baby's face, arms, or stomach, or pinching or squeezing the infant, or pulling or shaking the infant. Mothers were instructed *not* to tickle or poke their infants during this procedure, nor to pull intensively their infants' legs or arms. The mothers' touch was checked routinely during the interactions to make sure they were providing touch as instructed.

Behavior coding.—The onset and offset of the videotaped behavior were registered by pressing numeric codes on a laptop computer. All behavior modalities were coded separately. The behaviors were coded continuously and featured a second-by-second listing of behaviors and a matrix of percentage time the behaviors occurred (Guthertz & Field, 1989). One view of the videorecord was used per each modality: (1) infant facial expressions (three codes: smile, neutral, grimace), (2) infant vocal expressions (three codes: positive vocalizations, no vocalizations, and protest/crying), (3) infant gaze behavior (used three codes: gaze at mothers' face, gaze away from mother's face, gaze at mother's hands). Thus, coding of these measures required three separate viewings of each record. In this way, coding of the infants' behaviors included three positive behaviors: (1) smiling, (2) vocalizing, (3) gazing at mothers' hands, and three negative affective behaviors: (4) crying, (5) grimacing, and (6) gazing away from mom.

For infant smiling to be coded the infant mouth had to be "upturned," whether the mouth was open or closed. For infant grimacing, the infant's mouth had to be turned down or curled or the infant had to be crying. For gazing away from the mother, the infant had to be looking at any other place

but the mother's face, hands, or body. Positive vocalizations were discrete sounds like those involved in cooing and babbling (but the infant could not be fussing or protesting). For crying, the infant had to be grimacing and emitting nondiscrete/loud sounds.

Given the highly standardized procedure of this study, for control purposes the mother's behaviors were also coded; that is, mother's touch, facial expressions (smiles, negative/angry, neutral), and mother's vocal sounds were coded. This allowed us to ensure that mothers were following the still-face, no voice, and no-touch and touch instructions. For touch behavior, five (numeric) codes on the laptop computer were used to code touch behavior: (1) mother's hand resting on baby, (2) mild touching (stroking, caressing, rubbing), (3) intense touching (tickling, poking), (4) mild movement (lifting baby's feet or arms in slow, rhythmic cycling), and (5) intense movement (quick intense movements of arms and legs or pulling arms or legs) (Stack & Muir, 1990). The purpose to measure touch was to ensure that mothers were providing mild touch and movements (2 and 4) for at least 75% of the time during the still-face touch period and were not making intense movements or pulling the infant's legs or arms.

Observer Reliability

Observers were unaware of the hypotheses and of the mothers' depression status. The two independent raters were trained to 90% reliability on each response category with an experienced rater. Reliability of the behavior measures was determined on one-third of the sample. Product-moment correlation coefficients were obtained on the percentage scores of primary and secondary observers on all response measures of infant and mother behaviors. Observer reliability, calculated separately for each response measure, was at $p < .001$ for each measure. The reliability coefficients obtained for infants' behaviors were as follows: infant smile, $r = .96$; infant vocalization, $r = .92$; infant gaze at hands, $r = .90$; infant grimacing, $r = .97$; infant crying, $r = .94$; infant gaze away, $r = .98$. For mothers' behaviors the reliability coefficients were: (1) mother's hand resting on baby, $r = .99$; (2) mild touching, $r = .95$; (3) intense touching, $r = .92$; (4) mild movement, $r = .96$; and (5) intense movement, $r = .93$; vocal sounds, $r = .98$; smiles, $r = .92$; negative/angry face, $r = 88$; and neutral face, $r = .96$.

Results

The first analyses were a 2 (group: depressed vs. nondepressed) × 2 (condition: experimental vs. control) × 4 (periods of interaction) MANOVAs on infants' positive behaviors (smiling, vocalizations, and gazing at mothers' hands), and on infant's negative behaviors (grimacing, crying, and gaze away from mothers). For the first MANOVA on infant positive behaviors, the analyses yielded a significant three-way interaction effect of group × condition × periods, $F(9, 36) = 2.56$, $p < .05$. Then, significant main effects were also observed for group, $F(3, 42) = 4.28$, $p < .01$, and condition, $F(3, 42) = 2.7$, $p = .05$. For the MANOVA on negative behaviors, the analyses yielded a significant three-way interaction effect of group × condition × periods, $F(9, 36) = 2.56$, $p < .05$. For the negative infant behaviors significant main effects were also observed for group, $F(3, 42) = 3.90$, $p < .05$, and for condition, $F(3, 42) = 2.68$, $p = .05$.

Separate analyses for the control and the experimental conditions revealed: (1) no changes in the control condition on any behavior were observed over time, across the four periods; (2) no significant differences in the behavior of the infants of depressed and nondepressed mothers were observed in the control condition across the four periods; (3) no differences were observed between the control and experimental mother-infant dyads in the first normal period. These analyses suggested that the control and experimental conditions were similar at the beginning (first normal period) of the study and that the infants were not fatigued over time.

A significant main effect of group (depressed vs. nondepressed), $F(3, 28) = 7.42$, $p < .001$; a significant group × periods interaction, $F(9, 22) = 4.77$, $p < .001$, across periods for positive infant behaviors; a main effect of group, $F(3, 28) = 2.72$, $p = .06$; and a group × periods interaction effect, $F(9, 22) = 3.02$, $p < .01$, for negative infant behaviors, were each obtained in the experimental condition.

The repeated-measure ANOVAs for individual dependent measures in the experimental condition were conducted to assess for main and interaction effects associated with the primary grouping variable (depressed vs. nondepressed) across the four periods (normal, still-face-with-touch, still-face-no-touch, normal). Simple effects analyses between depressed and nondepressed scores were conducted only when the re-

peated measures showed significant interaction effects (Winer, 1971). Paired t tests were also conducted within subjects to compare the between still-face-with-touch and still-face-no-touch periods (shown by subscripts in Table 1). The results on each variable follow.

Infant Positive Behaviors

Smiling.—ANOVA results for smiling yielded a group trend (depressed vs. nondepressed), $F(1, 30) = 3.68$, $p < .06$, and a significant group × period interaction effect, $F(3, 90) = 2.94$, $p < .05$. The proportion of smiling decreased from the normal period of interaction to the still-face-no-touch period in both groups (Table 1). However, only the *depressed* group showed a significant increase in smiling from the still-face-no-touch to the immediately following still-face-with-touch period, $t(15) = -2.33$, $p < .05$. Simple main effect tests performed on infant smiling revealed that the depressed and nondepressed groups differed in the still-face-with-touch period, $F(1, 30) = 11.15$, $p < .005$, and in the last normal period, $F(1, 30) = 16.00$, $p < .005$, with the depressed group smiling more.

Vocalizations.—An ANOVA yielded a significant group effect (depressed vs. nondepressed), $F(1, 30) = 4.79$, $p < .05$, and a significant group × period interaction effect, $F(3, 90) = 8.74$, $p < .001$. The proportion of time spent vocalizing decreased from the first normal period of interaction to the still-face-without-touch period for the nondepressed group only (Table 1). Post hoc simple main effects revealed group differences in vocalizing during the still-face-with-touch period, $F(1, 30) = 5.52$, $p < .05$, and during the last normal period, $F(1, 30) = 12.50$, $p < .001$, with infants of depressed mothers vocalizing more than infants of nondepressed mothers. The differences noted in infants' vocalizations in the normal periods were not significant.

Gazing at mother's hands.—Results revealed a main effect for group (depressed vs. nondepressed), $F(1, 30) = 10.90$, $p < .005$, and a group × period interaction effect, $F(3, 90) = 3.72$, $p < .01$, in gaze at mother's hands. As expected, the proportion of time infants gazed at mother's hands increased significantly from the still-face-no-touch period to the still-face-with-touch period for both the depressed group, $t(15) = -4.88$, $p < .001$, and for the nondepressed group, $t(15) = 5.53$, $p < .001$. Simple main effects analysis revealed that infants of depressed mothers gazed at their mothers' hands more often than infants of nondepressed mothers during the first normal episode, $F(1, 30) = 5.10$, $p < .05$, still-face-with-touch period, $F(1, 30) = 4.97$, $p < .05$, and during the last normal period, $F(1, 30) = 13.30$, $p < .001$.

Infant Negative Behaviors

Grimacing.—An ANOVA on grimacing yielded a group effect (depressed vs. nondepressed), $F(1, 30) = 5.50$, $p < .05$, and a group × period interaction effect, $F(3, 90) = 7.01$, $p < .001$. For the depressed group, infant grimacing decreased from the still-face-no-touch period to the still-face-with-touch period in the depressed group only, $t(15) = 2.58$, $p < .05$. Simple main effects analysis revealed that infants in the depressed group grimaced less often than the infants of nondepressed mothers during the still-face-with-touch period, $F(1, 30) = 11.15$, $p < .005$. Grimacing was also less frequent, $F(1, 30) = 7.62$, $p < .01$, in the depressed group compared to the nondepressed group during the last normal period.

Crying.—For crying, only a group × period interaction effect was obtained, $F(3, 90) = 2.92$, $p < .05$. For the depressed group only, infant crying decreased from the still-face-no-touch period to the still-face-with-touch period, $t(15) = 3.43$, $p < .005$. Crying was lower, $F(1, 30) = 4.98$, $p < .05$, in the depressed group compared to the nondepressed group during the still-face-with-touch period. Crying continued to be lower, $F(1, 30) = 4.39$, $p < .05$, for the depressed group compared to the nondepressed group during the last normal period.

Gazing away from mother.—An ANOVA yielded a group effect (depressed vs. nondepressed), $F(1, 30) = 5.79$, $p < .05$, and a group × period interaction effect, $F(1, 30) = 7.55$, $p < .001$. The proportion of time the infants gazed away from their mothers significantly decreased, $t(15) = 5.65$, $p < .001$, from the still-face-no-touch to the immediately following still-face-with-touch period in the depressed group but not in the nondepressed group. Simple main effects analysis performed on gazing away from the mother revealed that the nondepressed group gazed away more than the depressed group during the still-face-with-touch period, $F(1, 30) = 18.00$, $p < .001$, and also during the last normal period, $F(1, 30) = 19.14$, $p < .005$. The difference observed in the first normal period was not significant.

Mothers' Behavior

Repeated-measures MANOVA on maternal touch revealed no significant main effects of groups (depressed vs. nondepressed)

TABLE 1

MEAN PERCENTAGE OF INFANTS' (N = 16 Depressed and N = 16 Nondepressed) BEHAVIORS ACROSS FOUR SUCCESSIVE CONDITIONS

INFANTS' BEHAVIORS	NORMAL PLAY		STILL FACE-NO-TOUCH		STILL-FACE-WITH-TOUCH		NORMAL PLAY		EFFECT p
	Depressed	Non-depressed	Depressed	Non-depressed	Depressed	Non-depressed	Depressed	Non-depressed	
Smile	29.0_a	33.7_a	7.3_a	2.6_b	18.6_a	2.8_b	32.1_a	16.7_c	I*
	(24.6)	(24.9)	(10.6)	(3.3)	(18.6)	(3.5)	(25.0)	(17.3)	
Vocalizations	10.5_a	20.5_a	10.9_{ab}	6.5_b	17.3_{ac}	4.8_b	27.1_c	4.1_b	G*I****
	(9.1)	(22.0)	(15.0)	(6.3)	(20.7)	(4.8)	(22.6)	(4.5)	
Grimace	5.0_a	$.0_b$	5.6_a	11.6_a	1.3_b	8.1_{ac}	2.5_{ab}	32.5_d	G*I****
	(9.3)	(.0)	(8.6)	(19.1)	(1.9)	(10.5)	(4.1)	(43.3)	
Crying	1.6_a	$.2_a$	8.2_b	10.6_b	1.1_a	10.1_b	2.9_a	13.4_b	I*
	(2.9)	(.5)	(10.2)	(16.2)	(1.6)	(16.2)	(4.9)	(19.3)	
Gaze at hands	15.3_a	4.8_b	1.8_c	$.4_c$	38.5_b	19.6_a	25.5_a	2.4_b	G***I**
	(20.3)	(6.4)	(3.0)	(.6)	(30.8)	(14.0)	(25.1)	(3.3)	
Gaze away	14.3_a	10.3_a	55.4_b	53.3_b	17.8_a	46.4_b	14.2_a	39.3_b	G*I****
	(15.9)	(8.3)	(30.9)	(30.9)	(13.2)	(23.5)	(13.1)	(18.8)	

NOTE.—Means bearing different subscripts are different at $p < .05$ or less revealed by post hoc comparison of adjacent groups. G = group effect. I = group (depressed/nondepressed) × period interaction effect. Standard deviations are in parentheses.

* $p < .05$.
** $p < .01$.
*** $p < .005$.
**** $p < .001$.

or group × period interaction effects ($p > .10$). Touch was provided almost continuously by all mothers (97.7% of the time by depressed mothers and 93.7% of the time by nondepressed mothers) during the 90-sec still-face-with-touch period (Table 2). The instructions provided to both groups for the still-face-no-touch and for the still-face-with-touch periods minimized any potential difference in maternal behavior. Also, touch instructions seemed to produce a carryover effect of the mothers' touch behavior from the still-face-with-touch period to the last normal period of interaction, during which both depressed and nondepressed mothers touched their infants more than during the first normal play period. The higher amount of touch during the last normal period compared to the first normal period could have accounted for the significant differences observed in infant behaviors between these two periods.

Overall MANOVA for mothers' vocal sounds, smiles, and stillface revealed no significant main effects of groups (depressed vs. nondepressed) or group × period interaction effects ($p > .10$). This result was also expected given that the maternal behavior in both groups was highly standardized and under experimental control during the still-face-no-touch and still-face-with-touch periods.

Discussion

As predicted, infants of depressed mothers responded more positively to the reinstatement of touch following a still-face-no-touch episode than did infants of nondepressed mothers. Infants of depressed mothers showed more positive affect (more smiles and vocalizations) and gazed more at their mothers' hands during the still-face-with-touch period than the infants of nondepressed mothers, who grimaced, cried, and gazed away from their mothers' face more often during this period.

We should note that, by specifically introducing a still-face-with-touch period immediately after a still-face-no-touch period, we were able to measure the soothing effects of touch in the still-face situation right when the infants began showing the distressing effects produced by their mothers' still-face without touch. All infants became somewhat similarly distressed during the still-face-no-touch procedure; in particular, their gaze away from mothers' face (gaze aversion) was significantly higher during this period compared to the other three periods. When touch was introduced in the still-face situation, however, the effects were more soothing for the infants of depressed mothers and gaze aversion significantly decreased, but only decreased for the infants of depressed mothers. In this way, the distress caused by maternal lack of facial expressions and voice was reduced by instructing mothers to actively touch their infants. These findings suggest that the effects caused by the still face (lack of emotional expressions) can be partially eliminated (or reduced) by mothers actively touching their infants while still facially and verbally unresponsive.

In general, both groups of infants seemed to like touch, and they showed it by smiling and vocalizing more when they were touched. This study extends the previous findings (Peláez-Nogueras et al., 1996; Stack & Muir, 1990, 1992) by examining differences between depressed and nondepressed groups. In addition to finding that infants of depressed mothers smiled and vocalized more, oriented more to their depressed mothers, and cried and grimaced less than infants of nondepressed mothers during the still-face-with-touch period, we found that during the final return to normal play period infants of nondepressed mothers did not appear to "recover" from the distressing still-face periods, and they began to cry, grimace more, gaze away more, and to smile and vocalize less compared to infants of nondepressed mothers. Because we minimized the potential sociodemographic confounds by having a homogeneous sample of depressed and nondepressed adolescent mothers of low SES, our results can be considered representative for this particular lower-income adolescent population. Given this homogeneity of our sample, the results may be limited in generalizability.

The effects observed in infant behavior were not accounted for by immediate group differences in maternal behavior. That is, the depressed and nondepressed mothers' behaviors were not significantly different in the conditions in which infant behavior differences were observed. This uniform pattern of maternal behavior was expected given the highly standardized procedures of this study with both groups of mothers. Both depressed and nondepressed mothers were specifically instructed and given a demonstration showing them how to behave in the still-face-no-touch period and how to touch their infants during the still-face-with-touch period. In the absence of immediate group differences in maternal behavior, the differences in the pattern of infant behaviors across conditions can be related to the in-

TABLE 2

MEAN PERCENTAGE OF MOTHERS' (N = 16 Depressed and N = 16 Nondepressed) BEHAVIORS ACROSS FOUR SUCCESSIVE PERIODS

	NORMAL PLAY		STILL FACE-NO-TOUCH		STILL-FACE-WITH-TOUCH		NORMAL PLAY	
	Depressed	Non-depressed	Depressed	Non-depressed	Depressed	Non-depressed	Depressed	Non-depressed
Mother's total touch:	63.8	65.3	.47	.37	97.9	93.7	88.9	75.6
	(31.3)	(30.1)	(1.5)	(1.0)	(3.4)	(15.2)	(12.3)	(27.1)
Resting on baby	10.8	10.8	.00	.12	12.4	11.2	24.4	18.3
	(10.3)	(9.3)	(.00)	(.50)	(11.1)	(13.3)	(18.7)	(19.4)
Mild touch	24.4	16.4	.47	.25	47.8	54.3	21.3	11.6
	(24.7)	(17.4)	(1.5)	(1.0)	(30.4)	(36.0)	(19.1)	(16.0)
Intense touch	7.1	11.1	.00	.00	13.2	9.0	12.1	7.3
	(11.0)	(13.8)	(.00)	(.00)	(19.9)	(12.7)	(11.8)	(7.6)
Mild movement	21.6	26.1	.00	.00	24.5	19.3	27.8	34.6
	(31.0)	(20.2)	(.00)	(.00)	(26.8)	(24.1)	(24.2)	(23.2)
Intense movement	.0	1.0	.0	.0	.0	.0	3.4	4.0
	(.0)	(2.2)	(.0)	(.0)	(.0)	(.0)	(6.5)	(5.9)
Mother's vocal sounds	86.5	89.7	2.7	.7	3.6	1.2	80.6	89.5
	(13.4)	(12.8)	(3.9)	(1.9)	(9.5)	(3.4)	(22.7)	(16.5)
Mother's face:								
Smiles	70.4	66.2	4.3	2.8	3.1	.9	51.8	46.7
	(21.7)	(32.0)	(7.3)	(6.7)	(5.9)	(2.2)	(28.8)	(28.7)
Negative/angry	1.3	1.2	3.5	5.3	3.9	3.5	1.6	4.8
	(3.4)	(3.8)	(14.0)	(20.7)	(13.0)	(9.9)	(3.5)	(9.6)
Neutral	28.4	32.8	92.3	91.7	93.1	95.6	46.7	48.7
	(21.1)	(32.7)	(14.6)	(21.5)	(14.2)	(9.8)	(27.6)	(27.9)

NOTE.—MANOVAs revealed no group and no group × period interaction effects. Standard deviations are in parentheses.

fant's prior history of interactions with a depressed mother. The differences observed in the infants' behavior may be attributed to maternal depression and its concomitant history of interactions.

Alternatives to learning-history explanations, however, should be considered. It has been argued that infants of depressed mothers are at unusually high risk for developing depression due to *genetic* or prenatal transmission (Zuckerman, Als, Bauchner, Parker, & Cabral, 1990). To predict infant "depressive" behavioral outcomes from any single factor, however, is almost impossible, whether this factor is genetic or postnatal behavior experience. To elucidate the etiology of infant depression was not the objective, rather, our goal was to determine if a short intervention with touch by depressed mothers would increase infants' positive affect and attention during still-face interactions. As predicted, touch was more effective in enhancing the positive behavior in infants of depressed mothers. Depressed mothers seemed to have facilitated more positive affect and attention in their infants by touching them during the interactions, and the optimal/nonintrusive type of touch used in this study appeared to provide comfort during the stressful still-face interactions.

The findings can be explained in a number of ways. One possible explanation is that the infants of nondepressed mothers did not show significantly less grimacing and crying when touch was introduced during the still face because these infants were less familiar with maternal unavailability (flat face and affect) and were thus much more difficult to soothe when touch was introduced. Moreover, infant grimacing and crying continued to be emitted by the infants of nondepressed mothers even during the resumed normal period. The increase in infant grimacing and crying during the mothers' subsequent return to normal play following a period of maternal unavailability was also observed by Toda and Fogel (1993).

Typically, mothers "fake good" and "try harder" to show positive behaviors during the initial moments of videotaping in experiments. Thus, the absence of group differences in maternal behavior in the initial normal play period should not be overinterpreted. For the purpose of this study, the first normal play period may neither be representative of a "true" baseline nor as relevant as the subsequent differences observed later on the final play period after still-face periods. It is possible that touch was more soothing for infants of depressed mothers, who might normally be deprived of contingent maternal touch and contact at home. Touch may have quickly become nonsoothing, and perhaps aversive, for the infants of nondepressed mothers, who might normally not be deprived and were more upset and stressed by the preceding still-face-no-touch period.

During the resumed normal play interaction, then, the infants of depressed mothers were not as distressed as those of nondepressed mothers. Touch was initially soothing to the infants of depressed mothers, and in the aftermath of the still-face periods, the infants of nondepressed mothers were more upset. This phenomenon suggests that as a result of their history of experiences, the infants of depressed mothers were less distressed by the still-face perturbations and the absence of maternal touch. Conceivably, infants of depressed mothers could have been less distressed in our study because they received more optimal touch than they were used to.

The results of the present study can be related to findings from a recent learning experiment using a *synchronized reinforcement procedure* (Peláez-Nogueras et al., 1996). Peláez-Nogueras and colleagues found that contingent tactile stimulation by a caregiver during face-to-face interactions increases affect and attention in 3-month-old infants. In that study, when touch was used as part of the caregiver's social stimulation and provided contingently, it effectively reinforced and maintained higher rates of infant eye contact, smiles, and vocalizations. Interestingly, the infants in the present study also increased eye contact with their mothers during the still-face-with-touch period; this may have occurred as a result of intermittent contingent touch stimulation on infant making eye contact with their mothers.

Both learning and emotional regulation processes prepare the infant to develop adaptive and organized behavior strategies (Peláez-Nogueras, 1992; Thompson, 1994). The differences observed in the infants' behavior may lie in the different histories of interactions between mother and child and histories of infant behavior regulation. The data for the first normal play period show that infants of depressed and nondepressed mothers differed in facial grimacing and looking at hands, suggesting differences in their learning histories and conceivably in their ability to regulate their behaviors. However, even though there were differences between infants of depressed and nondepressed moth-

ers, we should be cautious when attributing these differences to the infants' prior interactive histories with their mothers in light of the fact that there were no immediate group differences in the mothers' behaviors in the first normal play period.

In sum, the effects of maternal touch during still face were more powerful for infants of depressed mothers than for infants of nondepressed mothers, even when the amount and type of touch provided by the depressed and nondepressed mothers were the same. Touch appears to have strong positive influences on infant behavior, it can increase positive affect, increase infants' negative affect, and direct infants' attention, in particular, the attention of infants of depressed mothers during face-to-face interactions. The type of stimulation that involves touch during face-to-face interactions needs to be investigated further. Although short-term positive effects were achieved in the present study, long-term assessments and implementations of this type of intervention are needed to determine the more prolonged positive effects of touch on infant behavior. Future research should focus on touch intervention strategies with infants and their depressed mothers.

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