

Influences of Contingent Touch on Infant Behavior

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The influences of contingent touch on infant behavior were examined in seven studies of healthy full-term infants. The studies included 186 children, half of whom received contingent touch and half who served as control participants. Contingent touch is characterized by tactile stimulation provided by an adult in response to a specific infant behavior. Findings from this practice-based research synthesis indicate that contingent touch can increase infants' motor responses, promote positive affective behavior, and decrease negative affective behavior. Implications for practice indicate that touch is one type of response-contingent behavior that parents can use to promote the acquisition of infant motor, social-emotional, and other behaviors.

Purpose

The purpose of this practice-based research synthesis was to investigate the effectiveness of contingent touch for promoting positive behavioral outcomes in infants. The contingent touch practice that constituted the focus of this synthesis involved tactile (touch) stimulation of an infant's body in response to the infant's production of a targeted behavior (LePage, 1998).

The conduct of the research synthesis was guided by a framework that focuses on the degree to which variations in the provision of contingent touch was associated with variations in social-emotional and motor outcomes (Dunst, Trivette, & Cutspec, 2002). A practice-based research synthesis differs from more traditional research syntheses by systematically examining and unpacking the characteristics, features, and elements of environmental variables (Babbie, 1995; Bronfenbrenner, 1992) that are associated with behavioral or developmental differences.

Background

Developmental psychologists posit that touch is an important element in the healthy development of infants (Field, 1998; Greenough, 1990; Hertenstein, 2002). This notion has led a number of investigators to identify touch as a factor influencing the production of a variety of infant behaviors. Many investigators have examined the developmental benefits of touch in the contexts of infant massage, infant attachment, and parent-infant interactions (Field, 1998; Greenough, 1990; Hertenstein, 2002;

Stack & LePage, 1996; Weiss, Wilson, Hertenstein, & Campos, 2000). Other investigators have focused on the manner in which touch can be used to promote acquisition of particular infant behaviors (Palaez-Noguera, Field, Gewirtz, Cigales, Gonzalez, Sanchez & Clasky, 1997; Stack & Muir, 1992).

It has been well demonstrated that infants can "learn" the relationship between their behavior and its reinforcing environmental consequence when reinforcement is contingent upon child behavior (Watson, 1972; Watson & Ramey, 1972). Research also indicates that during interactions, infants display increased positive affect and maintain attention to adults longer when adult responses are contingent on infant behavior (O'Brien, Glenn, & Cunningham, 1994).

In studies investigating the use of touch to promote infant responding, adults deliver tactile stimulation in response to particular behaviors produced by the infant. The types of infant behaviors targeted by these studies include leg kicks, smiles, vocalizations, and visual attention (Brossard & Décarie, 1968; Paláez-Nogueras et al., 1996; Perez, 2001). Based on this work, it is believed that

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contingent touch may be an effective means for promoting infants' production of desired behaviors, including affective behaviors that are important for social-emotional development (for a review of other types of touch see Field, 2004 and Stack, 2001).

Description of the Practice

The contingent touch practice that was the focus of this research synthesis consists of an adult-delivered tactile reinforcement administered in response to a targeted infant behavior. In this synthesis, tactile stimulation refers to the adult placing a hand or fingers anywhere on the infant's body in immediate response to the targeted behavior (e.g., the infant smiling or looking at the adult). Such stimulation includes, but is not limited to, the placement of a hand gently on the infant's abdomen; systematic rubbing, stroking, tickling, or poking the infant on the legs, abdomen and forearms; and gently moving the infant's limbs.

Search Strategy

Search Terms

Identification of relevant studies was accomplished by using the keywords and truncated versions of the keywords *touch*, *contingent reinforcement*, *contingent touch*, *tactile stimulation*, *contingent stroking*, *infant stroking*, and *infant physical contact*. The search was limited to studies in which human participants were 12 months of age or younger since the focus of practice outcomes was infant behavior.

Sources

A computer-assisted bibliographic search was conducted using Psychological Abstracts (PsycINFO), Educational Resources Information Center (ERIC), Social Science Citation Index (SSCI), MEDLINE, Cochrane Database of Systematic Reviews (CDSR), Cochrane Central Register of Controlled Trials (CENTRAL), Database of Abstracts of Reviews of Effects (DARE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), InfoTrac OneFile, Expanded Academic ASAP, and Academic Search Elite. An online search using Google was also conducted. The reference lists of all acquired sources were reviewed in order to locate additional sources that may not have been located through the bibliographic search findings.

Selection Criteria

Studies were included in the research synthesis if they met the following criteria: (1) the study focused on the effects of contingent touch on infant behavior (2) the contingent touch intervention was described in sufficient detail to ascertain that it consisted of an adult-delivered tactile reinforcement administered in response to a tar-

geted infant behavior, (3) participants were 12 months of age or younger, and (4) the study included at least one infant outcome.

Exclusion criteria. It was necessary to exclude certain studies that did not meet the inclusion criteria during the initial phase of the search process. Specifically, studies were excluded if they: (1) presented data in which the touch provided was not primarily contingent on the infant's production of a behavior, (2) the contingent touch occurred only in conjunction with other contingent adult behaviors (e.g., adult contingently responded to the infant by simultaneously smiling, talking, and touching the infant), or (3) children in the study were older than 12 months of age.

Search Results

Five research reports including seven studies met the selection criteria. Three studies were published in peer-reviewed journals (Brossard & Decarie, 1968; Peláez-Nogueras et al., 1997; Peláez-Nogueras et al., 1996), and four studies were unpublished dissertations (LePage, 1998; Perez, 2001). Table 1 summarizes the characteristics of the study participants. Table 2 includes selected characteristics of the contingent touch procedures, research designs, and outcome measures.

Participants

The seven studies included 186 infants, 98 of which received contingent touch and 88 who served as comparison-group participants. All participants were healthy full-term infants ranging in age from 2 to 7 months. No studies were located that included infants with identified disabilities or conditions placing children at risk for poor outcomes (e.g., premature birth).

Characteristics of Contingent Touch

Most studies involved touch of the infant's limbs and/or abdomen in response to a socio-emotional behavior. In five studies, the infants were touched in response to their smiling. In four studies, the infants were touched when they made eye contact with an adult. In two studies, infants were touched if they displayed any type of positive affect, such as vocalizing or smiling. Only one study involved touch in response to a motor behavior. In that study, infants were touched in response to kicking a leg.

The types of touch used in the studies included limb movement (e.g., moving infants' legs up and down alternatively in a scissor-kick) (N=3), stroking (e.g., soft, rhythmic continuous touching of the infant using one hand) (N=2), tickling/tapping (e.g., non-rhythmic touching of the infant using the fingertips of one hand) (N=2), poking (e.g., one finger touching the infant) (N=2), and rubbing (e.g., moving all fingers of both hands rhythmically on the infant) (N=1). One study involved the placement of

a hand on the infants' body without applying any degree of pressure (Brossard & Décarie, 1968).

Duration of the touch varied across studies. In one study, the touch lasted 3 seconds; in another it lasted 30 seconds. In five studies, the touch continued for the duration of the infant's response.

Treatment Fidelity. Information regarding the fidelity of intervention implementation was reported in all but one study (Brossard & Décarie, 1968). Fidelity measures included: videotaped monitoring of the consistency of the adult's behavior across infants (5 studies), videotaped monitoring of the consistency of the contingent delivery or non-contingent delivery of touch according to research design (6 studies), maintaining consistency of the experimental setting across infants (6 studies), and measuring that the correct amount of pressure was applied during the touch by using an electronic device (1 study). Reported measures for all of these aspects of implementation indicated fidelity of administration of the intervention.

Research Designs

Three studies employed single participant designs, using a within-participant alternating treatments design (Peláez-Nogueras et al., 1997; Peláez-Nogueras et al., 1996; Perez, 2001). The remaining four studies used a between-group comparison design (Brossard & Décarie, 1968; LePage, 2000).

Of the four between-group designs, three studies employed non-contingent touch that was administered to the infant at the same point in time during each session that the matched-infants in the experimental group received contingent touch (LePage, 1998). The fourth between-group study had seven comparison conditions, ranging from the experimenter silently smiling at the infant to the infant being contingently picked up and rocked while an audio taped song was played (Brossard & Décarie, 1968).

Outcomes

Six studies measured social-emotional outcomes while the remaining study (Perez, 1996) measured motor outcomes only. The method used in all six studies that assessed social-emotional outcomes was observational coding of infant behaviors. Motor outcomes were assessed via observational coding of activity level (e.g., leg kicks).

Synthesis Findings

The relationship between contingent touch and the outcomes constituting the focus of investigation was ascertained in two ways. First, the statistical or functional relationship between contingent touch and the outcomes of interest as reported by investigators were examined. Second, the magnitude of effect (Cohen's *d*) between contingent-touch and infant responding was used as an index of the effect size estimates or degree of association

between the independent and dependent variables. This was done using the guidelines described in Dunst, Hamby, and Trivette (2004). Sufficient information was available in six of the seven studies to calculate Cohen's *d* effect sizes.

Table 4 shows the findings from the individual studies included in the synthesis. The investigators of six studies report positive social-emotional consequences of contingent touch, including increased social responding (e.g., increased eye contact), increased display of positive affect (e.g., increased smiling) and less display of negative affect (e.g., decreased fretting). Two of the studies compared different types of contingent touch, finding that systematic stroking was generally preferable to young infants than poking. The remaining study (Brossard & Décarie, 1968) reported that infants were slower to reach the criterion of 20 smiles in the touch only condition than infants in the other experimental conditions.

The one study that assessed motor outcomes measured infant-activity level of leg kicking (Perez, 2001). Reported results were that infant leg kicks increased when infants contingently received intense stroking, tickling, or tapping, but decreased when intense poking was used.

Effect sizes of post-test differences for behavioral outcomes were calculated for all studies for which data was available (Table 4). The number of instances where the effect sizes for the relationship between the contingent touch and behavioral outcomes exceeded a quarter of a standard deviation (.25), indicating more than a small or trivial difference, was ascertained (Cohen, 1988; Hopkins, 1997). Of the 20 effect sizes that were calculated across the studies, 96% exceeded the criterion. The average effect size for the group studies was .89 and the average effect size for the single participant studies was 1.45, indicating a discernable relationship between the use of contingent touch and infants' behavioral responding.

In only one study, the criterion exceeded a quarter of a standard deviation in the opposite direction than expected, indicating that contingent touch was not associated with the targeted behavioral outcome (Brossard & Decarie, 1968). This finding may be due to the fact that the contingent touch used in the study applied no pressure and therefore differed from the touch used in all of the other studies.

Rival Explanations

It is possible that certain threats to internal validity (Campbell & Stanley, 1963; Cook & Campbell, 1979) and rival explanations (Yin, 2000) for observed effects could explain the study findings reported above. However, most alternative plausible explanations and rival explanations for the reported observations of infant learning can be ruled out for a number of reasons. Neither history nor

maturation seems plausible alternative explanations for the reported outcomes in any of these studies inasmuch as the experimental sessions were relatively short (2 to 5 minutes), and environmental factors other than the introduction of contingent touch were practically nonexistent in the studies.

Factors such as testing and instrumentation do not seem likely explanations for observed outcomes because non-intrusive observational assessments were used to measure infant behavior. The fact that the studies employed observational coding as the primary method of data collection could have resulted in observer or rater bias. The likelihood of observer bias is minimized, however, by the fact that four of the five studies employed two independent observational data coders. In addition, in at least two of the studies, the independent coders were blind to the condition being coded.

The fact that the experimenter implemented the treatment in several of the studies could have resulted in experimenter bias, such that the experimenter influences the participant's responses. This concern is mitigated somewhat by the fact that in four of the five studies reviewed, reliability checks were conducted to insure that the experimenter's behavior was consistent across participants and across all study conditions. In one study in which a certain amount of pressure was to be applied in certain conditions, an electronic device was used to objectively measure the applied pressure during sessions.

Social elicitation effects, as opposed to learning (Bloom, 1975), is a rival explanation for observed effects in the studies, since two of the studies included continual social reinforcement in the form of smiling and/or cooing throughout the intervention sessions. However, one investigator used infant leg kicks to control for the possibility of such effects, as there is no evidence indicating that non-social motor responses are influenced by social-elicitation effects. The investigator demonstrated infant learning that was consistent with the other studies (Perez, 2001). In addition, four other studies controlled for social elicitation effects during the experimental sessions by having the adult maintain silence and a relatively neutral expression. These studies also reported infant learning similar to the others. Taken together, these findings suggest that social elicitation is not a likely factor influencing the observed outcomes in the synthesized studies.

In summary, the studies included in this synthesis generally controlled major threats to internal validity or rival hypotheses. That the plausibility of rival explanations or validity threats can be reasonably minimized strengthens the conclusion that the observed outcomes are attributable to the fact that the infants received contingent touch. Therefore, using contingent touch does appear to be effective for increasing infant motor and social-emotional responses.

Conclusion

The findings from this practice-based research synthesis indicate that contingent tactile stimulation, provided in response to an infant's behavior can increase infant production of motor and social-emotional responding. More specifically, in terms of social-emotional development, the administration of contingent touch, especially systematic stroking, enhances positive affective responding and decreases negative affective responding.

A *Bottomlines* (Vol. 4, No.4) report that describes the major findings from this research synthesis in non-technical, user-friendly language has been developed to supplement this *Bridges* report. The *Bottomlines* summarizes what we know about the use of contingent touch with infants and is written specifically for parents and practitioners. Both *Bridges* and *Bottomlines* reports are available to readers in electronic versions at our website (www.researchtopractice.info).

Implications for Practice

The findings from this research synthesis have at least one important implication for practice. Using contingent tactile stimulation to promote acquisition of desired infant behavior is supported by the available research evidence. This evidence indicates that providing opportunities in which an infant's behaviors result in tactile reinforcement is likely to increase the rate and strength of responding. For example, when an adult responds with systematic stroking to an infant's behavior, such as a smile, the infant is likely to smile more often at the adult. The patterns of findings from this synthesis are consistent with patterns of infant learning reported in the contingency learning literature (Hains & Muir, 1996); (Kassow & Dunst, 2004; O'Brien et al., 1994; Trivette, 2003).

According to Tarabulsky et al. (1996), providing response-contingent learning opportunities to infants can enhance their social and emotional development. Through contingent learning experiences, the infant comes to recognize a relationship between his or her behavior and a reinforcing consequence. It is this relationship that distinguishes contingent learning from non-contingent activities. In contingent touch interventions, the adult deliberately responds with touch to the infant's behavior (e.g., stroking the child's limbs in response to the infant smiling at the adult). It should be noted that touch is one of a class of reinforcers that influence infant operant responding. Other reinforcers include but are not limited to adult smiles and vocalizations (Barrett, Roach, & Leavitt, 1992). Regardless of the adult behavior that serves as the reinforcer, response-contingent learning opportunities provide the infant with experiences that promote understanding of his or her ability to influence the environment and to elicit desired reinforcement.

Knowing that contingency learning can be a powerful way to “teach” young infants, and that contingent touch is reinforcing to infants, adults can use such touch as one form of reinforcement to promote infant responding in a variety of developmental areas, such as the motor and social-emotional domains. While the studies reviewed in this synthesis were conducted under controlled experimental conditions and focused only on touch, it is likely the case that touch would be just one type of social contingency in more natural parent-infant interactions. Smiling, talking, and playing with the infant are other behaviors that parents are likely to use to reinforce their infant’s responses. Therefore, touch is just one component of the package of responses that parents can use contingently to promote the acquisition of motor, social-emotional, or other behaviors in their infants.

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Table 1
Characteristics of Study Participants

Study	Infant Characteristics						
	Sample Size		Sample Participants	Mean Age (Months)	Gender (%)		Ethnicity
	Exp.	Control			Male	Female	
Brossard & Décarie (1968)	4	28	Healthy institutionalized infants	4	7	25	Not Reported
LePage (1998) (Study 1)	12	24	Healthy full-term infants	7	50	50	Caucasian (92%) Asian/Pacific Islander (8%)
LePage (1998) (Study 2)	12	24	Healthy full-term infants	4	50	50	Caucasian (86%) African American (6%) Asian/Pacific Islander (8%)
LePage (1998) (Study 3)	24	24	Healthy full-term infants	5	50	50	Caucasian (86%) African-American (11%) Asian/Pacific Islander (3%)
Peláez-Nogueras et al. (1996)	10	-	Healthy full-term infants	3	60	40	African American (70%) Hispanic (30%)
Peláez-Nogueras et al. (1997)	12	-	Healthy full-term infants	3	42	58	African American (58%) Hispanic (42%)
Perez (1996)	12	-	Healthy full-term infants	4	50	50	African American (17%) Hispanic (83%)

Table 2
Characteristics of the Contingent Touch Interventions

Study	Person Administering Contingent Touch	Contingent Touch Activity	Contingency Relationship	Number of Session Days	Frequency of Experimental Sessions	Length of Experimental Sessions	Experimental Setting
Brossard & Décarie (1968)	Female researcher	Placement of hand on infant's abdomen without applying pressure	Touch provided in response to infant smile	Until 20th reinforced smile was elicited	3 per day	5 minutes	Isolated room in orphanage
LePage (1998) (Study 1)	Female researcher	Movement of infant's legs in a standardized scissor-kick motion	Touch provided in response to infant eye contact	1	1 per day	3 minutes	Testing room
LePage (1998) (Study 2)	Female researcher	Movement of infant's legs in a standardized scissor-kick motion	Touch provided in response to infant eye contact	1	1 per day	3 minutes	Testing room
LePage (1998) (Study 3)	Mother	Movement of infant's legs in a standardized scissor-kick motion	Touch provided in response to infant eye contact	1	1 per day	3 minutes	Testing room
Peláez-Nogueras et al. (1996)	Female researcher	Rhythmic rubbing of infants' legs and feet	Touch provided in response to infant eye contact	10	3 per day	2 minutes	Testing room of infant nursery
Peláez-Nogueras et al. (1997)	Female researcher	Stroking; tickling, poking	Touch provided in response to infant eye contact	4	3 per day	2 minutes	Testing room of infant nursery
Perez (1996)	Mother	Stroking, tickling, poking at mild and intense levels	Touch provided in response to infant leg kick	Up to 6	1 per day	3 minutes	Infant's home

Table 3
Study Design Characteristics

Study	Study Design Characteristics					
	Research Design ^a	Control Group Intervention	Random Assignment to Groups	Use of Blind Raters	Tx Fidelity Data	Outcome-Reliability Data
Brossard & Décarie (1968)	O OX OY OZ OA OB OC	Visual sight of researcher smiling at infant	No	No	No	No
LePage (1998) (Study 1)	OX O O	Non-contingent touch	Partial	Yes	Yes	Yes
LePage (1998) (Study 2)	OXO O O	Non-contingent touch	Partial	Yes	Yes	Yes
LePage (1998) (Study 3)	OXO O O	Non-contingent touch	Partial	Yes	Yes	Yes
Peláez-Nogueras et al. (1996)	OXO XOX	—	Yes	Not Reported	Yes	Yes
Peláez-Nogueras et al. (1997)	OXO XOX	—	NA	Yes	Yes	Yes
Perez (1996)	OXOXOX	—	NA	Not Reported	Yes	Yes

^a O = Baseline phase of study, X = Contingent touch phase of study.

Table 4
Outcome Measures and Major Findings

Study	Outcome Measures	Findings	Touch Comparisons	Effect Size (Cohen's <i>d</i>)
Brossard & Décarie (1968)	Number of minutes to reach criterion of 20 smiles	Infants in the contingent touch condition (a hand placed on the infant's body without pressure applied) were slower to reach the criterion than infants in the no touch experimental condition.	CT ^a vs. NCT ^b	-2.16
LePage (Study 1) (1998)	Percent duration of infant gaze at experimenter's face	Infants gazed longer in contingent condition	CT vs. NCT	1.78
	Percent duration of infant gaze away from experimental situation	Infants kept their gaze in the experimental situation longer in the contingent condition	CT vs. NCT	1.04
	Percent duration of infant smiling	Infants displayed increased smiling in the contingent condition	CT vs. NCT	.33
	Percent duration of infant fretting	Infants fretted less in the contingent condition	CT vs. NCT	1.42
LePage (Study 2) (1998)	Percent duration of infant gaze at experimenter's face	Infants gazed longer in contingent condition	CT vs. NCT	.94
	Percent duration of infant gaze away from experimental situation	Infants kept their gaze in the experimental situation longer in the contingent condition	CT vs NCT	.91
	Percent duration of infant smiling	Infants displayed increased smiling in the contingent condition	CT vs NCT	—
	Percent duration of infant fretting	Infants fretted less in the contingent condition	CT vs NCT	-.81
LePage (Study 3) (1998)	Percent duration of infant gaze at experimenter's face	Infants gazed longer in contingent condition	CT vs NCT	1.33
	Percent duration of infant gaze away from experimental situation	Infants kept their gaze in the experimental situation longer in the contingent condition	CT vs NCT	1.52
	Percent duration of infant smiling	Infants displayed increased smiling in the contingent condition	CT vs NCT	—
	Percent duration of infant fretting	Infants fretted less in the contingent condition	CT vs NCT	-1.91
Peláez-Nogueras et al. (1996)	Frequency of eye contact	Infants displayed increased eye contact in the contingent condition	CT vs NCT	1.38
	Frequency of smiling/vocalizing	Infants displayed more positive affect in the contingent condition	CT vs NCT	1.60
	Frequency of grimacing/crying/fussing	Infants were less likely to display negative affect in the contingent condition	CT vs NCT	-.91
Peláez-Nogueras et al. (1997)	Percent duration of eye contact	Infants displayed longer eye contact in the stroking condition	Rhythmic Stroking vs. Tickling/Poking	3.64
	Percent duration of smiling/vocalizing	Infants displayed more positive affect in the stroking condition	Rhythmic Stroking vs. Tickling/Poking	1.35
	Percent duration of protesting/crying	Infants displayed less negative affect in the stroking condition.	Rhythmic Stroking vs. Tickling/Poking	-1.56
Perez (1996)	Number of infant leg kicks	Infants increased their rate of leg kicking in the contingent touch conditions than in the non-contingent touch conditions	<u>Baseline Non-Contingent Touch</u> compared to:	
			Contingent Stroking	1.38
			Contingent Tickling	2.74
			Contingent Poking	.19

^a CT=Contingent Touch

^b NCT=Non-Contingent Touch