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Chapter 14

Infant Emotions Under the Positive-Reinforcer Control of Caregiver Attention and Touch

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In this chapter we summarize several research themes on infant emotional phenomena that we have approached via the operant-learning paradigm. These infant emotional phenomena include: *attachment*, *fear of the dark*, *fear of strangers*, *jealousy* and *depression*. We illustrate how these phenomena can be based on operant-learning processes that, as process explanations, constitute remarkable discrepancies from other nominal conceptions of "process" in the developmental and clinical literatures.

For the most part, infant emotional phenomena have been explored heretofore by nonexperimental means, often under the aegis of nominal process theories that resort to explanatory fictions (e.g., an "insecurely attached" infant, a "depressed" infant). Mainstream developmentalists tend to minimize or exclude entirely the contributions of environmental factors, most specifically of contingent stimuli provided via caregiver behavior and of learning, to the infant (problem) behaviors at issue. Thus, many infant emotional responses are conceptualized in the developmental literature as biologically based, or even worse as resulting from the nonprocess pseudo-causal hollow variable of chronological age (Gewirtz & Peláez-Nogueras, 1996). The developmental literature emphasizes that there are several unique universal emotions present at birth that are prewired to emerge as maturational processes (e.g., Izard, 1992). Also, cognitively-oriented functionalists (e.g., Barrett & Campos, 1987; Campos & Barrett, 1984; Lazarus, 1991) have emphasized prewired innate and universal emotions.

The experiments we describe here do not rule out definitively such unlearned or hereditary explanations of the key outcome behaviors "explained" in the literatures. However, their results do make it likely that much, if not most or all, of the variance in the infant behaviors studied could be accounted for by their relations with the parent-provided proximal antecedent and consequent stimuli.

In our operant-learning studies, when infant attachment, fear of the dark, fear of strangers, jealousy, and depression phenomena were studied under laboratory conditions, with maternal behaviors under experimenter control, these phenomena were shown to result from dramatically-different processes than those identified in

the literature. The infant adaptive problem behaviors actually appear to be operants under the control of occasioning stimuli and consequences inadvertently provided, in the contexts in which they appear, by the responding of well-intentioned, loving parents. Even so, the results of our experiments do not rule out definitively the literature's predominant notions that the behaviors denoting attachment, fear, jealousy and depression are innately determined and that, in time, children "grow out" of the problem behaviors involved. The results of our experiments, however, make plausible the idea that those attachment, fear- and jealousy-denoting behaviors may result alternatively from an operant-learning process involving positive reinforcement. Whenever possible in reports of the experiments that follow, we list the number or proportion of the subjects who conform to the patterns denoting success under the operant-learning paradigm. If binomial tests were used to evaluate the result patterns in terms of probability models, one-tail remote probabilities ($p < .0001$) in favor of the operant hypothesis would be found in every instance. Such a pattern of successful results should not be surprising, for in our work the sampling of the behavior of every infant subject in every phase of each design continues until the behavior criterion for that phase is attained. In addition, no subject is ever discarded on behavior-score grounds.

Attachment or Separation Anxiety: The Learned Basis of Infant Protests

In the child clinical literature, there has been a systematic failure to take into account whether or not there exists a systematic pattern of parental responding contingent on the infant target behaviors (Gewirtz & Peláez-Nogueras, 1991; Gewirtz & Peláez-Nogueras, 1992). This omission has led infant researchers to treat infant target behavior classes, such as protests occasioned by maternal departures or separations, as symptoms or indices of putative underlying "causes," for instance "attachment" (Bowlby, 1960; Schaffer & Emerson, 1964), "security of attachment" typologies (Ainsworth, Blehar, Waters, & Wall, 1978), or "separation anxiety" (Kagan, 1980; Kagan, Kearsley, & Zelazo, 1978; Weinraub & Lewis, 1977).

From our behavior-analytic perspective, the proximal explanation of the occurrence of these cued responses is far simpler: those infant response patterns appear in the setting in which they occur due to a history of conditioning there, wherein protests were occasioned by antecedent discriminative stimuli, and followed routinely or intermittently by contingent maternal responses functioning as reinforcing stimuli for those protest responses. The *protest* of the infant may be comprised of cries, screams, fusses, whines, or whimpers; in somewhat older children the protests may involve, in addition, such responses as grabbing the parent's body or clothing, pleading, or imploring. These responses denoting protests seem to be functional equivalents for delaying maternal departures and for cutting short separations from the mother. On this basis, these infant response can function as a class of operants in conditioning contexts, conditionable by their effectiveness in delaying and/or precluding maternal departures, or shortening separations.

Our thesis has been that cued separation protests result typically from an operant-learning-of-protests process in the departure or separation setting in which the protests appear, produced by a prior pattern of well-intentioned, idiosyncratic, maternal reactions contingent on those cued protests. Thus, the process variables manipulated in our experiments involved some of the typical contingent stimuli provided by the mother during her departures, by such of her discrete reactions as stopping, retracing her steps, hesitating, vacillating, turning to, speaking to, reasoning with or- once separated- returning to pick up her protesting child; and during actual separations when she calls or returns to her infant contingent on protests. We have shown that, when contingent, these events can function as reinforcing stimuli to raise the relative incidence of a child's protests (denoting the occurrence of operant conditioning) to discriminative stimuli provided by a mother's preparations to leave, by her actual departures, and by separations, with her being out of sight and earshot.

Our first two studies were designed to ascertain if, and how, infant protests can come under the control of cues and contingencies generated by maternal behaviors during her brief departures or separations from her child. The demonstration that such infant protests can be shaped, maintained, or increased by patterns of contingent maternal responding (provided on the basis of continuous reinforcement: CRF), and decreased or eliminated by maternal responding contingent on alternative-to-protests behaviors (thus providing differential reinforcement of other behavior: DRO), have provided evidence for the conditioned basis of the protests that have been treated as an unlearned, species-specific, index of "attachment" for some other theorists.

The Conditioning of Infant Departure and Separation Protests

In this first experiment (Gewirtz & Peláez-Nogueras, 1991), 23 six- to 11-mo.-old infants received treatments from their mothers, in 8 to 12 successive weekday 6- to 8- trial sessions conducted in our laboratory. Each trial consisted of a departure, a separation and a reunion segment. The departure segment involved the mother, under instructional earphone control, cuing her departure three times via vocal-plus-visual stimuli in a *standard* manner (i.e., standing up, kissing the child while saying "Bye, bye; I'll be right back" and then slowly walking toward the exit door, then stopping and turning to see her child and repeating her verbalizations twice more before closing the door). Each departure segment of a trial lasted approximately 28 secs. The separation segment of the trial (lasting up to 3 min.) began as soon as the mother exited the room and closed the door. The reunion segment lasted 15 sec. The intertrial interval was 60 sec. Under the conditioning (CRF) treatment, the mother's three responses during a departure and a separation were contingent on the infant's protests. In the reversal treatments, the same three maternal responses were contingent (DRO) on other behaviors than infant protest behaviors. The overall percentage interobserver agreement on infant cued protest responses between two independent observers for all subjects was 94.

In this experiment, the same treatment was implemented serially for the departure and separation segments of each trial. That is, contingent maternal responding to infant protests during a departure on the same trial always preceded her contingent responding to infant protests during the brief separation that followed. After a joint criterion was attained in *both* trial segments in that 80% or more of the trials include a protest (usually this occurred between the third and the sixth session), the DRO reversal treatment was introduced (simultaneously) for both departure and separation trial segments. A criterion for terminating the DRO treatment was that, on the last session, the proportion of trials involving protests be 20 % or less. An additional criterion for terminating the DRO treatment during separation segments was the time-duration without protests which was shaped proportionally across sessions up to 3 min. Across trials, the escalating DRO schedule employed during separations with mother outside the room involved her contingent responses shaping nonprotest durations of ever-increasing length. That is, maternal responding was provided contingent on the absence of protests for durations that increased up to three min. Nine infants served in an ABA (DRO-CRF-DRO) reversal design while 13 infants served in a BA (CRF-DRO) design.

The outcome measure used was the proportion of trials-per-daily-session on which the infant made a cued protest. As seen in Figure 1, every one of the nine infant subjects manifested the same inverted-"V", ABA pattern, confirming the effective-

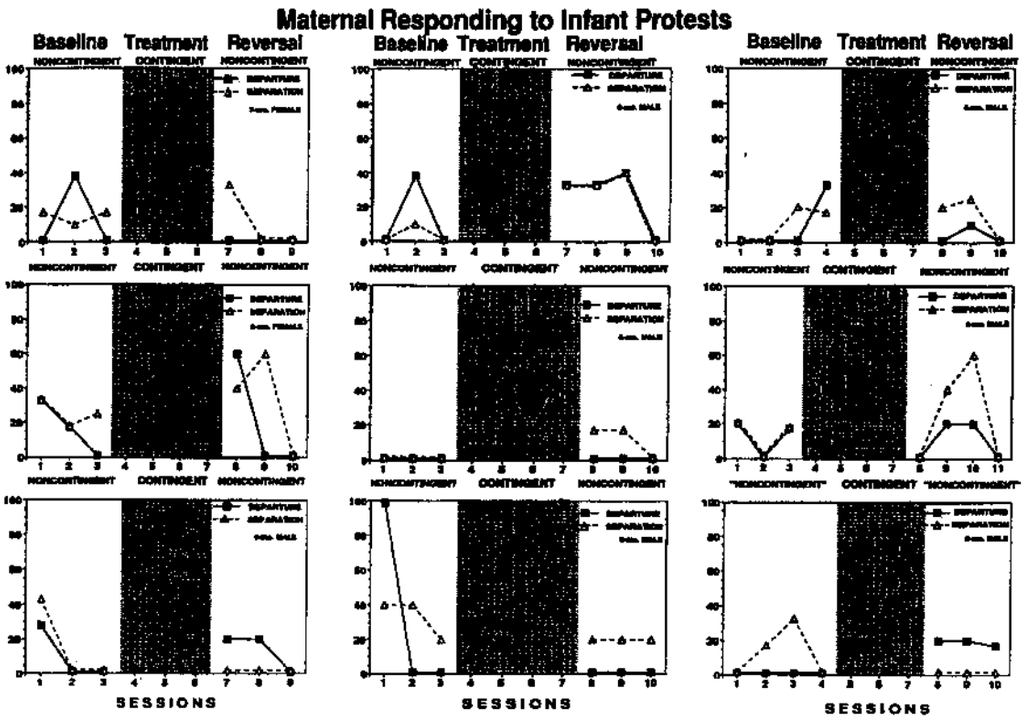


Figure 1. Under the ABA design, departure and separation protest chart of 9 infant subjects.

ness of the treatment separately under departures and separations. On a binomial basis, if each predicted inverted-"V", ABA pattern during departures, and separately during separations, is considered a "head", and every other pattern is considered a "tail", a one-tail test is in order. The one-tail probability of finding this 9-for-9 pattern in each of the two contexts is $p < .001$.

Based on the individual departure and separation curves of the same nine infants, composite protest curves (see Figure 2) were developed from the *median* percentage of protest trials per session, across the first, next-to-last, and last session scores in each of the three successive treatment phases. These two median curves smooth the two result patterns for the reader. Another result was that mothers of every one of the nine infants remained outside the room during separations, before infant protests were emitted, for much longer durations under the DRO than under the CRF treatment (one-tail binomial probability, $p < .001$, in every case).

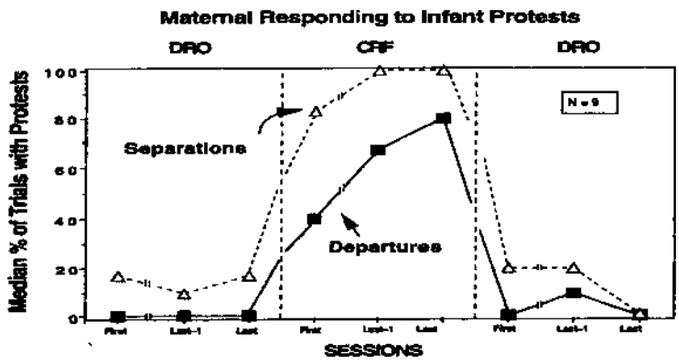


Figure 2. A composite protest chart (N = 9) representing Median Percentage-Protest trials per session, across the first, next-to-last (Last–1) and last session score under each of the three experimental phases of the ABA design.

Under the BA design, both the departure and the separation protests of *every one* of the 13 individual infants decreased from the maternal contingent-reinforcement (CRF) treatment phase to the (DRO) reversal phase of maternal responding differentially contingent on nonprotest behaviors. The one-tail probability of finding 13-for-13 is $p < .001$ in each of the two contexts, departure and separation. For the ABA and BA design groups, the frequency and content of maternal stimuli provided were implemented to be equivalent under both CRF and DRO treatments. The outcome measure was the proportion of session trials on which the infant made a cued protest.

Conditional Discrimination Between Departures and Separations: The Role of Context

We conducted a follow up study with 18 infants in an attempt to train a discrimination, indexed by protests, between maternal departure and separation

contexts (Peláez-Nogueras & Gewirtz, 1990). In addition, we wanted to control for the potential sequence effect in our first experiment where the conditioning for protests was cued first by maternal departures and then by maternal separations. The conditions were implemented in each trial segment sequentially and not independently. That is, a conditioning or reversal procedure (either CRF or DRO) was implemented for infant protests in both the departure segment and the ensuing separation segment of a trial.

Thus, the purpose of this second experiment on the theme of attachment was to condition *opposite* patterns of infant protests serially in the two trial segments (Peláez-Nogueras & Gewirtz, 1990). For one order of conditions, the protests in the departure segment of a trial were followed by a CRF schedule of maternal responding, which was opposite to the DRO schedule being implemented in the separation segment of that trial. For the second order of conditions, the CRF and the DRO sequence was reversed in context; protests in the departure segment were under a DRO schedule while protests during separation were under a CRF schedule. Specifically, infant protests should come under the control of different discriminative contextual stimuli and contingencies generated in successive segments of the same trials by differential maternal behavior. In this frame, under both orders the infant responses generated in the departure and separation contexts were conceptually and operationally distinguished from one another.

As in the first experiment, there were two treatment conditions. A series of S^Ds (discriminative stimuli, which included the mother saying "Bye, bye" while picking up her purse and walking toward the door) set the occasion for infant protests to occur and to be reinforced three times by contingent maternal responses (for example, saying "What is the matter? I'll be right back. Don't worry.") during the departure segment of a trial while, under the ensuing separation segment of the same trial, another series of S^Ds (closing the door and disappearing out of infant's sight and earshot) set the occasion for any other infant response but the protest to be reinforced by the contingent return of the mother to the infant. Thus, discrimination training was implemented, with infant protests coming under the differential control of S^Ds from maternal departures and the ensuing brief separations.

Subjects were 18 infants, ranging in age from 6 to 10 mo, who participated in 8 to 12 daily training sessions in our laboratory. Each session consisted of 6 to 8 trials. Each of two groups received the treatments in one of two orders. For one group of 9 infants in a modified BA reversal design, during every trial the mother's responses (under instructional control) were provided contingent on each infant protest under a CRF schedule during her departures, and under a DRO schedule under the ensuing separation segment of the very same trial, contingent on infant nonprotest behaviors (such as vocalizations, smiles, or play). If in a DRO trial a protest was emitted, 10 sec had to elapse before a nonprotest would be followed by contingent maternal responding. When the response criterion was attained under both segments of the trial, the CRF schedule of maternal responding was reversed by a shift to a DRO schedule. In the second group, 9 infants received a counterbalanced, inverse

treatment order: maternal DRO responding followed departure protests and maternal CRF responding followed the ensuing separation protests.

Using the index proportion-of-trials-with-protests in a session, contrasts were made, first, between the concurrent CRF and DRO treatment scores of the final session of the first condition, and, second, between the sequential CRF treatment scores of the final session of the first condition and the DRO treatment scores of the final session of the second condition(s). *Every* infant in each of the two condition orders emitted a behavior pattern in which (a) within treatments, the CRF behavior pattern was higher systematically than the concurrent DRO behavior pattern (for *each* treatment order, 9 of 9, one-tail binomial test $p < .001$), and (b) sequentially, the CRF behavior pattern was systematically higher than the DRO behavior pattern (for *each* treatment order, 9 of 9, one-tail binomial test $p < .001$). Thus, the behavior of all 18 infant subjects conformed to the operant hypothesis: every one could be trained successfully to discriminate between maternal departure and ensuing separation trial segments. This was denoted by their emitting opposite patterns of responding in those two segments of the same trials. To simplify and complete the picture, these results are summarized in Figures 3a and 3b, showing median proportions of infant responses per trial block in each condition.

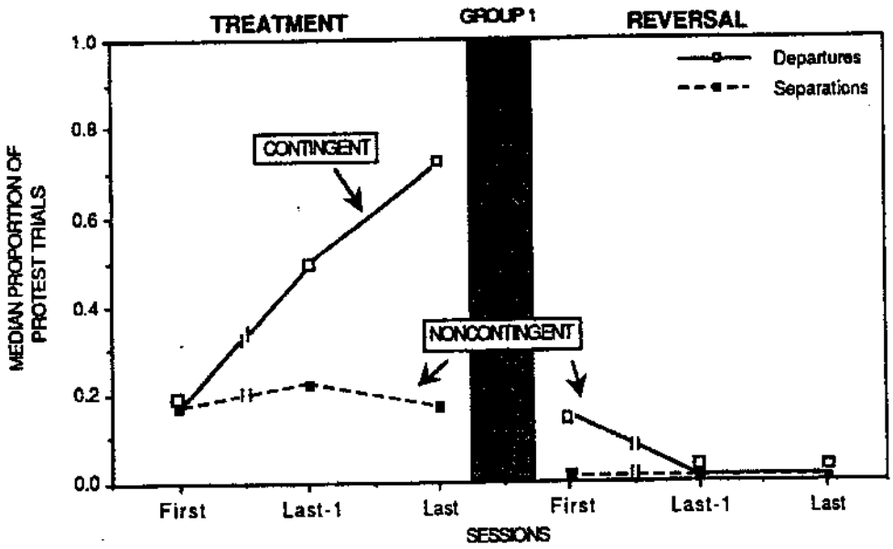


Figure 3a. Under the BA design, the chart shows median proportions of protest trials for maternal contingencies (CRF) following infant protests during departures and contingencies on other behaviors (DRO) following separation protests, in the same session, with subsequent reversal conditions (Group 1, N= 9).

The results of these two experiments supported the assumption that infant protests cued by maternal departures, and during brief separations, that have served

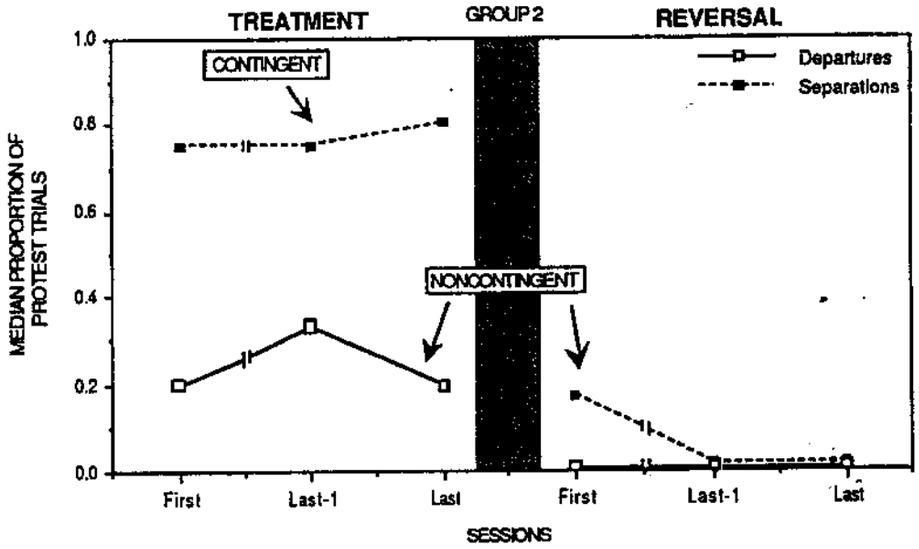


Figure 3b. Under the BA design, the chart shows median proportions of protest trials under maternal contingencies (CRF) following infant protests during separations and contingencies on other behaviors (DRO) following departure protests, in the same session, with subsequent reversal conditions (Group 2, N = 9).

as an "attachment" or "separation anxiety" index in the infancy literature, can be conditioned in the usual departure/separation settings in which they appear, trained under the differential reinforcement contingencies provided by maternal behaviors. These results support the possibility that the protest pattern is very likely to be trained inadvertently in the life settings in which it occurs by the maternal reactions that operate under the conception of positive, responsive, "loving" mothering.

Our two experiments support the conclusion that the contingent maternal responding (under experimenter control) conditioned cued infant operant protests in the laboratory (thus demonstrating internal validity), and it is very likely that conditions like those of our two experiments operate similarly in other life settings for mother-infant dyads (thus providing external validity). By ignoring environmental antecedents, and in particular the patterns of maternal behaviors routinely contingent on separation-cued infant protests that very-likely had been occurring prior to and during standardized assessments in laboratory settings, cited studies such as those by Ainsworth and associates, Schaffer and Emerson, Weinraub and Lewis, and Kagan and associates were led conceptually to consider infant separation protests to be symptoms or indices of putative underlying "causes". Those causes – which we believe to be fictional- are "attachment" for Bowlby and for Schaffer and Emerson, "security or insecurity of attachment" in the case of Ainsworth, "separation distress" for Weinraub and Lewis, and "separation anxiety" for Kagan and his associates. We believe that the proximal explanation based on a functional analysis that focuses on the reinforcement contingencies for infant protests is more parsimonious than the concepts those researchers have proposed.

In the same way that emotional behavior denoting "attachment" were approached, the emotional conceptions of "fear of the dark," "fear of strangers," and "jealousy" were examined experimentally. These phenomena are also conventionally conceived of as resulting from unlearned panhuman emotions. They can all involve protests, and were thus also addressed in human-infant subjects in terms of operant learning under positive reinforcement in three experiments.

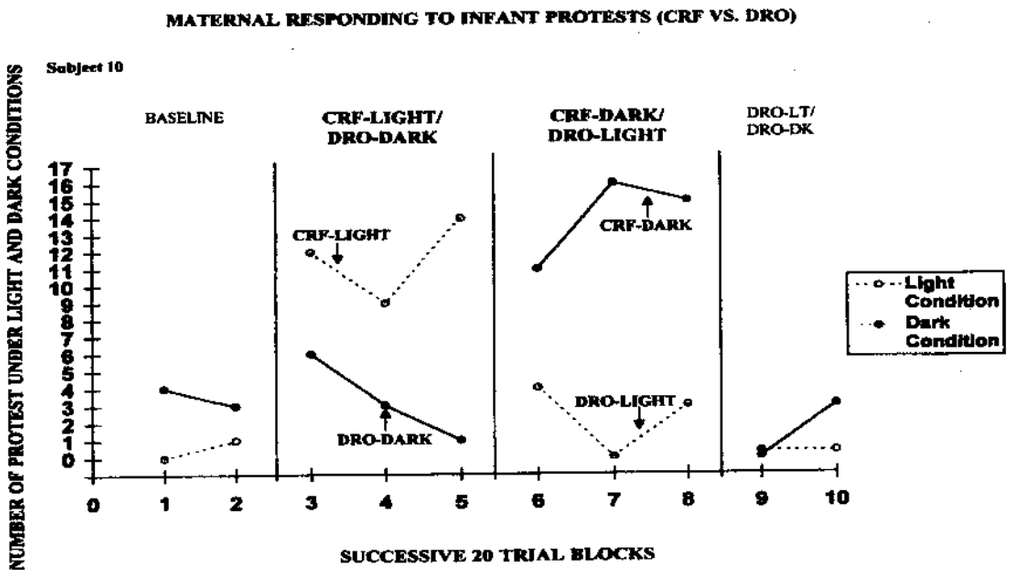
Children's "Fear of the Dark" and "Fear of Strangers"

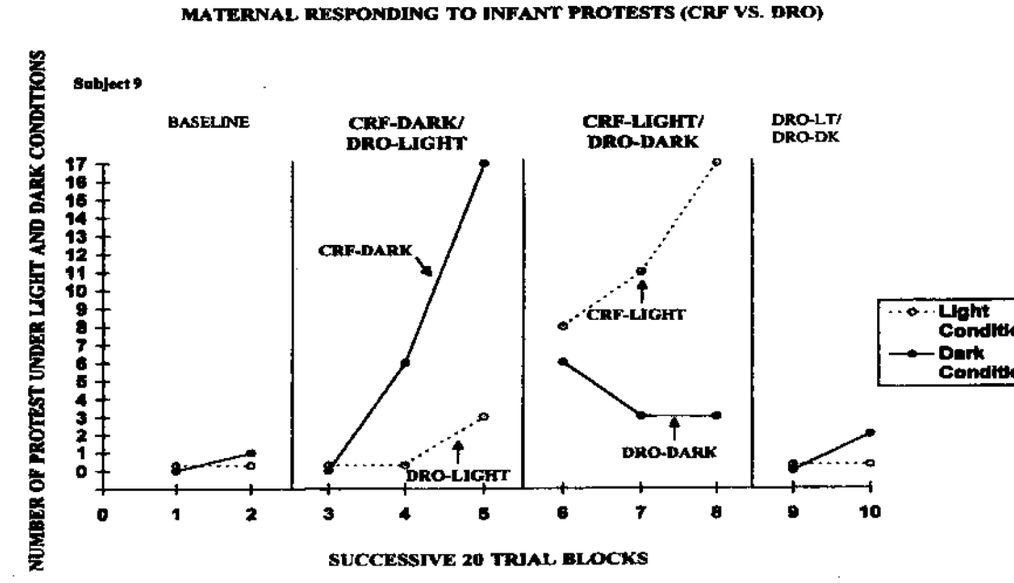
We employed methods similar to those reported earlier to study three additional developmental themes that have been approached in the literature by nonexperimental means. Such approaches completely ignore the contributions to the child behavior problem class of learning processes such as result from caregiver behaviors provided contingent on infant protests. We refer to protests that have been taken to be indicators of the *"fear of the dark"* and the *"fear of strangers"* in infants and children. Such protests have been reported to be emitted by infants when there is change from illumination to darkness. Similarly, protests or locomotor-avoidance responses at the approach of a "stranger" have been taken to denote the fear of strangers. Under the nominal theories employed in the literature, these fearful protests and avoidance behaviors have been conceived of as universal and unlearned (Izard, 1992). Yet, these operants may not always be valid indicators of fear, as they are under positive reinforcer control. The protest and approach and avoidance responses toward strangers often may result from operant conditioning to the onset of darkness or the approach of a stranger (as discriminative stimuli) by contingent attention, functioning as positive reinforcement, provided by well-intentioned, concerned parents.

Fear of the dark. In this experiment (Sanchez, Gewirtz, & Peláez-Nogueras, 1998) on the "fear of the dark", 10 normal 6- to 8-mo.-old infants sat strapped in a highchair for 25 min per day, from 10 to 20 weekdays, with their mothers seated immediately behind them (operating under instructional control), in a single-subject alternating-treatments and reversal design in the presence and in the absence of light in a room. For five infants, the effects of contingent maternal attention (CRF) on protest behaviors, and on nonprotest behaviors through differential reinforcement (DRO), were compared across four experimental phases: (a) baseline, (b) CRF for protests in light and DRO in darkness, (c) CRF for protests in darkness and DRO in light, and (d) Reversal or elimination of protest both in darkness and light contexts. The order of contexts and treatments were counterbalanced for the other 5 infants. Facial expressions of the infants confronting darkness were recorded by infrared camera and their vocal behavior (other than protests) scored.

When protest frequencies were compared in subjects within concurrent, and separately within sequential, CRF and DRO treatments, every one of the 10 infants showed increasing and dramatically greater protest frequencies in the CRF than in the DRO treatment, separately in the light and in the dark conditions (see Figures 4a and 4b). In addition, no difference in facial expressions for any one of the 10 infants was found between the light and the dark condition. Thus, it was demon-

strated that what some take to be fear-denoting protests are as readily conditioned in illumination as in darkness by contingent maternal attention.





Figures 4a and 4b. Number of protests per trial block involving concurrent and sequential contrasts between CRF and DRO contingency conditions, in illuminated and dark contexts, for two representative infants in two treatment orders.

Fear of strangers. Empirical studies have shown that not all children show a fear-of-strangers response, nor do all researchers conceive that the 'fear of strangers' is related to age or developmental level. The presumed ubiquitous 'fear of strangers' was explored from a conditioning perspective (Lum Lock, Gewirtz, Peláez-Nogueras, & Markham, 1997). Six 8- to 10-mo-old infants participated in a four-phase single-subject design: (A_1) baseline; (B_1) parent attention contingent on infant approaches to female strangers; (A_2) parent attention contingent on the infant avoidance of/withdrawal from the strangers; and (B_2) parent attention contingent on infant approaches to the strangers. The baseline assessed the infant's initial approach rate to the female stranger in the absence of maternal-provided cues or contingencies. Under the two conditioning phases (B_1, B_2), infant locomotor approach responses to the stranger were shaped and maintained by the mother's contingent attention (on a CRF schedule); for the A_2 reversal phase, attention was provided (on a DRI schedule) contingent on the infant's avoidance of the stranger (this was a DRI, differential reinforcement of incompatible behavior, schedule, because reinforcement was contingent on behavior incompatible with approach).

Each trial began with the infant on the right side of a playpen, beyond a red line that divided the playpen in two, with mother seated two feet away adjacent to the side where she could (under experimenter instructional control) shape and control by providing discriminative and contingent (reinforcing) stimuli for her infant's approach and avoidance behavior to the approaches of a series of female "strangers." From a distance of 3 m, a stranger female approached the infant on repeated trials, on each occasion initiating contact by smiling and talking. When the infant locomoted in the stranger's direction across the red dividing line, an approach was scored. When the infant locomoted away from the stranger, across the red dividing line, or remained beyond the red line away from the stranger, an avoidance response was scored. In every session, three to six different strangers participated with each infant, rotating after five trials.

In Figure 5, the homogeneous behavior patterns of every one of four infant subjects, rising from baseline level in the first contingency phase, declining in the reversal phase, and again increasing in the final contingency phase, illustrates how each infant learned to approach or avoid the female stranger depending on the discriminative and reinforcing stimuli provided by the mother. For two infants, the behavior pattern was identical, except for an unsatisfactory rising or declining baseline, accepted in error by the experimenter. Thus, as indicated by the work on infant "fear of the dark," the results of this experiment suggest that behaviors denoting the "fear of strangers" in life settings may be influenced via an operant-conditioning process by maternal behavior.

Jealousy. Various infant behaviors that have previously been taken to denote infant "jealously/rivalry" can, through operant learning, come readily under the control of discriminative cues and contingencies provided by the behavior of the mother. Jealousy in siblings and from an infant to a sibling can occasion that infant's jealous protests, with the mother's attentive reorienting (under the experimenter's

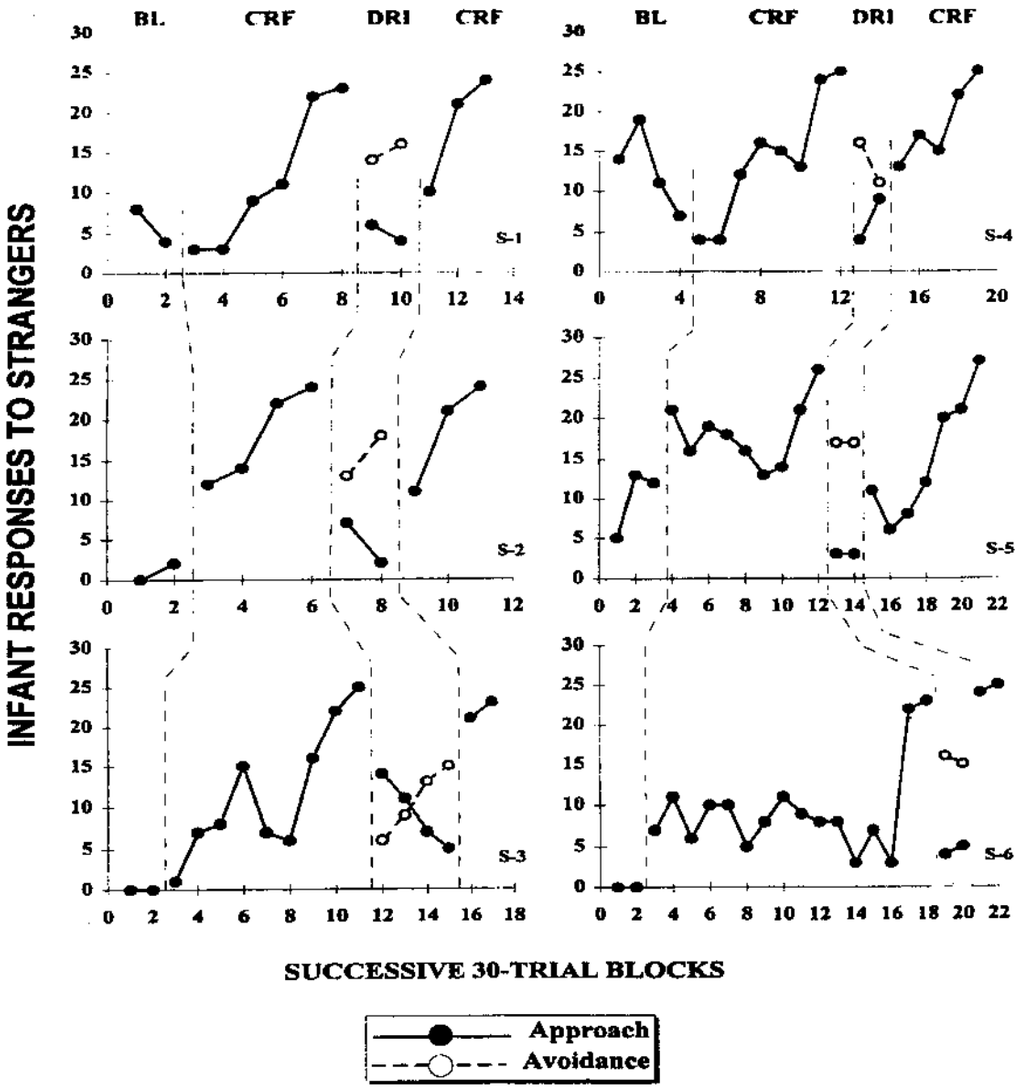


Figure 5. Under the control of maternal contingencies, the chart shows infant approach and avoidance responses to encounters with female strangers (N = 6). BL-No Parent Attention, CRF-Attention Contingent on Approach, DRI-Attention Contingent on Avoidance

instructional control) to the protesting child serving to reinforce those jealous protests. An experiment (Roth, Gewirtz, & Markham, in press) was conducted to investigate the role of maternal attention in occasioning and maintaining jealous behavior as an operant. Four 11- to 14-month-old–twin pairs participated concurrently in a "dual" single-subject design. One infant from each pair completed a CRF-DRO-DRO (BAA) design with shaping while the other twin completed a yoked DRO-CRF-DRO (ABA) design, also with shaping. During the DRO phases, maternal attention was made contingent upon behavior other than jealous protests

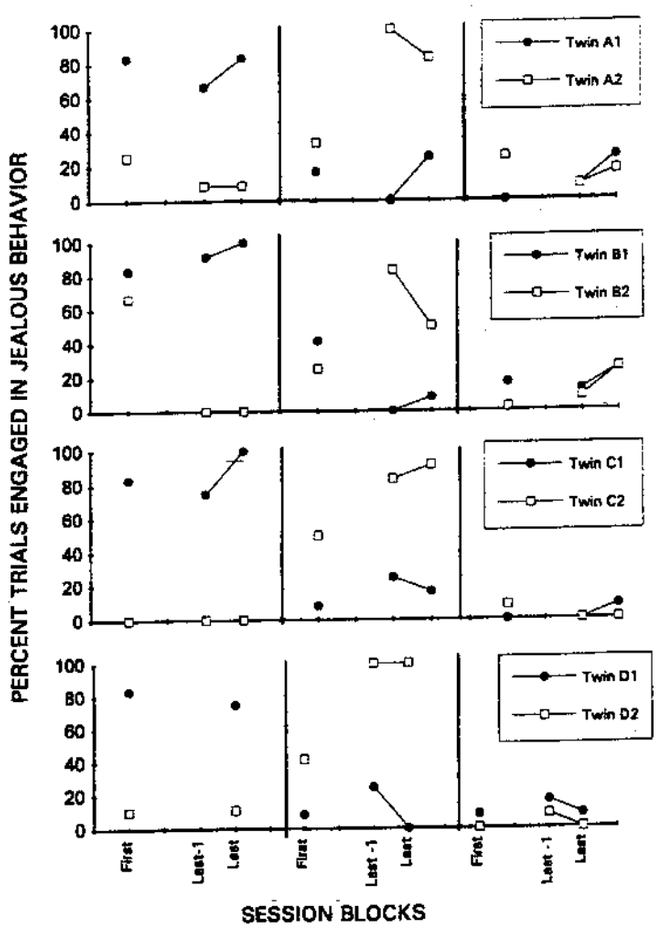


Figure 6. Percentage of trials on which jealous protests were emitted by four twin infant pairs: Twins 1 are under a CRF/DRO/DRO design and Twins 2, concurrently, are under a DRO/CRF/DRO design.

and, during the CRF phases, maternal attention was contingent on behavior denoting jealousy (see Figure 6).

Just as in our previous experiments on departure and separation protests, and on "fear of the dark" and "fear of strangers", it was found that the infants' jealous protests decreased during DRO phases and increased during CRF phases of maternal responding. Results showed that maternal attention to one twin infant can function as a discriminative stimulus for jealous protests of the second twin infant, and that the restoration of maternal attention to protests of the second twin can function as a positive reinforcer to shape and increase those jealous protests. These results represent a behavioral demonstration of how environmental events can operate to establish and maintain protests that denote jealous behavior in siblings.

The studies summarized thus far are all based on demonstrations involving simple reversal designs (sometimes joined with alternating treatments designs) initially with continuous reinforcement of operant classes. In the first two separation-protest experiments, the plan was to use relatively-large numbers of subjects in group designs. This was because at the time we were not confident that mothers would be willing and able to bring their infants to the lab repeatedly, for 10 or more visits. We discovered subsequently that many mothers could come often enough, making single-subject designs feasible.

The Reinforcing Effects of Touch on Behavior of Infants of Depressed Mothers

In developmental psychology, research has focused, for the most part, on investigating the effects of maternal facial, orienting, and vocal stimuli on infant social development and learning. However, the systematic investigation of the role of the caregiver's tactile stimulation as an active social component and potential reinforcer for infant behavior has been neglected. Very few studies have been designed to explore the socio-communicative functions of maternal touch during face-to-face interactions, and there has been no attempt to separate the effects of various components or modalities of social stimuli during interactions to determine their relative discriminative and reinforcing values. The paucity of studies leaves a gap in our understanding of early social learning.

The effects of maternal depression. Having a "depressed" mother increases by three times a child's risk of developing the abnormalities characteristic of depressed mothers (Weissman, Prusoff, Gamon, Merikangas, Leckman, & Kidd, 1984). Researchers have identified depressed mothers as unresponsive, insensitive to the infant's behavior cues, ineffective, noncontingent, emotionally flat, negative, disengaged, intrusive, avoidant of confrontation, and generally, less competent and uninvolved in interactions with their infants (Cohn & Tronick, 1983; Cohn, Matias, Tronick, Connell, & Lyons-Ruth, 1986; Field, 1984; 1992; Peláez-Nogueras, Field, Cigales, Gonzalez, & Clasky, 1994; Peláez-Nogueras, Field, Hossain, & Pickens, 1996).

Experiencing early interaction disturbances places infants of depressed mothers at risk for later affective and socioemotional disorders. Infants of depressed mothers (the "depressed infants") appear to develop a "depressed mood style," as early as at 3 months. These infants typically exhibit less attentiveness, fewer smiles, more frequent fussiness, more frequent gazing away, and lower activity levels when interacting with their depressed mothers compared to infants of nondepressed mothers (Cohn, Campbell, Matias, & Hopkins, 1990; Gelfand & Teti, 1990; Goodman, 1992). At one year, infants show growth and developmental delays if their mothers remain depressed. Thus, depressed mothers and their infants appear to *share* their behavior "states," spending more time in negative attentive and affective behavior states than nondepressed mothers-infant dyads (Field, Healy, Goldstein, & Guthertz, 1989).

Touch as intervention. The series of studies we have been conducting was designed to investigate the effects of various laboratory manipulations of maternal behavior on infant learning of social and attentive responses during interaction. These studies were directed to examining how caregiver *touch* stimuli provided contingent on infant behavior can function to condition those behaviors denoting "mood states". We wanted to determine also if there would be an increased effectiveness of touch when part of a compound stimulus (auditory and visual) presentation as a reinforcer for infant behaviors denoting positive and negative moods (Peláez-Nogueras, Field, Cigales, Gewirtz, Gonzalez, Clasky, & Sanchez, 1997; Peláez-Nogueras, Gewirtz, Field, Cigales, Malphurs, Clasky, & Sanchez, 1996).

A *synchronized-reinforcement* procedure was developed in which the onset and offset of adult stimulation is controlled by the onset and offset of the infant eye-contact response with the caregiver/experimenter. In addition to determining the efficacy of touch stimulation as a reinforcing event, this procedure permitted evaluation of whether or not infants would show a preference for social compound stimuli that included touch over compound stimuli that did not include touch, in a face–to–face situation with an adult experimenter. Also, the synchronized-reinforcement procedure permitted the comparison of the effects of different types of touch stimulation, for example stroking vs. tickling on infant behavior (Peláez-Nogueras et al., 1997). Infants' responses indicated a preference for stroking over tickling.

Subjects were 10 normal full–term infants, 6 males and 4 females, who ranged in age from 1.6 to 3.5 mos at the start of our first touch-conditioning study. In the high-risk clinic where the study was conducted, these infants were labeled "depressed infants," given that they were born of depressed adolescent mothers and their rate of positive emotional responses (smiling, cooing) was low. A mother was considered to be "depressed" based on cutoff scores on the Beck Depression Inventory (BDI) (Beck, Ward, Mendelson, Mach, & Erbaugh, 1961). The 21 BDI items are scored on a 4–point scale indicating absence/presence and severity of depressed feelings, behaviors and symptoms. The scale is a commonly-employed instruments in research on non–clinically depressed samples. The mothers of these infants had BDI scores of 13 or greater and were considered depressed.

At the beginning of the experiment, the infants were seated in an infant seat, located on a table top, with face 20 inches from the experimenter's. A single–subject alternating–treatments (ABA, BAB) design was implemented. Each daily session consisted of three periods. The Touch (A) and No–touch (B) treatments were alternated across periods.

During the *Touch treatment*, each time the infant began eye contact, the experimenter responded contingently by smiling, vocalizing and rubbing/massaging rhythmically both of the infant's legs and feet using the five fingers of both of her hands, for the duration of the infant's eye–contact responding. Deep but gentle pressure was used in slow circular motions at a rate of approximately one circular rub per second. The stimulation occurred for as long as the infant was making eye contact, within the 2–min duration of a treatment trial.

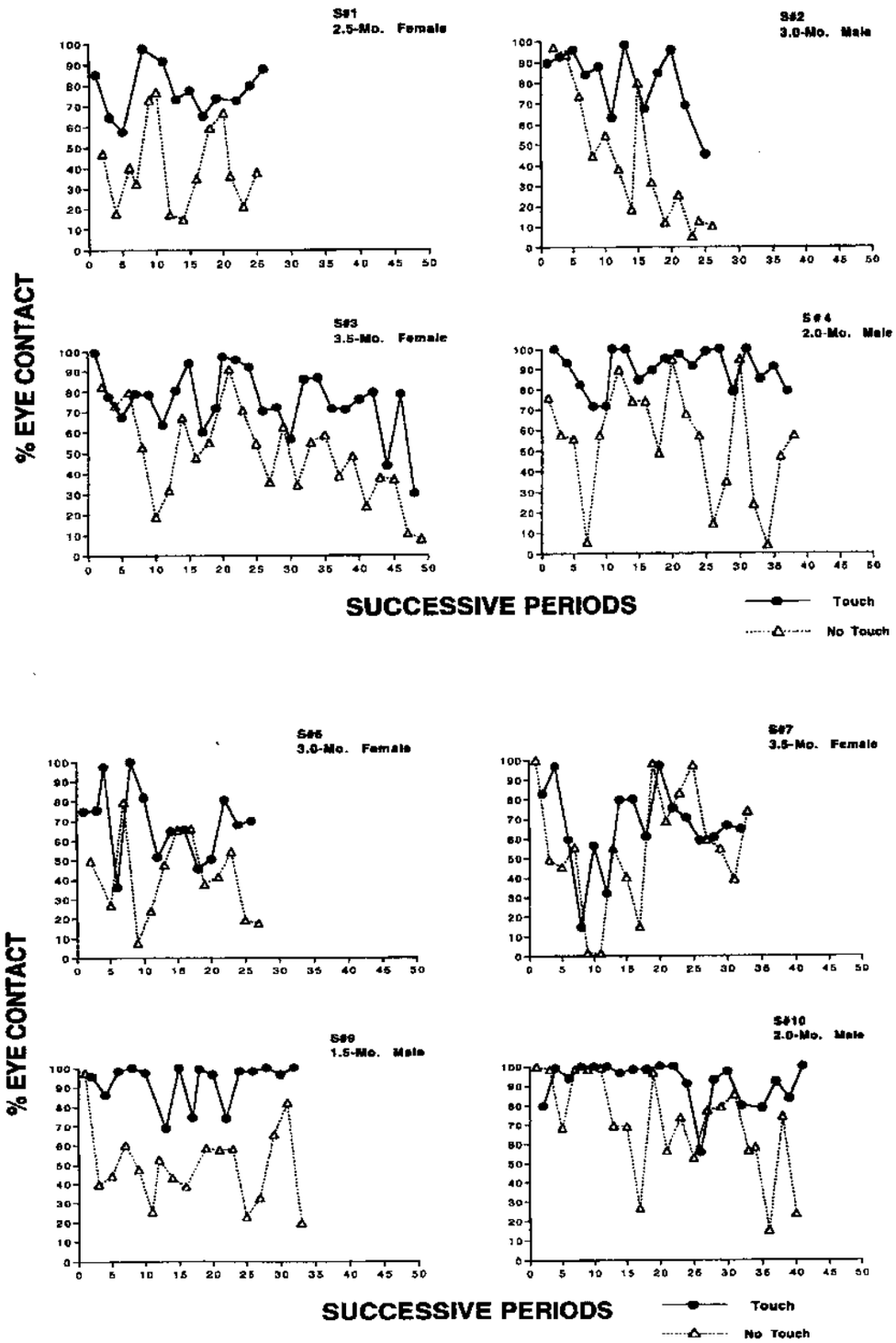


Figure 7a and 7b. Percentage of time each of 8 infants made eye contact across periods as a function of Touch vs. No–Touch treatment.

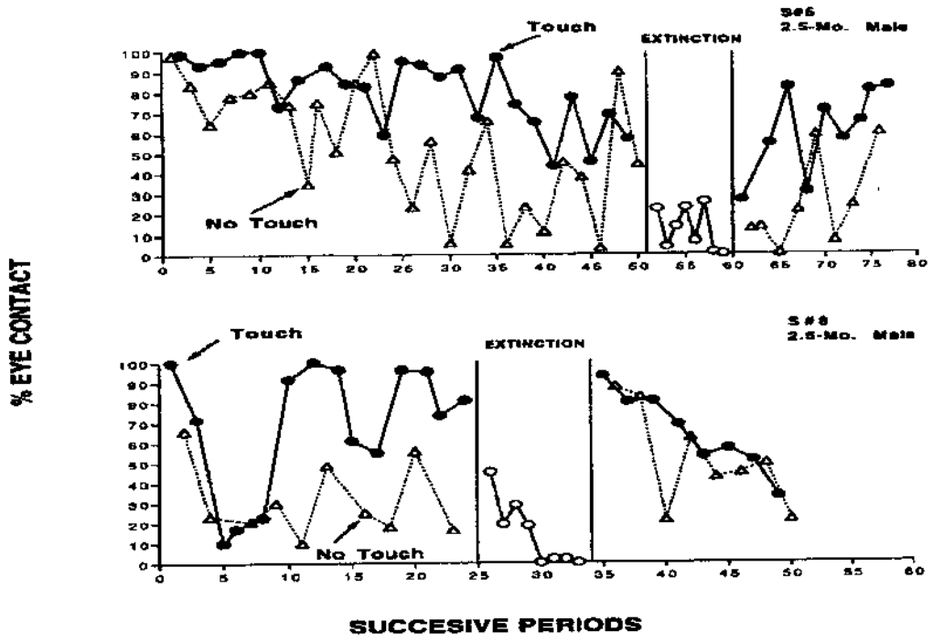


Figure 7c. Percentage of time two infants, who received an extinction phase, made eye contact across periods as a function of Touch vs. No-Touch treatment.

The *No-Touch treatment* was identical, except that no touch was provided. That is, each time the infant began eye contact with the experimenter, the latter responded contingently by smiling and cooing to the infant (but no touch was provided). Under both conditions, as soon as the infant looked away from the experimenter's eyes, the experimenter stopped smiling at, vocalizing to (and touching in the Touch condition) the infant. The experimenter continued facing and looking at the infant with a neutral face, until the infant again emitted an eye-contact response.

In both treatment conditions, during the 30-sec interval between periods the infant was turned away from the experimenter, and rocked and entertained with a toy by a second experimenter. The total duration of a session was 7 min. The total number of sessions for each subject ranged from 11 to 30 ($M = 14$), and the total number of treatment periods across sessions ranged from 26 to 75 ($M = 40$).

To test the reversibility of the eye-contact response, a subsample of two subjects received a reversal (extinction) phase. The comparison between the Touch and the No-Touch treatment showed that the Touch treatment was associated with a higher percentage (i.e., *longer* periods) both of infant eye contact and of responses denoting positive affect (smiles and vocalizations), and lower percentage of responses denoting negative affect (cries and protests).

The individual data show a higher percentage of eye contact (the target response) across successive conditioning periods for all subjects. The two infant subjects who received the reversal (extinction) probes showed reversibility of their eye-contact

response (see Figure 7c). However, when the stimulation treatments were reintroduced in the last phase, eye–contact and positive affect increased only in one subject. In general, all infants spent more time making eye contact with the adult experimenter during the Touch treatment than in the No–touch treatment (see Figures 7a and 7b).

The results indicated that, under the synchronized conjugate-reinforcement schedule, a stimulus compound comprised of touch together with auditory and visual stimuli was a more effective reinforcer for infant eye-contact responding than a compound that did not include touch. The results supported our assumption that familiar caregivers who are nondepressed can provide effective contingencies as part of preventive intervention programs to occasion and maintain more positive and fewer negative behaviors in the infants than do depressed mothers typically.

In the case of infants of depressed mothers, it is suggested that the operant contingencies provided, not by mothers but by others, can produce positive social behavior (eye-contact) and mood enhancing responses (infant smiles and vocalizations) that reverse depression-like behaviors in the infants. In general, it appears caregiver's touch has strong influences on human behavior and may be used successfully in intervention programs with at-risk populations including the depressed and the aged.

Conclusion

The developmental themes enumerated in this chapter were addressed experimentally in terms of operant-learning conceptions, with parent behavior providing antecedent discriminative, and consequent reinforcing, stimulus events for units of infant behavior. The outcomes under scrutiny were found to result from dramatically-different processes than those proposed in the developmental and clinical literatures. Infant's problem or adaptive behaviors were found to be comprised of discriminated operants apparently under the close control of discriminative stimuli and consequences provided via the responding of well-intentioned loving parents (caregivers), acting possibly under the influence of popular theories in the field. While the results we have described do not rule out definitively the explanations of the denotative behaviors found in the literatures surveyed, they make it likely that some, if not much or all, of the variance in the behaviors at issue could be accounted for by relations with the proximal antecedent and consequent environmental factors that we have been studying.

The experiments on infant protests we have reported illustrate potential pathways to development in the child of problem-behavior patterns (that is, fussing, whimpering, instrumental crying, and rage) that can result from these early mother-infant chains of interaction that interfere with behaviors denoting social competence. We believe that results like those reported can provide bases for designing preventive interventions that parents and other caregivers might use to preclude, eliminate or at least minimize maladaptive behaviors while potentially increasing more developmentally-appropriate behavioral patterns. The processes highlighted

by application of the operant-learning paradigm are *un*expected under the routine conceptions of process that have been applied in the literature, yet reflect a level of analysis that, from moment to moment, reflects the parental/environmental influence on developmentally-important infant behaviors. Indeed, in the behavior arenas surveyed the well-intentioned, loving, caregiver creates problem-behavior patterns that, subsequently, require much effort to set right.

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