JOURNAL OF APPLIED DEVELOPMENTAL PSYCHOLOGY **17,** 199–213 (1996)

Infants' Preference for Touch Stimulation in Face-to-Face Interactions

MARTHA PELÁEZ-NOGUERAS
Florida International University

JACOB L. GEWIRTZ
TIFFANY FIELD
MARICEL CIGALES
JULIE MALPHURS
SARA CLASKY
AIDA SANCHEZ
University of Miami School of Medicine

Infant preference for social stimulation that included touch during a face-to-face situation with an adult was investigated. Ten 1.5- to 3.5-month-old infants (M = 2.6, SD = .6) participated in a within-subjects repeated-measures design. Two treatment conditions were compared in an alternated, counterbalanced order with each infant. Under the touch treatment, the infant eye-contact responses were followed by continuous contingent adult smiling, cooing, and rubbing of the legs and feet. Under the no-touch treatment, the infant eye-contact responses were followed by contingent adult smiling and cooing, but not by touching. The results showed that, during the touch condition, infants emitted more eye contact and more smiles and vocalizations, and they spent less time crying and protesting compared with the no-touch condition. The results demonstrated that a social stimulus compound that included touching the infants functioned as a more effective reinforcer for infant eye-contact behavior than a stimulus compound that did not include touch.

Studies involving tactile stimulation of neonates and infants have reported improvements in growth, and in motor, cognitive, and social development following touch interventions (see reviews by Field, 1980; Ottenbacher et al., 1987). In

This research was supported by an NIMH Research Scientist Award no. MH00331 and NIMH Basic Research Grant no. MH46586 awarded to Dr. Tiffany Field. Results from this research were reported at the 1995 Biennial Meeting of the *Society for Research in Child Development.* We thank Angie Gonzalez for data coding, Peter Nogueras for assisting with figures, and Dr. Ziarat Hossain for assisting with statistical analyses.

Correspondence and requests for reprints should be sent to Martha Peláez-Nogueras, Department of Educational Psychology and Special Education, Florida International University, Miami, FL 33199 E-mail: (marthpn@aol.com).

early infant development research, touch interventions have concentrated primarily on the physical and perceptual development of high-risk infants, focusing on the therapeutic applications of touch. Tronick (1989) suggested that touch can regulate arousal, enhance proximity between mother and infant, and organize and soothe the infant. Few studies, however, have been devoted to investigating the effects of touch on infant social and emotional behavior in face-to-face interaction.

Only recently has the role of caregiver touch in face-to-face interactions with infants received attention (e.g., Gusella, Muir, & Tronick; 1988; Field et al., 1995; Peláez-Nogueras, Field, Hossain, & Pickens, 1996; Stack & Muir, 1990, 1992; Tronick, Als, Adamson, Wise, & Brazelton, 1978). In some of these studies, touch was used successfully to increase infants' social behaviors like attention (eye contact) and positive affect (smiles and vocalizations) during face-to-face interactions with their caregivers (Peláez-Nogueras et al., 1996; Stack & Muir, 1990, 1992). At the same time, negative effects of some types of touch, like frequent poking and tickling, have been noted in the context of face-to-face interactions by some investigators (Cohn, Campbell, Matias, & Hopkins, 1990; Cohn, Matias, Tronick, Connell, & Lyon-Ruth, 1986; Field, Healy, Goldstein, & Guthertz, 1990; Peláez-Nogueras et al., 1995).

In early conditioning studies, tactile stimulation was used as part of a social reinforcer complex that included an adult smiling and making sounds (e.g., "tsk, tsk") contingent on infant vocalizations (e.g., Rheingold, Gewirtz, & Ross, 1959; Weisberg, 1964). In those learning studies, contingent adult stimulation was very effective in reinforcing and maintaining the vocalizations of 3-month-old infants. Touch stimulation, however, was minimal, discrete, and provided only for short durations (1 s). For the most part, studies of mother–infant interaction have also included tactile stimulation within a multimodal–modal composite, as it typically occurs in natural settings. The effects of longer durations of touch stimulation, within a multimodal compound stimuli during face-to-face interactions have not been systematically implemented and assessed. Questions remain about infant preferences for social stimulus complex that do, and do not, include touch and about the reinforcing properties of adult touching during face-to-face interactions with infants. For example, does social stimulation that includes touch increase the infant's affective and attentive responses during face-to-face interactions with adults more than social stimulation that does not include touch?

Two procedures that have been very useful in studying the impact of touch on infant behaviors during face-to-face interaction with caregivers are the *still-face procedure* (Stack & Muir, 1990, 1992) and the *synchronized reinforcement procedure* developed for this study. In the still-face situation, the mother's behavior is manipulated by having her adopt a stationary, expressionless pose (e.g., Gusella et al., 1988; Lamb, Morrison, & Malkin, 1987; Mayes & Carter, 1990; Peláez-Nogueras et al., 1995; Stack & Muir, 1990, 1992; Toda & Fogel, 1993). These studies have shown that touch can reduce infants' negative affect, modulate positive affect, and direct attention during touch-only interactions. Peláez-

Nogueras et al. (1995) 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 with periods of normal interaction. When touch was reintroduced during the still-face condition, however, infants' positive affect and attention increased.

Operant conditioning procedures have been very useful in determining infants' preferences for particular types of adult-contingent stimulation (see review in Gewirtz & Peláez-Nogueras, 1992). For the most part, operant procedures have been used to investigate infants' preferences for visual and auditory stimulation (e.g., DeCasper & Prescott, 1984; Poulson & Nunes, 1988; Walton, Bower, & Bower, 1993). Similar conditioning studies testing for tactile stimuli preference are notably missing from the developmental literature. Touch preferences and their role in regulating infants' behaviors and their interactions with caregivers may be an important contributor to the area of infant social development. In general, developmental research has demonstrated that some of the basic principles for organizing behavior (e.g., contingency, timing, synchrony) are an essential component of mother–infant face-to-face interactions (e.g., Fogel, 1988; Tronick & Cohn, 1989).

Synchronized Reinforcement Procedure

The synchronized reinforcement procedure developed for this study is a contingency-based operant procedure that specifically allows the experimenter to compare the reinforcing efficacy of different types of adult stimulation in maintaining infant behavior. It permits a systematic comparison of the effects of different adult compound stimuli (e.g., auditory, visual, tactile) alternated during face-to-face interactions. The procedure allows the experimenter systematically to demonstrate that caregiver touch can regulate infant state (attention) as well as control infant positive affect (denoted by smiles and vocalizations). During extinction, in the absence of auditory stimuli and in the absence of changes in maternal facial expressions, the rate of infant responses is expected to decrease, thus, demonstrating a functional relation between the reinforcing tactile stimulation and the infant behavior.

In this study we compared the effect of an adult stimulus compound treatment that included touch with the effect of an adult stimulus compound treatment that did not include touch (only auditory and visual stimuli) on infant behavior during face-to-face interactions. To ascertain the importance of touch in maintaining and increasing attention and positive affect of 3-month-old infants, two hypotheses were tested:

1. Infants would engage in more eye contact with an adult who provides contingent (synchronized) tactile stimulation in addition to smiling and cooing than when the same adult provides smiles and cooing but does not touch the infants.
2. Infants would show more positive affect (smiles and vocalizations) and less

negative affect (protesting and crying) resulting from contingent stimulation involving touch compared with contingent stimulation involving visual and auditory stimuli but not touching.

METHOD

Participants

Participants were 10 full-term infants, 6 boys and 4 girls, who ranged in age from 1.5 to 3.5 months (M = 2.6, SD = .6) at the start of the study. All infants were healthy at birth and at the time of testing. Criteria for inclusion were that they were more than 37 weeks gestational age and that they had no physical or mental disability. The mothers of these infants were low socioeconomic status, primiparous African American (N = 7) and Hispanic (N = 3) unmarried adolescents. Three infants were discontinued from the study, two because of illness and one because of numerous absences.

Participants were recruited from an infant nursery where full-time day care was provided. The nursery was housed in a vocational education center attended by the infants' mothers. The day-care nursery was brightly decorated and equipped with toys, swings, and a crawling structure. There was one caregiver for every two infants. These caregivers provided frequent touching to the infants. In addition, mothers were required to visit the nursery daily to interact with their infants and to feed and change the infant's diaper.

Setting and Apparatus

Daily sessions were conducted in a testing room next to the infant nursery. Each participant was seated in an infant seat, located on a table top, with his or her face approximately 20 in. from the experimenter's face. Two video cameras recorded the sessions. One camera was focused on the infant; the other was focused on the experimenter. The cameras, connected via a special-effects generator to a video recorder, also provided a split-screen image on a monitor. The time–date generator timed the duration of each conditioning period, which was visible on the monitor, and facilitated subsequent coding.

Design and Procedure

A within-participants, alternating-treatments (ABA, BAB) design was used. Synchronous reinforcement situation was used for both treatments (touch and no touch). The term "synchronous reinforcement" describes the method used here in which the onset and offset of the adult stimulation is controlled by the onset and offset of the infant eye-contact response.

Each daily session consisted of three 2-min periods separated by a 30-s interperiod interval. During the interperiod interval, the infant was turned away from the experimenter, rocked and entertained with a toy by a research assistant. All infants were awake and alert with the same arousal level at the beginning of each session. Participants were randomly assigned to either an ABA or BAB

order for the first session of this study. The touch (A) and no-touch (B) treatments were alternated across the three periods of a session, thus, counterbalancing for order of treatment presentation. An entire session lasted 8 min.

Touch Treatment. During this conditioning treatment, each time the infant made eye contact, the experimenter responded contingently by smiling, vocalizing, and rubbing rhythmically both of the infant's legs and feet using the five fingers of both of her hands. Deep, but gentle pressure was applied in slow circular motions at a rate of approximately one circular rub per second. The reinforcing stimulation occurred for as long as the infant was making eye contact, within the 2-min (maximum) period of a treatment.

No-Touch Treatment. Each time the infant made eye contact with the experimenter, the experimenter responded contingently by smiling and cooing to the infant, but no touch was provided. This stimulation occurred also for the duration of the infant's eye-contact response.

Under both treatment conditions, as soon as the infant looked away from the experimenter's eyes, the experimenter stopped providing stimulation, but continued looking at the infant with a neutral face. The treatment stimulation was reinstated when the infant again emitted the eye-contact response.

The total number of sessions on the first phase varied across participants from 8 to 17 (M = 12, SD = 3), and the total number of conditioning periods ranged from 24 to 50 (M = 35, SD = 9.1). Sessions were discontinued when the participant was unable to continue in the project because of illness or chronic absence (N = 3). A session was also terminated early if the infact cried for 30 consecutive s.

Extinction. To test if the adult stimulation was actually functioning as a reinforcer for infant behavior, an extinction phase was implemented in a subsample of two participants (see Figure 2) against which the effects of the experimental conditions could be compared. Extinction consisted of withdrawal of stimulation. During an extinction session the experimenter maintained a neutral face and provided no auditory or tactile stimulation throughout the three 2-min periods also separated by 30-s interperiod intervals. Participant 8 received 8 extinction periods after 25 conditioning periods, and participant 5 received 8 extinction periods after 50 conditioning periods.

For control purposes, the experimenter's contingent stimulation was monitored and coded. In addition, an observer intermittently checked the interacting experimenter to insure that the facial expressions (smiling), vocalizations (cooing), and sitting position were the same in both treatments and across sessions.

Behavior Coding

Infant behaviors were coded from the videotapes using a laptop computer. The behaviors were coded continuously, and the computer output featured a second-

by-second listing of behaviors and a matrix of the percentage time that the behaviors occurred (Guthertz & Field, 1989). The infants' behaviors coded included: (1) eye contact; (2) positive affect (smiling and vocalizing); and (3) negative affect (grimacing and crying). An *eye-contact* response was coded if the infant visually fixated the experimenter's eyes. *Positive affect* responses were coded if the infant smiled (i.e., the infant's mouth was "upturned," whether the mouth was open or closed) or the infant emitted a vocalization not in the context of fussing or crying. Finally, *negative affect* responses were coded if the infant grimaced (i.e., the infant's mouth was turned down), cried, or fussed.

Observer Reliability

Two independent observers were trained to achieve high reliability ($r = .90$) with an experienced observer on every response category. Reliability of the behavior measures was determined on all data of four randomly selected participants (40% of the sample). Each observer coded the amount of time infants engaged in each response category. Primary and secondary observer scores were correlated using a separate Pearson-product moment correlation for each response category. The interobserver agreement on infant behavior, reliable at $p < .001$ for each response measure, was $r = .98$ for infant eye contact (total periods analyzed = 177), $r = .82$ for infant positive affect (total periods = 122), and $r = .97$ for infant negative affect (total periods = 122). Kappa coefficients were also computed (Bakeman & Gottman, 1986; Bartko & Carpenter, 1976) for each dependent measure. Interobserver reliability coefficients ranged from $\kappa = .79$ to 1.0 ($M = .90$) for eye contact and from $\kappa = .71$ to 1.0 ($M = .89$) for affect.

To assess the reliability of the primary experimenter's stimulation (i.e., smiles and coos) across treatment conditions, an experimenter viewed only the experimenter portion of the (split-screen) video tape for 40% of the sample. The primary experimenter's behaviors were coded on each of two factors: (1) intensity of smiles (i.e., slight, moderate, or broad), (2) volume of coos (i.e., soft, moderate, loud). Scores on each factor were compared across treatments using chi-square tests. No differences in experimenter's smiles and coos between the Touch and No-touch treatments were found.

RESULTS

The dependent measures were the percentage of observation time infants engaged in eye contact, positive affect, and negative affect responses. Infants obtained two percentage scores per session (one for touch treatment and one for no-touch treatment) for each of these three response categories.

Because the number of sessions varied across subjects, only the first 10 sessions for each participant were used in the group analyses. The percentage-scores data for eye contact were analyzed via a 2 (Treatment) × 2 (Treatment orders) × 10 (Sessions) repeated-measures ANOVA.

A main effect of treatments revealed that the mean percentage of time infants made eye contact was significantly greater during the touch treatment, $M = 80.9\%$, $SD = 19.2$, than during the no-touch treatment, $M = 53.4\%$, $SD = 27.1$; $F(1,234) = 112.2$, $p < .001$. A significant change across sessions for infant eye-contact response, $F(9, 234) = 4.23$, $p < .001$, was observed, suggesting a cumulative response effect over time under both treatments. No Treatment × Session interaction or treatment-order effects (ABA vs BAB) were noted.

Figures 1 and 2 present complete individual data plots showing the percentage of time each of the 10 infants made eye contact across periods as a function of treatment condition. Single-subject data suggest that 6 of the 10 infants learned very rapidly (within the first few treatment periods) to respond differentially to the two treatments. Three participants took longer (range = 5–12 periods) and only one failed to respond differentially (see Figure 1).

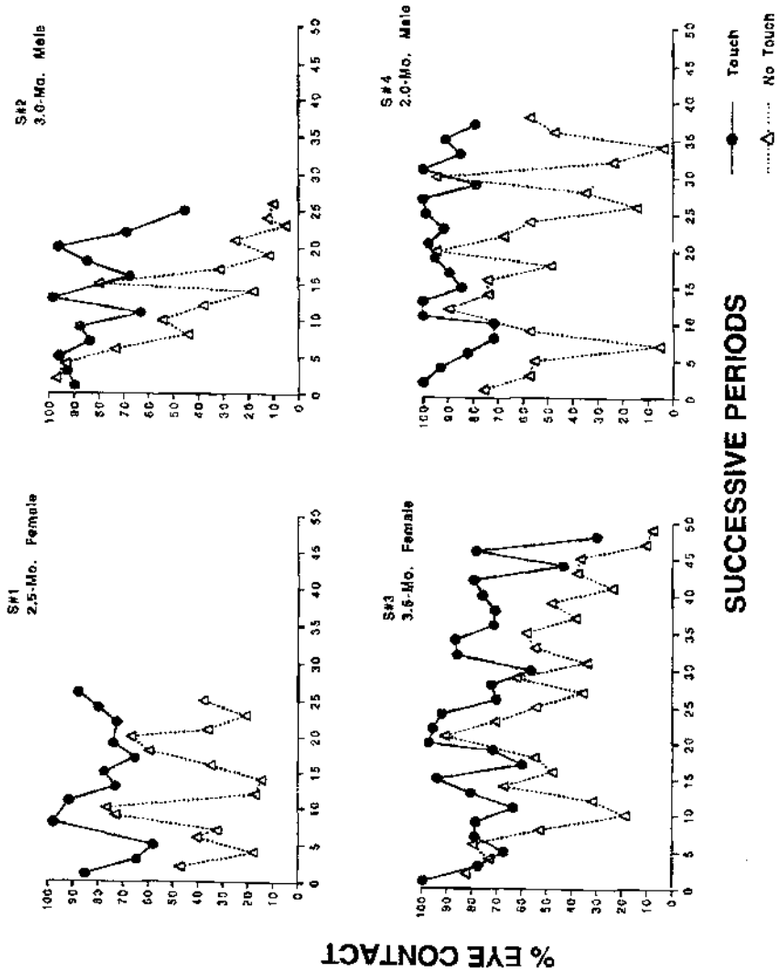
In addition to the analyses of the group data, individual eye-contact means on periods were analyzed separately using data from all sessions (rather than only from the first 10) for each infant. Individual repeated-measures ANOVAs on Treatment × Session were conducted. Percentage of eye contact was again significantly greater under the touch than the no-touch treatment for 9 out of the 10 participants (see Tables 1 and 2).

Positive and Negative Affect

Separate ANOVAs were also run for positive and negative affect with scores for the first 10 sessions. The mean percentage of time infants emitted smiles and vocalizations (denoting positive affect) across sessions was significantly greater during the touch, $M = 48.6$, $SD = 24.6$, than under the no-touch treatment, $M = 16.2$, $SD = 16.1$; $F(1,234) = 169.4$, $p < .001$. A Treatment × Session interaction effect was also found for positive affect scores, $F(9,234) = 1.91$, $p < .05$, suggesting that, over the first 10 sessions, the effects of the touch condition for positive affect increased.

A significant main effect was also found for negative affect. The mean percentage of time infants emitted cries and protests (denoting negative affect) for the first 10 sessions was greater for the no-touch, $M = 24.0$, $SD = 27.3$, than for the touch treatment, $M = 3.0$, $SD = 7.9$; $F(1,234) = 85.6$, $p < .001$. Neither session nor Treatment × Session interaction effects were found significant for negative-affect scores.

Thus, these group analyses' results show that, when touch was added to the stimulus complex, on average the infants emitted positive expressions a greater percentage of the time than negative expressions. Positive and negative affect data were also analyzed separately for each of the 10 infants, using data from all (rather than only the first 10) sessions. The individual positive affect means were significantly greater for the touch than the no-touch treatment for 9 of the 10 participants. At the same time the individual negative affect scores were signifi-


S#1
2.5-Mo. Female
S#2
3.0-Mo. Male
S#3
3.6-Mo. Female
S#4
2.0-Mo. Male
% EYE CONTACT
SUCCESSIVE PERIODS
Touch
No Touch

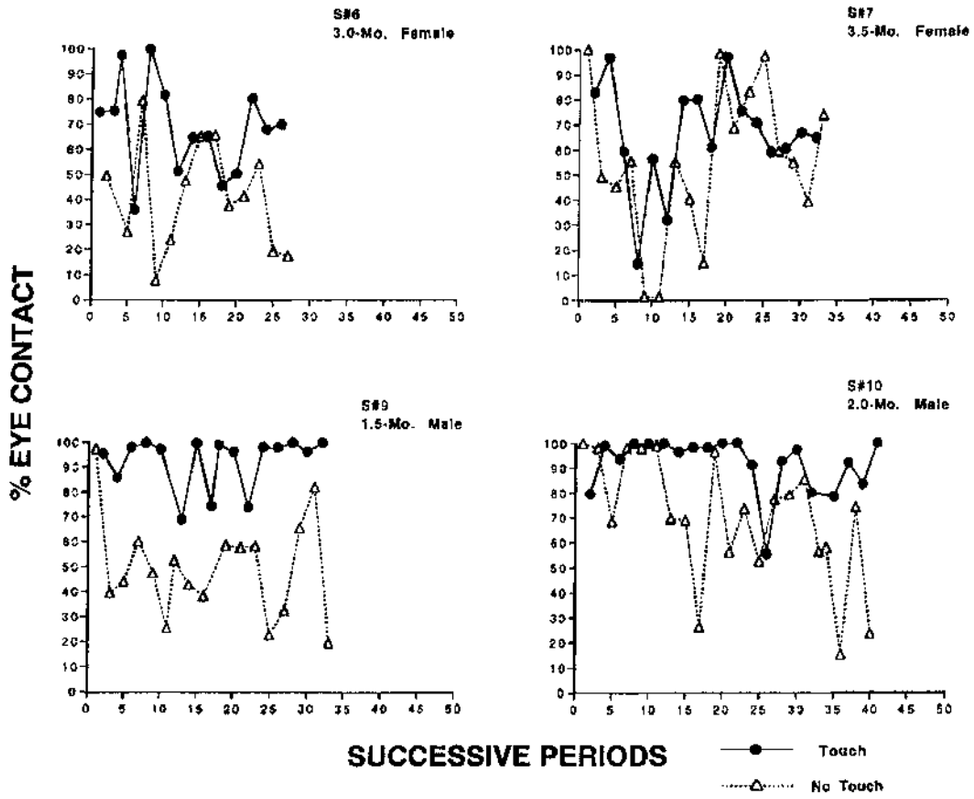


Figure 1. Percentage of time each of the 8 infants made eye contact across periods as a function of treatment condition (touch vs. no-touch).

TABLE 1
Mean Percentage of Infant Behavior During Touch and No-Touch Conditions (Individual Scores)

Participant	Age (mos.)	% Eye Contact (*SD*)			% Positive Affect (*SD*)			% Negative Affect (*SD*)		
		Touch	No-Touch	$p <$	Touch	No-Touch	$p <$	Touch	No-Touch	$p <$
1	2.5	77.3 (11.9)	41.2 (20.9)	.001	45.0 (24.0)	11.3 (18.9)	.001	2.2 (05.2)	17.9 (16.2)	.005
2	3.0	81.1 (16.4)	42.5 (32.1)	.001	41.6 (18.1)	15.4 (18.0)	.005	8.2 (10.9)	44.4 (31.7)	.005
3	3.5	76.1 (16.3)	48.6 (22.1)	.001	60.6 (18.1)	15.8 (15.6)	.001	1.8 (4.2)	12.6 (20.4)	.05
4	2.0	90.0 (9.8)	54.4 (27.7)	.001	47.1 (20.5)	14.5 (16.6)	.001	4.4 (11.8)	38.0 (28.9)	.001
5	2.5	75.5 (20.0)	47.4 (30.8)	.001	61.8 (26.2)	18.6 (19.7)	.001	2.3 (6.2)	30.8 (31.2)	.001
6	3.0	68.7 (18.5)	42.1 (21.2)	.005	72.6 (19.5)	24.7 (15.7)	.001	1.9 (7.2)	14.2 (24.6)	NS
7	3.5	66.2 (21.2)	55.2 (30.6)	NS	55.1 (17.6)	29.9 (23.3)	.001	0.2 (1.0)	0.2 (.7)	NS
8	2.5	67.7 (27.6)	40.3 (23.5)	.001	35.9 (22.1)	14.9 (22.9)	.05	9.1 (13.5)	48.8 (30.6)	.001
9	1.5	92.7 (10.6)	49.2 (20.9)	.001	35.9 (25.3)	9.0 (7.7)	.001	2.5 (9.9)	41.3 (24.5)	.001
10	2.0	91.9 (11.4)	70.3 (25.6)	.005	32.2 (27.5)	17.2 (15.6)	.05	3.3 (14.8)	13.4 (25.6)	NS

$N = 10$.

TABLE 2
Mean Percentage of Infant Behavior During Touch and No-Touch Conditions (N = 10)

	Touch	No-Touch	Effect (p)
Eye contact	80.90	53.40	G****
(*SD*)	(19.20)	(27.10)	
Positive affect	48.60	16.20	G****, I*
(*SD*)	(24.60)	(16.10)	
Negative affect	3.00	24.00	G****
(*SD*)	(7.90)	(27.30)	

G = group effect; I = interaction effect.
*$p < .05$. **$p < .01$. ***$p < .005$. ****$p < .001$.

cantly lower for the touch than for the no-touch treatment for 7 of the 10 infants (Table 1).

Extinction. The two infant participants (S5 & S8) who received an extinction phase showed a decrease of their eye-contact response. As shown in Figure 2, the percentage of time that eye contact occurred for S5 and S8 was very low and decreased to 0% during the last two to four extinction periods. At the same time, infant protesting and crying were high during these periods. However, when the stimulation treatments were reintroduced in the last phase of the study for these two infants, their eye contact and positive affect increased again. S8 was not able to take part in the study any longer because of illness and therefore was not able to attain again clear differential responses between the two treatments in the last reconditioning phase of the study (see Figure 2).

DISCUSSION

Infants spent more time making eye contact, vocalizing, and smiling with the adult experimenter during the touch treatment relative to the no-touch treatment. Furthermore, adult stimulation that did not include touch increased infants' negative affect responses. The results showed that a contingent social stimulus compound that included touch during face-to-face interactions with infants functioned as a more effective reinforcer for infants' eye-contact behavior than a contingent social stimulus compound that did not include touch.

The obtained effects were quite robust. With the exception of one interaction, all significant tests achieved a probability of $p < .001$. Because we minimized the potential sociodemographic confounds (by having a homogeneous sample), the results can be considered representative for this particular population. How-

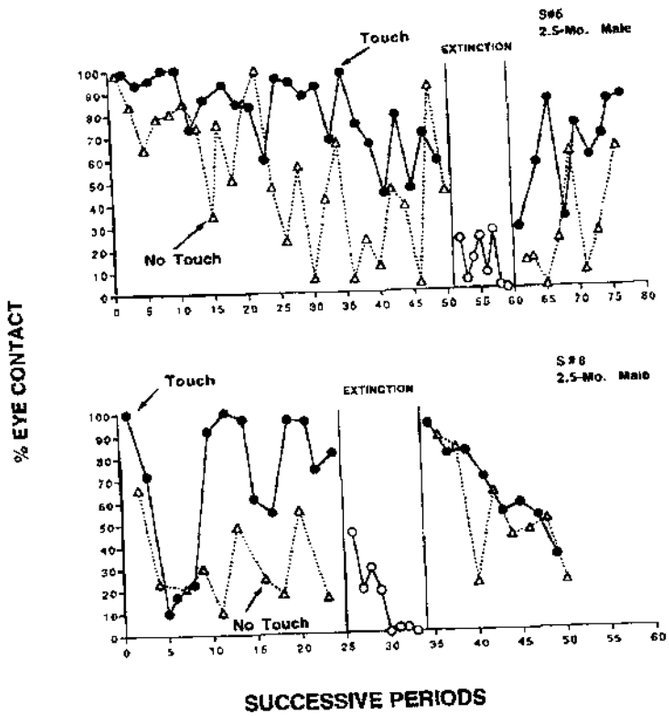


Figure 2. Percentage of time S5 and S8 (who received the extinction phase) made eye contact across periods as a function of treatment condition (Touch, No-Touch, Extinction).

ever, given this homogeneity of participants, the results may be limited in generalizability.

The study presented here contributes to the existing literature on mother–infant interactions by providing a reliable procedure (and measure) that allows researchers to determine which stimulation is preferred by the infant during face-to-face interactions. The conditioning procedure permits assessment of infants' responses to different social compound stimuli, a measure which researchers could ideally use as an online indicator of how infants are responding to intervention procedures. In the synchronous reinforcement situation during face-to-face interaction an infant can regulate the amount of stimulation provided by the adult. An infant could *only* obtain and maintain stimulation (e.g., touch, cooing, and smiles) by sustaining eye contact with the experimenter. The way for an infant to avoid or terminate the adult stimulation was to gaze away from the experimenter's eyes. This operant learning provides an effective means by which to study and determine infant preferences for a variety of social stimuli.

Individual differences and behavior variability were expected and found. Our theoretical assumption is that the interindividual differences observed in the

operant level of eye contact and positive affect may be partially accounted for by different histories of interaction between mother and infant and the self-regulatory behaviors of the infant. Clearly, whereas some infants had a more stable pattern of responses to contingent stimulation, most infants demonstrated differential responses to the two treatments very rapidly. Implementation of treatment was continued for several additional sessions in an attempt to reach stability of the response pattern. Stability across periods, however, was not observed in every participant. For the most part, preferences for the touch treatment began to show between the second and fifth treatment periods where the larger effect occurred. Conceivably, these individual preferences for touch reflect different thresholds for responding negatively (e.g., protesting emotionally) to the absence or removal of touch, and in some cases they could have produced different patterns of infant eye contact and variability among some of the scores. Processes denoted by different infant ages could be another reason for this variability in gaze, and in positive and negative hedonic state between infants (Ellsworth, Muir, & Hains, 1993; Gusella, Muir, & Tronick, 1988).

In general, the infants in our study responded very positively to stimulation that included touch. The participants in this study were not deprived and were frequently touched during their interactions with the caregivers in the day-care setting. During their routine visits to the day-care center, the mothers of these infants touched and kissed their infants, often while interacting with them. However, even though our infants experienced ample human tactile contact while in day care, we know little about the touch they experienced in other settings. A question not addressed by this study was the role of routine patterns of touch stimulation experienced by infants in determining touch preferences.

Future research should also be directed toward identification of other potential factors, such as infant's history of mother–infant interaction, individual differences in thresholds for touch stimulation, and the nature of touch used that could alter its effects. For example, it is reasonable to speculate that infants who are touched often by their parents during interaction would show more positive affect responses when touched by other adults than would infants who are less frequently touched by their parents. Social stimulation effects may vary with different infant thresholds for tactile stimulation. There may be infants who tolerate touch and do not show preferences. On the other hand, some infants may require more stimulation and others may require less. Social stimulation treatments that are effective for some infants should not necessarily be effective for all infants. For example, a study of tactile/kinesthetic stimulation of full-term infants using the same procedures that had been effective with preterm infants yielded negative results, suggesting that full-term infants not only did not benefit from that tactile stimulation but fared less well than the control group (Koniak-Green & Ludington-Hoe, 1987). Findings with particular infants (e.g., infants of depressed mothers) should not be generalized to all infants (Peláez-Nogueras, Field, Cigales, Gonzales, & Clasky, 1994).

Additional questions for future research on touch include: (a) Which parts of

the body do infants prefer having touched (e.g., legs, arms, back, face)? (b) which type of tactile stimulation is the more effective as a reinforcer (e.g., massage/rubbing or light stroking)?; (c) How does touch compare with visual and/or auditory social stimuli as reinforcer of infant behaviors? (4) Do some types of touch function as positive reinforcers for and other types of touch function as aversive stimuli for various infant behaviors?; (d) How does the infants' history of experiences with touch affect their response patterns in new and different contexts?

The behavior young infants display is a crucial aspect of their interaction with adults in their environment. Indeed, it may be the primary mode of communication with their caregivers. Hence, it is of utmost importance that caregivers learn how to interact with their infants and learn to interpret their reactions to touch. More importantly, what infants may benefit from most are interventions and tactile stimulation that are individually tailored. To provide such a procedure, future research must first assess each infant's responses to different types and intensities of tactile stimulation, before a formal intervention is recommended to be implemented by parents and caregivers.

In sum, the type of stimulation that involves touch during face-to-face interactions needs to be researched further. Although short-term positive effects were achieved in our study, and the synchronized reinforcement procedure permitted the investigator to receive feedback from the infants indicating their preferences for the social/tactile treatment, to determine the more prolonged positive effects, long-term assessments and implementation of these interventions are recommended.

REFERENCES

Bakeman, R., & Gottman, J.M. (1986). *Observing interaction: An introduction to sequential analysis*. New York: Cambridge University Press.

Bartko, J.J., & Carpenter, W.T. (1976). On the methods of reliability. *Journal of Nervous and Mental Disease, 163*, 307–317.

Cohn, J.F., Campbell, S.B., Matias, R., & Hopkins, J. (1990). Face-to-face interactions of postpartum and nondepressed mother–infant pairs at two months. *Developmental Psychology, 26*, 185–193.

Cohn, J.F., Matias, R., Tronick, E.Z., Connell, D., & Lyon-Ruth, K. (1986). Face-to-face interactions of depressed mothers and their infants. In E.Z. Tronick & T. Field (Eds.), *Maternal depression and infant disturbance* (pp. 31–45). San Francisco: Jossey-Bass.

DeCasper, A.J., & Prescott, P.A. (1984). Human newborns' perception of male voices: Preference, discrimination, and reinforcement value. *Developmental Psychobiology, 17*, 481–491.

Ellsworth, C.P., Muir, D. W., & Hains, S.M.J. (1993). Social competence and person-object differentiation: An analysis of the still-face effect. *Developmental Psychology, 29*, 63–73.

Field, T. (1980). Supplemental stimulation of preterm neonates. *Early Human Development, 4*, 301–314.

Field, T., Healy, B., Goldstein, S., & Guthertz, M. (1990). Behavior state matching in mother–infant interactions of nondepressed versus depressed mother–infant dyads. *Developmental Psychology, 26*, 7–14.

Fogel, A. (1988). Cyclicity and stability in mother–infant face-to-face interactions: A comment on Cohn and Tronick (1988). *Developmental Psychology, 24*, 393–395.

Gewirtz, J.L., & Peláez-Nogueras, M. (1992). B.F. Skinner's legacy to human infant behavior and development. *American Psychologist, 47*, 1411–1422.

Gusella, J.L., Muir, D.W., & Tronick, E.Z. (1988). The effect of manipulating maternal behavior during an interaction on 3- and 6-month-olds' affect and attention. *Child Development, 59*, 1111–1124.

Guthertz, M., & Field, T. (1989). Lap computer or on-line coding and data analysis for laboratory and field observations. *Infant Behavior and Development, 12*, 305–319.

Koniak-Green, D., & Ludington-Hoe, S.M. (1987). Paradoxical effects of stimulation on normal neonates. *Infant Behavior and Development, 10*, 261–267.

Lamb, M.E., Morrison, D.C., & Malkin, C.M. (1987). The development of infant social expectations in face-to-face interaction: A longitudinal study. *Merrill-Palmer Quarterly, 33*, 241–254.

Mayes, L.C., & Carter, A.S. (1990). Emerging social regulatory capacities as seen in the still-face situation. *Child Development, 61*, 754–763.

Ottenbacher, K.J., Muller, L., Brandt, D., Heintzelman, A., Hojem, P., & Sharpe, P. (1987). The effectiveness of tactile stimulation as a form of early intervention: A quantitative evaluation. *Developmental and Behavioral Pediatrics, 8*, 68–76

Peláez-Nogueras, M., Field, T., Cigales, M., Gonzales, A., & Clasky, S. (1994). Infants of depressed mothers show less "depressed" behavior with their nursery teachers. *Infant Mental Health Journal, 15*, 358–367.

Peláez-Nogueras, M., Field, T., Gewirtz, J., Cigales, M., Gonzalez, A., Sanchez, A., & Clasky, S. (1995). Infants preference for rhythmic versus nonrhythmic touch. In D.W. Muir (Chair and Discussant), *Communicating with touch during mother–infant interactions*. Symposium conducted at the Biennial Meeting of the Society for Research in Child Development. Indianapolis, Indiana.

Peláez-Nogueras, M., Field, T., Hossain, Z., & Pickens, J. (1996). Depressed mothers' touching increases infants' positive affect and attention in still-face interactions. *Child Development, 67*, 1780–1792.

Poulson, C.L., & Nunes, L.R.P. (1988). The infant vocal-conditioning literature: A theoretical and methodological critique. *Journal of Experimental Child Psychology, 46*, 438–450.

Rheingold, H.L., Gewirtz, J.L., & Ross, H.W. (1959). Social conditioning of vocalizations in the infant. *Journal of Comparative and Physiological Psychology, 52*, 68–73.

Stack, D.M., & Muir, D.W. (1990). Tactile stimulation as a component of social interchange: New interpretations for the still-face effect. *British Journal of Developmental Psychology, 8*, 131–145.

Stack, D.M., & Muir, D.W. (1992). Adult tactile stimulation during face-to-face interaction modulates five-month-olds' affect and attention. *Child Development, 63*, 1509–1525.

Toda, S., & Fogel, A. (1993). Infant response to the still-face situation at 3 and 6 months. *Developmental Psychology, 29*, 532–538.

Tronick, E.Z. (1989). Emotions and emotional communication in infants. *American Psychologist, 44*, 112–119.

Tronick, E.Z., Als, H., Adamson, L., Wise, S., & Brazelton, T.B. (1978). The infant's response to entrapment between contradictory messages in face-to-face interaction. *Journal of the American Academy of Child Psychiatry, 17*, 1–3.

Tronick, E.Z., & Cohn, J. F. (1989). Infant–mother face-to-face interaction: Age and gender differences in coordination and the occurrence of miscoordination. *Child Development, 60*, 85–92.

Walton, G.E., Bower, N.J.A., & Bower, T.G.R. (1992). Recognition of familiar faces by newborns. *Infant Behavior and Development, 15*, 265–269.

Weisberg, P. (1964). Social and nonsocial conditioning of infant vocalizations. *Child Development, 34*, 377–388.