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The Effects of Systematic Stroking versus Tickling and Poking on Infant Behavior

MARTHA PELÁEZ-NOGUERAS
Florida International University

TIFFANY FIELD
University of Miami

JACOB L. GEWIRTZ
Florida International University

MARICEL CIGALES, ANGELA GONZALEZ, AIDA SANCHEZ, and SARA C. RICHARDSON
University of Miami

Effects of contingent stroking were compared to effects of contingent tickling and poking on infant eye contact (attention) and affect during face-to-face interactions with an adult female. Twelve 2-to 4.5-mo-old infants participated in a within-subjects alternating-treatments design. Each subject received the two touch conditioning treatments in alternation within each of four consecutive sessions. In each session, three 2-min conditioning periods were implemented. Compared to tickling and poking treatment, during the systematic-stroking treatment all infants spent a greater proportion of time making eye contact with the experimenter, smiled and vocalized more and frowned and cried less.

The beneficial effects of systematic stroking and massage have been documented for neonates and infants (Field, 1980; Field, Schanberg, Scafidi, Bauer, Vega-Lahr, Garcia, Nystrom & Kuhn, 1986; Lester & Tronick, 1990; Scafidi, Field, Schanberg, Bauer, Tucci, Roberts, Morrow & Kuhn, 1990; for a review see Ottenbacher, Muller, Brandt, Heintzelman, Hojem & Sharpe, 1987). These studies have shown that touch stimulation, when properly

Direct all correspondence to: Dr. Martha Peláez-Nogueras, Department of Educational Psychology and Special Education, Florida International University, Miami, Fl 33199 <marthapn@aol.com>.

undertaken, can contribute to the infant's growth, and well being. For example, in the Field et al. (1986) study, preterm neonates were given massage therapy to the abdomen, back, and legs, three times a day for a total of 45 minutes. These neonates experienced greater weight gain, spent more time awake and active, and showed more mature performance on the Brazelton scale in orientation, motor, and state behaviors than did the neonates in the control group. For the most part, these studies have documented the beneficial effects of stroking for neonatal physical development and performances on the Brazelton assessment scale.

Only few studies have investigated the effects of caregivers' touch in *face-to-face* interactions with their infants (Gusella, Muir & Tronick; 1988; Peláez-Nogueras, Field, Hossain & Pickens, 1996a; Peláez-Nogueras, Gewirtz, Field, Cigales, Malphurs, Clasky & Sanchez, 1996b; Stack & Muir, 1990; 1992; Tronick, Als, Adamson, Wise & Brazelton, 1978). Rhythmic touch has been found successfully to reinforce infants' social behavior like eye contact and positive affect of face-to-face interactions with adults (Peláez-Nogueras et al., 1996b). Likewise, the negative effects of some types of touch have also been noted in the context of normal face-to-face interactions in which mothers were observed to poke and tickle their infants frequently (Cohn, Matias, Tronick, Connell & Lyon-Ruth, 1986; Field, Healy, Goldstein & Guthertz, 1990).

The lack of consensual definitions of the various types of touch, however, still poses a problem in the interpretation of studies using touch stimulation with infants. It is often assumed that "massage," "rubbing," "patting," "handling," "poking and tickling," "stroking," and other types of touch have interchangeable meaning and function. Such assumption, however, may be incorrect. Our view is that, due to different functions, diverse types of touch during interaction may prompt different behaviors in infants, and they may produce different emotional reactions. Different types of touch result in more or less positive or negative affect and may evoke more or less infant attention. Our hypothesis is that systematic stroking, which involves gently stroking and circular pressure using the palm of the hand or the fingertips, may be preferred by the infants. Tickling and poking, on the other hand, which involve light pushes to and touching of the infant body in an attempt to cause laughter or twitching movements may produce avoidant responses.

Two experimental procedures have been used to study the impact of adult touch on infant behaviors during face-to-face interactions: the *still-face situation* (Stack & Muir, 1990, 1992; Peláez-Nogueras et al., 1996a), and the *synchronized reinforcement procedure* (Peláez-Nogueras et al., 1996b). By implementing these two procedures, researchers have found that the caregiver's touch can regulate infant attention as well as evoke and reinforce infant smiles and vocalizations. In the still-face procedure, the mother's behavior is manipulated by having her adopt a stationary, expressionless pose or still face (Gusella et al., 1988; Lamb, Morrison & Malkin, 1987; Mayes & Carter, 1990; Stack & Muir, 1990, 1992; Peláez-Nogueras et al., 1996a; Toda & Fogel, 1993). For example, in measuring the effects of touch alone during face-to-face interaction, Stack and Muir (1990) found that when mothers were asked to be facially unresponsive, silent, and not to touch their infants during a still-face episode, infants displayed more grimacing and less smiling compared to an episode of normal-play interac-

tion. However, when touch was introduced during the still-face period, infants' positive affect and attention increased significantly.

The synchronized reinforcement procedure is a contingency-based technique that allows the investigator to measure infant instrumental behavior and preferences for social stimulation (Peláez-Nogueras et al., 1996b). Specifically, the procedure facilitates the comparison between two or more types of adult stimulation during face-to-face interactions with infants. Peláez-Nogueras et al. (1996b) used this operant-conditioning procedure to compare the effects of an adult stimulus compound that included touch, voice, and smiles to one that did not include touch. Under the multimodal treatment that included touch, the infant eye-contact responses were always reinforced with synchronous stimulation consisting of caregiver's smiling, vocalizing, and touching the infant's legs and feet. This type of stimulation occurred for the duration of the infant's eye-contact response. Under the no-touch treatment, infant eye-contact only produced synchronous smiling and vocalizing, but no touching was provided. Peláez-Nogueras et al. (1996b) found that infants made more eye contact, emitted more smiles and vocalizations, and spend less time crying and protesting, in the condition that included touching. The findings of that study suggest that in face-to-face interactions, synchronous tactile stimulation can effectively reinforce infant's attention and smiles and vocalizations.

In natural face-to-face interactions mothers have been noted to use touch in various ways (Stack & Muir, 1990). Typically, mothers touch their infants over 65% of the time when interacting with their infants. Mothers spend about 15% of the time resting their hand on their infant, 30% providing mild touch (stroke, caress), 16 per cent in intense touching (tickle, poking), 16 per cent in mild movement (lifting feet or moving arms in a slow rhythmic pattern), and 9% in an intense movement (movements of arms and legs at a fast pace). These different types of touch, however, have not been systematically analyzed and compared to one another to determine the type of touch infants prefer and the more effective in maintaining and increasing infant positive affect and attention.

In the present study, *two* types of touch, systematic stroking and tickling/poking touch, were compared using the synchronized reinforcement procedure. It was hypothesized that the systematic stroking would maintain infant eye-contact and positive affect (smiles and vocalizations), a greater proportion of the time than the tickling/poking touch. The two touch treatments were provided by a trained experimenter and both patterns of touch were synchronized with, and contingent on, the infant making eye contact with the experimenter. Thus, the infant response determined when the experimenter would initiate or terminate the touch stimulation.

METHOD

Participants

Twelve normal full-term infants (5 male and 7 female), ranging in age from 2 to 4.5 months (M age = 3.3) participated. The infants' mothers (M = age 18) were African-American (N = 7) and Hispanic (N = 5) of low SES (M = 4 on the Hollingshead two-factor index). The

infants were recruited from a nursery where they received full-time care. To complete the 12 periods of interaction, eight infants required four consecutive daily sessions (visits to the laboratory), and four required five sessions. Two infants were discontinued from the study after the first two sessions because they did not attend the nursery during that week. When an infant appeared to be tired, by protesting continuously for more than 30 consecutive seconds, the treatment periods were terminated for that day. Overall, four sessions were canceled and rescheduled.

Setting and Apparatus

Daily experimental sessions were conducted in the mornings in a laboratory adjacent to the infant nursery. All infants were awake and alert at the beginning of each session. During testing, the infant was seated in an infant seat located on a table top. The infant was positioned to be face-to-face with the female experimenter's face, approximately 25 inches apart. Two video cameras were connected to create a split-screen image on a monitor, allowing concurrent, real-time observation of the infant's and the experimenter's behaviors. The videotapes were used for subsequent second-by-second coding of infant behavior. The duration of each period was recorded in seconds using a time-date generator.

Design and Procedure

A within-subjects alternating-treatments design was used to compare the infants' responses under the two touch treatments. In this way, each subject served as its own control. Each conditioning period lasted two min and there were 3 periods in a session. There were a total of 12 conditioning periods implemented with each subject (in four sessions). During each 15-sec interperiod interval the infant was turned away from the experimenter and entertained with a rattle by a research assistant while remaining in the infant seat. The infant received no voice or tactile stimulation during this period. A session lasted approximately eight minutes.

Synchronized Reinforcement Procedure. In both touch treatments, tactile stimulation of the infant's body (legs, abdomen and forearms) was provided immediately contingent on the onset of an eye-contact response by the infant with the female experimenter. In both touch treatments, the touch stimulation continued for the duration of the eye-contact response. As soon as the infant gazed away from the experimenter's eyes, the stimulation was terminated. When the infant again made eye contact, the touch stimulation was reinstated immediately. In this way, the infant response controlled the duration of the contingent stimulation provided by the experimenter, uninformed regarding the experimental hypothesis. For control purposes, the experimenters' contingent stimulation was monitored and checked by a second experimenter in the room standing out of the infant's sight. The two different patterns of touch stimulation used were:

(1) Systematic Stroking. This touch treatment consisted of a deep circular rub on the infant's legs, moving up gradually and rhythmically to the abdomen and then to the forearms, administered only while the infant was making eye-contact with the experimenter. When the

infant was not making eye contact with the experimenter, the experimenter's hands remained on her lap and no other stimulation was provided.

(2) Tickling/Poking Touch. This touch treatment consisted of a pattern of short nudges of the infants' legs, moving up to the abdomen and then to the forearms. This touch was administered gradually and in an arrhythmic manner for the duration of infant eye contact. When the infant was not making eye contact with the experimenter, the experimenter's hands remained on her lap and no other stimulation was provided.

The twelve infants were randomly assigned to begin the first session under either the systematic stroking or the tickling/poking treatment; thus, order was counterbalanced across subjects. The two touch treatments were alternated across the four sessions of three 2-min periods each. All infants received touching for 12 conditioning periods (six under Systematic Stroking and six under Tickling/Poking periods).

Behavior Coding

Experimental sessions were video taped for coding and interobserver reliability calculations. The three infant behaviors coded included:

1. *Eye contact;*
2. *Positive affect*, defined as smiling and vocalizing; and
3. *Negative affect*, defined as protesting and crying. For gazing away from the adult, the infant had to be looking at any other place but the adult's face.

For infant *smiling* to be coded the infant mouth had to be "upturned," whether open or closed. *Positive vocalizations* were discrete sounds like those involved in cooing and babbling (but not fussing or protesting). For *crying*, the infant had to be grimacing and emitting loud nondiscrete, cyclic-wail sounds.

The percentage of time each infant engaged in eye-contact, smiles and vocalizations, and protest and cries was coded for each of the 12 conditioning periods for both treatments. Each period was coded twice using a real-time, continuous coding system, one time to code eye-contact or gaze away, and a second time to code affect responses (positive and negative). In addition, from the videotapes, a research assistant checked that the facial expressions (smiling), vocalizations (cooing), and sitting position of the experimenter interacting with the infants were the same in both treatments. Coding was done on a lap-top computer which yielded a second-by-second output of the three categories of behavior and a summary matrix of the percentage of time each behavioral category occurred throughout each period (Guthertz & Field, 1989).

Interobserver Reliability

Two research assistants who did not know the hypothesis of the study were trained independently to 90% agreement on the behaviors with an experienced rater before conducting reliability. Interobserver reliability was then calculated on infant eye contact with the experimenter and affect response categories by both coders for the twelve periods including

all one-second intervals of four randomly selected subjects (33% of the sample). Both observers scored independently the amount of time (min and sec) the infants engaged in eye contact, positive affect (smiles and vocalizations), and negative affect (protests and cries) during each conditioning period and then the percentage of time infants engaged in each behavior was calculated. Agreement was defined as the comparison rater coding the same response on a second by second basis. To test reliability, Kappa coefficients were computed (Bartko & Carpenter, 1976; Bakeman & Gottman, 1986) across each dependent measure. The reliability coefficients ranged from $k = .78$ to 1.0 ($M = .90$) for eye contact and from $k = .72$ to 1.0 ($M = .89$) for affect (positive and negative).

The experimenter was trained to pose a slight natural smile across the 2-min period of the treatment. The smile was to preclude the effects of a still-face expression. An observer viewed only the experimenter portion of the (split-screen) videotape for 33% of the sample. The experimenter's smile was coded as being: (1) slight, (2) moderate, or (3) broad. Scores were compared across treatments using Chi-square tests and they revealed no differences in the experimenter's facial expressions between the two treatments.

RESULTS

The percentage of time each infant engaged in eye-contact response, positive affect (smiles and vocalizations), and negative affect (protest and cries) was calculated for each of the conditioning periods. Although initial visual inspection of the data indicated no overlap of the scores for two of these three outcome measures between the two touch treatments, inferential statistics were used in all analyses. t-tests for correlated data were calculated between the behavior means of the 6 periods under the Systematic Stroking treatment and the behavior means of the 6 periods under the Tickling/Poking treatment, for the 12 subjects (Table 1).

The t test revealed that the mean percentage of time the infants engaged in more *eye contact* during the systematic stroking periods ($M = 72.0$, $SD = 11.1$) than during the tickling/poking touch periods ($M = 35.7$, $SD = 8.7$), [$(t(11) = -12.65, p < .001)$]. The infants

TABLE 1
Mean Percentages of Infant Behaviors During Stroking Versus Tickling/Poking Touch ($n = 12$)

	Touch Condition			
Infant Behavior	**Stroking**	**Tickling/Poking**	***t* value**	***p***
Eye Contact	72.0	35.7	−12.65	.001
(*SD*)	(11.1)	(8.7)		
Positive Affect	30.6	8.9	−6.15	.001
(*SD*)	(20.1)	(10.5)		
Negative Affect	7.2	26.5	4.75	.001
(*SD*)	(8.7)	(15.2)		

TABLE 2
Mean Percentages of Infant Behavior During Stroking and Tickling/Poking Touch Periods (Individual Scores)

Subject	Sex	Age (mos.)	% Eye Contact		% Positive Affect		% Negative Affect	
			Stroking	Tickling	Stroking	Tickling	Stroking	Tickling
1	M	4.5	71.0 (19.6)	35.0 (30.6)	2.5 (2.3)	1.3 (3.2)	3.3 (4.4)	19.9 (29.0)
2	F	4.5	62.4 (21.8)	28.5 (31.3)	48.5 (37.6)	20.2 (33.1)	5.8 (14.1)	13.2 (23.1)
3	M	2.5	74.2 (18.3)	46.8 (18.2)	68.7 (16.4)	35.1 (29.2)	0.0 (0.0)	29.8 (19.5)
4	M	3.5	75.8 (22.5)	43.1 (10.5)	22.9 (38.9)	1.5 (2.1)	33.8 (46.5)	65.7 (37.0)
5	F	4.0	51.7 (31.7)	24.3 (22.4)	7.8 (8.2)	0.2 (0.4)	4.3 (6.1)	14.7 (28.2)
6	M	2.5	83.5 (12.3)	41.7 (30.3)	16.0 (17.4)	7.6 (10.6)	3.0 (4.7)	46.6 (35.8)
7	M	3.5	67.6 (20.9)	30.0 (22.3)	11.1 (13.9)	2.2 (4.7)	18.9 (32.3)	30.9 (28.7)
8	M	3.0	64.0 (22.3)	40.3 (26.2)	28.6 (17.8)	3.2 (4.2)	2.0 (4.9)	0.1 (0.2)
9	F	2.5	77.2 (19.0)	43.3 (22.1)	33.4 (18.0)	0.0 (0.0)	5.9 (6.5)	24.8 (38.7)
10	F	3.0	91.5 (5.7)	30.7 (20.9)	37.3 (31.4)	7.3 (14.7)	12.4 (15.0)	20.8 (17.5)
11	F	3.0	83.2 (9.8)	51.5 (26.5)	56.5 (21.9)	18.9 (16.9)	29 (7.1)	28.4 (30.9)
12	F	3.0	62.8 (20.3)	23.6 (9.2)	31.6 (21.3)	6.8 (10.5)	0.0 (0.0)	30.6 (24.7)

Note. Standard Deviations are in parenthesis

also expressed significantly more *positive affect* (smiles and vocalizations) during the systematic stroking periods ($M = 30.6$, $SD = 20.1$) than during the tickling/poking periods ($M = 8.9$, $SD = 10.5$), [$(t(11) = -6.15, p < .001)$]. Finally, infants' *negative affect* (protests and crying) was observed less often during the stroking periods ($M = 7.2$, $SD = 8.7$) than during to the tickling/poking periods ($M = 26.6$, $SD = 15.2$), [$(t(11) = 4.75, p < .001)$]. Mean data for each of the 12 subjects across the two treatments is provided in Table 2.

DISCUSSION

As predicted, infants spent greater proportions of time making eye contact with the experimenter during Stroking than during Tickling/Poking touching. Similarly, infants smiled and

vocalized more, and protested and cried less, during the Systematic Stroking treatment than during the Tickling/Poking touch, suggesting that infants respond positively to systematic stroking stimulation and negatively (aversively) respond to Poking/Tickling. These results contribute to our knowledge that touch can modulate infant attention and affect in face-to-face interaction with adults. In addition, the study extends the previous findings (Peláez-Nogueras et al., 1996a; 1996b) on the reinforcing effects of contingent touch by examining differences between two types of touch used often by caregivers in natural settings (Stack & Muir, 1990).

We should emphasize that in the face-to-face situation of this study, the infants could receive contingent adult stimulation only by initiating and sustaining eye contact with the experimenter. Hence, sustained infant eye contact responses were instrumental for adult stimulation under both conditioning treatments, and the experimenter's stimulation could be terminated at any time by the infant gazing away from her. While most infants in this study rapidly responded differentially to the two touch treatments, individual differences and behavior variability were noted. For most of the infants, preferences for the continuous systematic stroking emerged between the second and third treatment periods, where the larger effect in eye contact responses was observed. In an attempt to terminate the negative effects of tickling/poking touch, the infants in this study engaged in such self-regulatory behaviors as head and gaze aversion. This aversion was reflected in their negative affect, as denoted by such behavior as protesting, crying, and gazing away from the experimenter to terminate the poking/tickling. On the other hand, the experimenter's tactile stimulation in the form of systematic stroking reinforced infant eye-contact responses, evoked more positive affect and resulted in less gaze aversion in the infants. The procedure allowed each infant to determine the density (total duration) of touch stimulation desired, based on an infant threshold for each type of touching.

Given that human infants perform many rhythmical movements throughout the first year of life including kicking, rocking, banging, waving (Thelen, 1993), it is conceivable that infants also may prefer tactile stimulation that is rhythmic to one that is nonrhythmic. The data from the present study suggest that frequent tickling/poking are aversive forms of stimulation for infants. One reason may be the lack of rhythmical movements/stimulation often involved in tickling and poking. Our recommendation is that parents or caregivers should be encouraged to refrain from touching their infants in these ways, in particular when the infant behavior suggests that the stimulation being provided is aversive (Peláez-Nogueras & Gewirtz, 1997). At times, there may be mixed cues from the infant, because this type of touch stimulation can cause laughter and twitching reflexive movements.

The practical implications of these findings are that systematic stroking enhances positive affect and differentially reinforces attention in infants during face-to-face interactions with adults. The stroking stimulation used in this study with 2-to-4-mo.-old infants may facilitate early competence and adaptation to the social environment. Questions remain, however, about how long-term touch interventions may affect infants' social, cognitive, and emotional development, as well as what the types of touch and the parameters that are more effective during these social interactions. Additional studies that would investigate infant responses

to other variations of positive touch are required to evaluate further infant preferences for touch stimulation.

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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., 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.

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*(1), 7–14.

Field, T., Schanberg, S.M., Scafidi, F., Bauer, C.R., Vega-Lahr, N., Garcia, R., Nystrom, J. & Kuhn, C.M. (1986). Tactile/kinesthetic stimulation effects of preterm neonates. *Pediatrics, 77*(5), 654–658.

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.

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.

Lester, B.M. & Tronick, E. (Eds.) (1990). Stimulation and the preterm infant. *Clinical Perinatal, 17*(1), 1–239.

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., Hossain, Z. & Pickens, J. (1996a). Depressed mothers' touching increases infant positive affect and attention in still-face interactions. *Child Development, 67*, 1780–1792.

Peláez-Nogueras, M. & Gewirtz, J. (1997). The context of stimulus control in behavior analysis. In D. M. Baer & E. M. Pinkston (Eds.), *Environment and Behavior* (pp. 30–42). Singleton, CO: Westview Press.

Peláez-Nogueras, M, Gewirtz, J.L., Field, T., Cigales, M., Malphurs, J., Clasky, S. & Sanchez, A. (1996b). Infants' preference for touch stimulation in face-to-face interactions. *Journal of Applied Developmental Psychology, 17*, 199–213.

Scafidi, F.A., Field, T., Schanberg, S.M., Bauer, C.R., Tucci, K., Roberts, J., Morrow, C. & Kuhn, C.M. (1990). Massage stimulates growth in preterm infants: A replication. *Infant Behavior and Development, 13*, 167–188.

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.

Thelen, E. (1993). Timing as a developmental mechanism. In G. Turkewitz & D. Devenny (Eds.), *Developmental time and timing* (pp. 85–104). Hillside, NJ: Erlbaum.

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., 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.