Rhythms of Dialogue in Infancy and Attachment Narratives in Childhood

by

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Abstract

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The present study examined infant-adult early coordination of vocal rhythms (mother and novel social partner) in face-to-face "play" interactions at 4 and 12 months as it related to childhood attachment representations at age 4, assessed by the Attachment Story Completion Task (ASCT; Bretherton, Ridgeway & Cassidy, 1990). Degree of vocal rhythm coordination was considered a preverbal relational measure, not specific to infant attachment. Coordinated interpersonal timing (CIT) of adult-infant pause and switching pause was assessed by time-series analysis in 41 infants with mother and stranger, at home and in the lab.

Two analyses were conducted. Analysis I tested the low and high ends of vocal rhythm coordination between infant-adult partners at 4 and 12 months in order to determine attachment classifications at age 4 that were associated with vocal rhythm coordination outside of the midrange. Analysis II tested the ends of the distribution of attachment narratives in childhood; low scores indicated disorganized (D), high scores indicated avoidant (A) styles of representing attachment. This analysis was conducted to determine vocal rhythm coordination patterns in infancy that were associated with disorganized and avoidant attachment in childhood.

The majority of study findings emerged in the 4-month context, in the stranger-infant interaction. In Analysis I, it was found that adult's lowered coordination of vocal rhythm with the infant predicted both avoidant (A) and resistant (C) attachment narratives in childhood. Mother's lowered coordination specifically predicted resistant narratives; stranger's lowered coordination predicted both. Heightened adult coordination was also predictive of both avoidant and resistant attachment; mother's heightened coordination predicted avoidant, and stranger's predicted resistant attachment in childhood. In Analysis II it was found that children who told both avoidant (A) and disorganized (D) narratives at 4 years were associated with a pattern in which strangers lowered or inhibited vocal rhythm coordination with them at 4 months.

This study found that a midrange degree of vocal rhythm coordination, especially in the 4 month stranger-infant interaction, was indicated for developing attachment security. Both lowered ("withdrawn" or "inhibited") and heightened ("vigilant") patterns of stranger tracking the infant's communication were related to problematic, insecure (A, C, and D) attachment narratives in childhood.

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I. Introduction

Rhythms of Dialogue in Infancy

The study of the quality of the developing attachment relationship between a preverbal infant and the primary caretaker is the study of the dyad's capacity to be engaged, to discover one another, and to play, in an open and safe relational environment. At this point in development, much of the action of the relationship is held within this amazingly complex nonverbal dance, to which both the parent and the infant actively contribute. Facial gestures, vocal exchanges, postures, gazes and touch make up the steps, but there is a rhythm that is unique to each pair as they negotiate their developing relationship. Each parent-infant pair dances in the finely coordinated micro-synchronies of both gesture and of vocalization. "In vocalizing to the infant, we are talking about music," notes Stern, (2001, p.144). One aspect of this music, the coordination of mother-infant vocal rhythms, has been shown to hold a wealth of information about the infant's earliest representations of primary attachment relationships.

This study takes a different approach to investigating the origins of developing attachment representations in that vocal rhythm coordination in infancy, rather than 12-month infant attachment, serves as the early measure of developing internal working models of attachment relationships assessed in childhood. Although vocal rhythm coordination predicts the quality of developing attachment between mother and infant, vocal rhythm coordination between stranger and infant also indexes children's developing relational strategies. An additional goal of the present work is to examine

early nonverbal patterns of relating for those children who evidence insecure attachment representations and relational difficulties at 4 years.

Prior research has explored preverbal vocal rhythm coordination and its relation to attachment outcomes only as far as 12 months (Jaffe, Beebe, Feldstein, Crown & Jasnow, 2001; Beebe, Jaffe, Feldstein, Hane, Crown, Markese, Jasnow & Moore, 2007). The current study seeks to expand this exploration of the contribution of preverbal vocal rhythm coordination to relational development by looking at the relationship of 4- and 12-month vocal rhythm coordination (in the contexts of mother-infant, stranger-infant; home and lab) to attachment representations and socio-emotional development, or "relatedness," in the preschool years.

Vocal rhythm is a rich and versatile variable with which to assess nonverbal communication, both in infancy and in adulthood (Beebe, 1985; Beebe et al., 2007; Jaffe et al., 2001). Mother-infant dialogues show reciprocal "influence" (used interchangeably with "coordination") of the two partners, as do linguistically based adult dialogues. These preverbal dialogues share features with semantically organized adult dialogues. Therefore, vocal rhythm "matching" or coordination in pre-linguistic interactions between mother and their infants is referred to as "protoconversation" (Beebe, Stern & Jaffe, 1979).

Over three decades of infant research have shown the infant's remarkable capacity to actively engage in rhythmic exchanges. Studies have shown that infants have the ability to register and distinguish rhythmic events prenatally, and to remember them at birth, such as the particular rhythm of a storybook read to them by their mothers in the

third trimester of pregnancy (DeCasper & Carstens, 1980; DeCasper & Fifer, 1980). Within the first months of life, infants can discriminate miniscule auditory duration changes and perceive synchrony; by 4 months they can discriminate duration rate and rhythm (Lewkowicz, 2000). Additionally, infants have the capacity to form expectancies of perceptual patterns and social rhythms. If these rhythms are altered, or disrupted, they notice, as early as 0 – 2 months of age (DeCasper & Fifer, 1980).

This research makes clear that in the preverbal period, as early as 2-4 months of age, infants are highly competent perceivers and participants in the rhythms and synchronies of their social environments and their relationships, both with primary attachment figures and with novel partners. Thus, rhythm and vocal timing exchanges are an index of the pre-verbal infant's most developed system of communication and affective processing (Jaffe et al., 2001). Their assessment is thus likely to provide information about early relational patterns and their relation to developing attachment security.

An example of the early development of perceptual capacities, 4-month infants and mothers coordinate the duration of the "switching pause," which regulates the turn taking rhythm of "protoconversation," in the same way that adults do (Beebe, Alson, & Jaffe, 1988; Jaffe et al., 2001). The "switching pause" occurs at the moment of the turn exchange. The coordination of switching pause means that the duration of the switching pause of one individual predicts the duration of the switching pause of the partner. Thus, the partner "adjusts" or "coordinates" his pace with that of the other. Thus, preverbally, infants are adaptive social partners.

Studies of vocal rhythm coordination in infancy have revealed relational information contained in adult-infant coordination of vocal rhythm behavior. In mother-infant dyads, at 4 months and at 12 months, degrees of coordination of pause and switching pause that are neither at the low, or high end of the range, but that are "midrange", have predicted secure attachment outcomes at 1 year (Jaffe et al., 2001). In both mother-infant, and stranger-infant dyads in which interactive coordination was both at the low and high poles of the distribution, infants were found to be insecurely attached at 1 year, with different partner combinations predicting different attachment classifications (see Jaffe et al., 2001). Building on this research, midrange mother-infant vocal rhythm coordination at 12 months predicted secure attachment at 12 months (Beebe et al., 2007). The present study proposes that midrange 4- and 12-month vocal rhythm coordination, in both the mother-infant and stranger-infant interaction, will be optimal for secure attachment narratives at 4 years.

Other empirical research, not specifically focused on attachment outcomes, has also supported the concept that midrange coordination of communication, assessed through vocal rhythm behaviors, is optimal for infant relational development (Belsky, Rovine & Taylor, 1984; Hane, Feldstein and Dernetz, 2003; Isabella and Belsky, 1991; Lewis and Feiring, 1989; Leyendecker, Lamb, Fracasso, Scholmerich, and Larson, 1997).

Clinical Implications of Vocal Rhythm Research

While attachment research has clearly been proven to be a valuable method of assessing the infant's relational development and the nature of the attachment bond, limitations in research tools have prevented the assessment of problematic dyadic

functioning in infancy prior to 12 months. Infants may begin to represent distress in a pre-symbolic, implicit/procedural mode, through the expression of maladaptive forms of self- or interactive-regulatory behaviors both with primary attachment figures and with other relational partners. Empirical exploration of the role of mother-infant vocal rhythm coordination, and adult-infant coordination in general, may be valuable in a variety of clinical assessment and treatment contexts.

The assessment of early nonverbal interactions, specifically through the measurement of preverbal vocal rhythm coordination, may prove a valuable way of assessing early difficulties, thereby providing an earlier measure of risk, and allowing for earlier clinical interventions. By using the study of microanalytic self- and interactive regulation patterns in the preverbal dyadic exchange, prior to the 1-year age point when attachment can be assessed, the assessment of mother-infant and stranger (clinician) - infant vocal interactions could provide valuable clinical information before attachment security can be assessed at 12 months in the Ainsworth Strange Situation Paradigm (Ainsworth, Blehar, Waters & Wall, 1978, Ainsworth & Wittig, 1969).

In this way, specific risk factors for the later development of insecure attachment, and possible subsequent child psychopathology, may be documented. If so, vocal rhythm patterns empirically determined to be indicative of early maladaptive relational development could be applied to the design of primary intervention programs for at-risk infants and preverbal toddlers with deviant coordination (at the high and low pole) as a clinical indicator for primary prevention and intervention.

Empirical evidence that vocal rhythm coordination in the preverbal period relates to the child's attachment representations and relational development at 4 years of age would also lend strength to existing mother-infant treatment models. Treatment approaches have already begun to use the findings that midrange degrees of vocal rhythm coordination in mother-infant dyads are optimal for secure attachment at 1 year (Beebe, 2005; Cohen & Beebe, 2002). The concept of optimum degrees of mother-infant vocal rhythm coordination has been applied to mother-infant treatment, both as a) an assessment method in the clinical situation, and b) as an intervention technique for mothers experiencing other problematic dyadic behavioral patterns. For example, in non-optimally coordinated dyads in which mothers either minimally engage and coordinate with their infants vocally ("withdrawn" or "inhibited" communication), or engage in overly coordinated vocal exchanges ("vigilant" communication), clinical interventions can help them to "track" their infants vocalizations, or to "slow down" and modulate the degrees of coordination respectively (Beebe, 2005; Cohen & Beebe, 2002). By contrast, for mothers with infants who demonstrate gaze and postural avoidance in the face-to-face interaction, vocal rhythm coordination provides a method of engaging infants emotionally without overwhelming them, and without requiring that they visually engage (Beebe, 2005; Cohen & Beebe, 2002).

Vocal rhythm coordination and the turn taking structure of dyadic vocal exchanges have been found to carry important social and emotional qualities of the relationship, such as warmth, empathy and interpersonal attraction, regardless of their connection to attachment per se (Welkowitz, Cariffe, & Feldstein, 1976). The nonverbal process between parent and child, and therapist and child can be utilized at a clinical level

to engage in treatment and to monitor the treatment process, especially in preschool-aged children, and in children with compromised expressive and receptive language.

Further evidence of the importance of early vocal rhythm coordination for childhood development, as proposed in this study, would add to clinical theory and practice. An example of the application of the concept of clinical tracking and modulating of vocal rhythm exchanges to therapy, between child patients and therapists, has been suggested by Harrison (2003), who employs a modified technique of sensitizing herself to the turn-taking rhythms in child treatment as a means of "staying with" the child.

Because vocal rhythm is measurable both in preverbal mother-infant interactions, and in later verbal interactions across development through adulthood, the "coordination of vocal rhythms" has the unusual characteristic of being a "life span" variable, relevant to every stage of development. It has been associated with an array of interpersonal outcomes, such as mutual attraction, perception of familiarity, feelings of secure bonding, effective communication of ideas, and perceived empathy (Beebe et al., 2007; Feldstein, Alberti, & BenDebba, 1979; Feldstein & Field, 2002; Feldstein & Welkowitz, 1978; Field, 1985; Jaffe et al., 2001). Because of these characteristics, vocal rhythm is well positioned to identify potential continuities in attachment representations as the child transforms cognitively, emotionally, and socially, from 4 months to 4 years. Vocal rhythm coordination has been shown to be a life-span organizing principle, underlying an individual's social and emotional relatedness to an array of partners, from peers, to romantic partners to therapists (Beebe & McCrorie, 1997, 1999; Crown, 1991; Feldstein,

1988; Holtz, 2004; Jaffe et al., 2001; Beebe et al., 2007). An improved understanding of the relational meaning of vocal rhythm coordination in infancy would contribute to an empirically grounded understanding of the power of vocal rhythm coordination as a therapeutic tool in child and adult treatment models (Beebe & Lachmann, 2003; Bucci, 2001; Holtz, 2004).

Interpersonal Vocal Rhythm Coordination

The study of "vocal rhythms," refers to the study of the "organization of two ongoing naturalistic streams of behavior," the durations of vocalizations and pauses, "one of the mother, one of the infant, and of their interrelation," (Beebe et al., 1979, p. 217). Each partner, adult and infant, has an ongoing stream of durations of vocalizations and pauses. The degree of coordination between the two streams can be assessed by time-series techniques (see Jaffe et al., 2001). This assessment yields a coefficient of coordination which represents the degree of variance accounted for in the infant's stream of durations of sound and silence by those of the mother, or stranger, [(M) → **I**; infant's behavior is predicted by mother's], and the degree of variance accounted for in the mother's stream of durations of sound and silence by those of the infant [(I) → **M**].

Analysis of adult-infant contingencies reveals coefficients of coordination in which degrees of dyadic rhythm coordination can be identified across the range of low to midrange to high values. Infants with "secure" attachment classification at 1 year have been shown to fall into the "midrange" at 4 and 12 months, while infants who are classified as "insecure" fall outside the "midrange," at the low and high poles (Beebe et al., 2007; Jaffe et al., 2001). At both age points in infancy, dyads can be identified as

being hypo-contingent or "withdrawn/inhibited", midrange contingent, or hyper-contingent or "vigilant," (relative to the sample), in relation to attachment categories assessed later in development (e.g. 1 year, 4 years).

Vocal rhythm coordination is one fundamental aspect of the infant's capacity for processing interactions and for bonding. In social interactions with novel partners as well as in intimate relationships, vocal rhythm provides nuanced social information necessary to predict and coordinate with the partner. The adult partner characteristically speaks to the infant in simple, repetitive rhythms that effectively "mark" and structure social information so that it is predictable, yet interesting for the infant, allowing the infant to begin to process, remember and represent interactions and experiences (Stern, 1971; Stern, Beebe, Jaffe & Bennett, 1977; Jaffe et al., 2001). In these ways, the mother's rhythmic communication to the infant, and the developing interpersonal coordination of the preverbal mother-infant exchange, provide the infant a temporal patterning with which to begin to process and represent relational experiences.

Infant researchers have posited a neurobiological theory of infant representation of the quality of mother-infant relatedness. Models of preverbal brain development advance the idea that the developing relationship between an infant and primary caretaker mediates the infant's early ability to regulate emotion, and thus, the mother is instrumental in co-regulating the infant's developing autonomic nervous system (Stern, 1971; Hofer, 1994; Perry, 1996; Schore, 2002). Neurobiological models suggest that the earliest developing regions of the infant's brain encode this dyadic relationship neuronally as an "internal working model" of the quality of relatedness. Thus, this

working model of early dyadic relatedness is represented in the infant's implicit, non-conscious memory (Hofer, 1994; Schore, 1994; Siegel, 1999; Valent, 1998). As the infant's remarkably well developed ability to process and respond to timing and rhythms has been demonstrated (DeCasper & Carstens, 1980; DeCasper & Fifer, 1980; Lewkowicz, 2000), vocal rhythm coordination is understood as one essential pathway of mother-infant co-regulation that contributes significantly to preverbal brain development.

Preverbal vocal rhythm can also be conceptualized as a form of play, (Stern, 1985; Stern, Beebe, Jaffe & Bennett, 1977), both in the sense of mutual enjoyment, and in the sense of a space with which to experience a wide array of affects and reactions, and to learn about the different relational paths where each might lead. Similar to theories of adult attachment representations, infant research has suggested that a stable, yet open and flexible "midrange" vocal rhythm "dialogue" between mother and infant predicts the early development of a secure attachment climate, specifically in the "midrange model," (Beebe, 2000; Beebe et al., 2007; Jaffe et al., 2001).

Stern (2001) reminds us of the importance of midrange degrees of mother-infant vocal rhythm coordination in discussing the Jaffe et al (2001) monograph:

> Play requires a certain level of openness that does not permit high predictability…Playing can only occur in a setting where there is a feeling of ease, of security, of not having to be vigilant, being free of other pressing needs. Only in such a setting can some of the basic aspects and requirements for play appear, such as a loose frame that permits spontaneity and unpredictability; the incorporation of accidents, errors, and rule violations; the momentary uncoupling

> from the other to explore and adjust inside yourself and then rejoin the partner; sometimes fiddling with the very timing of interactions and expectations so as to create variations and pleasurable violations; and other such nonlinear and frame-breaking features that enhance creativity (pp. 145-146).

The importance of play for relational, emotional and cognitive development forms the basis of contemporary child development theory. Because preverbal face-to-face "play" of mother-infant (novel partner-infant) vocal rhythm exchanges at 4 and 12 months has been shown to predict 12-month attachment outcomes, it seems likely that these early templates may not only be represented as early internal working models of the flexibility and security of primary relationships, but will also continue to affect the child's relational development, assessed in this study at age 4 years. As suggested by Jaffe et al., (2001) preverbal rhythms of dialogue may serve as one of many crucial early guides of the developmental trajectory of relatedness.

II. Literature Review

In order to elucidate the origins of developing attachment representations in the preverbal period, studies of nonverbal behavior in infants, and facial-visual dyadic communication between infants and primary attachment figures, and between infants and novel social partners in the early months of life are essential. These studies provide a way of viewing the relationship before behavioral indicators of attachment security can be assessed.

Research on nonverbal dyadic communication has proven valuable empirically and clinically, providing important clues as to the ways in which elaborated relational models develop in the preverbal period of child development. Studies of nonverbal communication provide clues to how these early interactions may affect attachment representations and social-emotional functioning as infants develop. The following section will review several areas of research and theory to develop the argument that vocal rhythm coordination in infancy is a valuable relational measure, not specific to mother-infant attachment, which may index early relational patterns that are related to the child's capacity to form secure (versus insecure) attachment narratives in childhood.

Vocal Rhythm Coordination as an Assessment of the Early Relational Climate

Early mother-infant interactions in the preverbal period are central to dyadic nonverbal communication and co-constructed affect regulation, and are therefore essential to understanding the development of self- and interactive regulation, socio-emotional functioning and attachment representations in childhood. Vocal rhythm has

been interpreted as an early form of preverbal communication in which the caregiver conveys a sense of "being with" the infant through coordination of durations of pauses as the partner regulates her own rate of vocalization, and switching pause as the vocal "turn" is exchanged (Beebe et al., 2007; Jaffe et al., 2001).

Interactive predictability of the rhythm of each partner is a measure of the degree to which behavior is contingent on the partner's pattern. Studies of vocal rhythm coordination in infancy have revealed relational information contained in the mother-infant dyad's degree of coordination. Both at 4 months and at 12 months, midrange degrees of coordination have predicted a developing secure attachment climate at 1 year. Conversely, in those mother-infant dyads in which interactive predictability of vocal rhythms (at 4 and 12 months) was both at the high and low poles of the distribution, infants were found to be insecurely attached at 1 year (Beebe et al., 2007; Jaffe et al., 2001). Other studies have also found midrange degrees of coordination of the behaviors to be optimal for infant relational development (Belsky, Rovine & Taylor, 1984; Hane, Feldstein and Dernetz, 2003; Isabella and Belsky, 1991; Lewis and Feiring, 1989; Leyendecker et al., 1997).

By definition, vocal rhythm coordination describes both the communicative action of mother and infant, and the dyadic interaction, in each microsecond of relating. Brief segments of audiotaped "proto-conversation" are assessed for degree of vocal rhythm coordination between partners, without any semantic content. Prior to the possibility of utilizing attachment measures at 12 months, degree of vocal rhythm coordination may contribute to the developing unconscious affective tone of the relationship. As Jaffe et al.

(2001) describe, “Infant-adult coordination in the first year might reflect the quality of interaction,” as it is unfolding, (p.4). As partners coordinate rhythmic patterns such as sound-silence, they share their experience of the relationship, such as the “perceived warmth, similarity and empathy of their interaction,” (Jaffe et al., 2001, p.3).

The rhythmic exchange not only describes the quality of the relationship; each partner’s pattern of coordination tells a story about his or her own way of relating to another. The “dyadic systems” model of communication brings to the forefront the continual nature of the bi-directional interplay between partners (Beebe, Jaffe & Lachmann, 1992; Jaffe et al., 2001). Mother and infant adapt to each other moment-by-moment as they coordinate cycles of vocalizing, pausing, and joining. Mother-infant vocal rhythms “move” with other nuanced nonverbal forms of communication and are highly correlated with rhythms of looking, head movement, and gesture (Jaffe et al., 2001; Beebe & Gerstman, 1980; Stern et al., 1977). For the purpose of this research, the rhythms of the pre-linguistic communicative vocal exchange between mother (novel social partner) and infant are particularly important as a quantifiable index of the complex nonverbal system of dyadic adult-infant face-to-face communication.

Infant researchers have used an adult dialogue model (Jaffe & Feldstein, 1970) of vocal rhythm coordination to assess mother-infant (stranger-infant) exchanges in the infant’s first year in order to model the infant’s developing social use of language (Beebe et al., 1979; Beebe et al., 2007; Jaffe et al., 2001). The vocal rhythm measure is especially relevant in infancy as the infant’s pre-linguistic exchange with adult partner is

captured, irrespective of whether the sounds are the adult's words, or the infant's preverbal sounds (Jaffe et al., 2001, p. 18).

In this model, vocal "dialogue" consists of a sequence of sounds ("vocalizations") and silences ("pauses") of each speaker, and "switching pauses" at the point of the turn exchange, all measured in terms of durations in seconds (Jaffe et al, 2001). Thus, this model taps more than the sound/silence rhythm of each partner. Co-constructed and negotiated moments of exchange are captured as meaningful aspects of the timing of mother-infant (and stranger-infant) proto-dialogue. In this way, the bi-directional interpersonal nature of communication is captured by shedding light on each partner's attempts at organizing procedures for vocalizing and pausing, for managing attention and activity level, and for joining and being joined (Jaffe et al., 2001, p.19).

Infant Capacity to Perceive Temporal Information and Temporal Contiguity

The infant is born with an extremely well-developed capacity to perceive and distinguish temporal patterns. Studies utilizing perceptual and auditory stimuli have demonstrated this capacity, as well as the infant's capacity for rhythmic coordination (DeCasper & Carstens, 1980; DeCasper & Fifer, 1980; Lewkowicz, 1989; 2000). Rhythms and "chunks" of these rhythmic phrases provide the infant's earliest social and cognitive information (Beebe & Gerstman, 1980; Stern, 2001). The infant's ability to detect patterns and rhythms in the world of people and objects allows for the development of expectancies in the physical and social world, allowing increasingly stable representations upon which to build cognitive and affective developmental advances. Rhythmic accents that are repeated yet altered, so as to prevent habituation,

accent information, allowing prediction and anticipation. Expectancies facilitate efficient information processing, memory encoding, and the representation of action sequences and events (Jaffe et al, 2001; Warner, 1988). As infants engage socially with their immediate caretakers and with new partners, vocal and behavioral rhythms provide the essential cues necessary to allow infants to predict and coordinate with familiar and novel social partners, (Jaffe et al., 2001; Warner, 1992).

Much developmental research has focused on the infant's capacity to detect coordination. One particular model of development, that of Koos and Gergely (2001) focuses on the infant's experience of and ability to discriminate contingent and non-contingent events and interactions. This capacity has been described in infant research that demonstrates the presence of an "innate contingency detection module" in infancy. This inborn capacity first allows bodily recognition through perfect contingency detection, and later evolves around 3 months to a preference for imperfect, socially related contingencies through which the infant becomes engaged in important early interactions and the environment (Bahrick & Watson, 1985; Koos & Gergely, 2001; Watson, 1994). This model highlights the developmental importance of the infant's preference for imperfect, interactive contingency in the 4-month period.

To illustrate this model, a study by Koos and Gergely (2001) observed 6.5 month olds' behavior and preference for imperfect, interactive contingency (interaction with mother's image) versus perfect, self contingency (engagement with their own reflection) in: 1) a free-play condition with mother (imperfect contingency), 2) a still-face condition (loss of contingency), and 3) a free-play reunion episode (imperfect contingency).

Compared to secure infants, infants who were later classified as demonstrating "disorganized" attachment at 12 months were increasingly attracted to perfect contingency (engaging their own reflection). This occurred both during the stressful still face paradigm and during the reunion episode when the mother was again available as an imperfectly contingent social partner. Just like secure infants, they were distressed by the mother's non-contingency, avoided looking at the non-contingent mother, and looked significantly more at the mother's image in the reunion episode. However, it was the elevated attraction of the disorganized infants to the perfectly contingent self-image as a distress-regulating strategy that set them apart from the secure infants (Koos & Gergely, 2001).

From this research comes the "flickering switch" hypothesis, which posits that after loss of contingent control over the attachment figure, disorganized infants are drawn to regressed sources of stimulation and are therefore able to self-soothe through interacting with their own, perfectly contingent reflection. In the face of loss of social contingency and control of the social world, the disorganized infant uses perfectly contingent bodily-oriented self-stimulation as a self-regulatory mechanism (Koos & Gergely, 2001).

The infant's alternating experiences of contingent control, as a result of the caregiver's frequently fluctuating states of withdrawn/intrusive and emotionally present/absent behavior, have been hypothesized as the early roots of a developing insecure attachment climate (Koos & Gergely, 2001). This compromised early attachment environment, or "deviant contingency environment" results in an undermining

of the infant's "innate contingency detection module," (Bahrick & Watson, 1985; Koos & Gergely, 2001; Watson, 1994). A potential developmental consequence of the inherent sense of lack of social control implied by disorganized attachment is the sense that interpersonal interactions may result in a terrifying loss of social contingency, which then triggers a helpless/anxious reaction (Koos & Gergely, 2001).

Another model, that of Jaffe, Beebe, Feldstein and colleagues, is the optimum midrange model of vocal rhythm coordination (Jaffe et al., 2001). This model builds on the infant's early ability to perceive temporal information and contiguity, and argues that the early temporal, rhythmic focus of relatedness shapes the infant's experience of early, preverbal interactions, and specifically attachment relationships. According to this model, hypo- or hyper-contingent bidirectional adult-infant interactions indicate dysregulation. This dysregulation may disturb the infant's ability to regulate self-states and to anticipate the social role of the other, therefore compromising developing secure early attachment (Jaffe et al., 2001).

According to this theory, hyper-contingent "vigilant" interaction with attachment figures may dysregulate the infant's ability to manage self states, and be experienced by the infant as intrusive and overwhelming (Jaffe et al., 2001). Alternatively, early experiences with hypo-contingent, unpredictable, emotionally mis-attuned "withdrawn" attachment figures may be experienced as associated with a loss of social- and self-agency and with painful negative, traumatic affects associated with states of "separateness" from the interacting partner.

Another model by which to consider the relationship between the infant's ability to perceive temporal contiguity and developing attachment is from the perspective of maternal violation of interpersonal expectancies, and their consequences for the infant's developing sense of self and other (Lyons-Ruth, Bronfman & Parsons, 1999; Main & Hesse, 1990). A distressed caregiver's unpredictable response to the infant violates social expectancies and therefore makes the integration of disparate affective states, inference of knowable, non-threatening mind states, and attribution of rational intention impossible (Fonagy, Gergely, Jurist & Target, 2002; Gergely, Nadasdy, Csibra & Biro, 1995). Infants who are subjected to these interpersonal violations are then consistently unable to apply the principle of "mental coherence" in order to develop an integrated explanation of another's mental states and intentions (Dennett, 1987; Fonagy et al., 2002; Gergely, 2000).

The subsequently impaired capacity to engage in truly mentalized, intersubjective experiences leaves the infant vulnerable to experiencing affect in the other and in the self that cannot be represented and therefore regulated (Fonagy et al., 2002). This relational dilemma not only compromises the infant's developmental ability to represent the other's mind, but also the ability to represent the infant's own mind (Fonagy et al., 2002). As a result of the caregiver's inability to consistently and empathically represent the child as an intentional being and to accurately and reliably affectively "mark" the infant's arousal states, the child cannot "find himself in the other," and therefore cannot internalize a stable representation of the self as feeling, thinking, and believing in emotionally nuanced, richly represented ways (Fonagy et al., 2002; Gergely, 2000).

Nonverbal Communication in Infancy and the Prediction of Relational Outcomes

Nonverbal communication between infants and their caregivers provides a rich window into the developing relationship between mother and infant (Beebe et al., 2003). Already at 4 months, infants who are later found to have insecure attachment relationships with their caregivers are using more "labile" engagement styles, and demonstrating both self- and interactive regulatory disturbances (Field, 1995; Koulomzin, Beebe, Anderson, Jaffe, Feldstein & Crown, 2002). Infants of depressed mothers have been shown to be physiologically over-aroused and preoccupied with self-regulation at the expense of interactive regulation in the first six months of life (Field, 1995; Tronick, 1989; Weinberg & Tronick, 1998). Strikingly, when 6-month-old infants of depressed mothers interact with novel partners, they continue to generalize a negative style of interaction (Field, Healy, Goldstein, Perry et al., 1988).

One line of thinking that has developed out of the optimum midrange model of vocal rhythm coordination has speculated that nonverbal communication systems that are either skewed toward self-regulation (hypo-contingent avoidance) sacrificing interpersonal coordination, or those that are too dependent on interactive regulation (hyper-contingent vigilance) potentially sacrificing self-regulation, can be detrimental to the infant's ability to form a secure attachment to caregivers (Beebe, Jaffe, Cohen, Chen & Buck, 2000; Beebe & McCrorie, 1997; 1999).

Vocal Rhythm Coordination and Developmental Outcomes

The pioneering Jaffe et al. (2001) study, "Rhythms of Dialogue in Infancy," applies the Jaffe-Feldstein (1970) model of adult-adult vocal rhythm communication to the examination of 4-month vocal rhythm coordination between infants and mothers (and infants and strangers) in relation to the prediction of 12-month attachment and cognition. Findings supported the hypothesis that early vocal rhythm exchanges play a fundamental role in the infant's developing social, emotional, and cognitive development. Both mother-infant and stranger-infant 4-month vocal rhythm coordination patterns, particularly of pause and switching pause (home and lab) predicted 12-month attachment outcomes (Ainsworth SSP). Midrange degrees of mother-infant and stranger-infant coordination were optimal for attachment. In contrast, high degrees of stranger-infant coordination in the lab were optimal for cognition (Bayley Developmental Index; Bayley, 1969).

The Jaffe et al. (2001) study concluded that 4-month vocal timing measures were effective in predicting 12-month outcomes because the dialogue model measures the infant's early regulation of the pragmatics of "proto-conversation." The 4-month timing patterns were seen as "procedural" or "performance" knowledge, and as precursors of various developing kinesic patterns, particularly the turn exchange, in the 12-month outcomes. Additionally, researchers hypothesized that the open, flexible system indexed by midrange degrees of coordination allowed the optimum balance of self- and interactive regulation (Beebe & McCrorie, 1997; 1999). Thus, this study pointed to the

early roots of the infant's developing regulation of interactive states, shaping preverbal relational representations and guiding the trajectory of relational development.

The Beebe et al. (2007) study extended the work of Jaffe et al. (2001) by investigating whether the form and function of 12-month vocal rhythms, recorded with the same infants in the same contexts, were similar to those at four months. This study assessed both homotypic (same form/function) and heterotypic (different form/same function) continuity. Overall, 12-month vocal rhythm durations and contingency were not correlated with 4-month counterparts, suggesting that transformation of form was more prevalent in the data than continuity of form. This finding is consistent with theories of the transformational nature of development (Sameroff, 1983). Change in the form of vocal rhythm patterns between the two age points is also consistent with findings that the organization of vocal rhythm changes from the infant-adult model, to one which more closely approximates that of an adult model as language enters the exchange (Beebe et al., 1985).

Regarding the function of vocal rhythm coordination, the study demonstrated that the coordination of vocal rhythms at both 4 and 12 months was significantly related to 12-month attachment. Strikingly, these coefficients of vocal rhythm coordination at 4 and 12 months displayed similar functions with regard to attachment. At 4 months, midrange coordination in the mother-infant and stranger infant exchange was optimal for attachment security (Jaffe et al., 2001), and the same was true of 12-month mother-infant vocal rhythm coordination (Beebe et al., 2007). This study thus demonstrated that vocal rhythm coordination at 4 and 12 months had similar functions in relation to 12-month

attachment, in that midrange degrees of coordination were optimal at both time points. The important finding that 12-month vocal rhythm is equally important in predicting attachment representations at 12 months serves as the foundation for the present study's attempt to link 4-year attachment representations to preverbal 4- and 12-month vocal rhythm coordination, clearly a powerful early indicator of the relational climate in the first year of life.

Facial - Visual Communication and Developmental Outcomes

Research examining facial, visual and postural communication between mothers and infants has also contributed to the understanding of early relational development. Research in this area has demonstrated that early dyadic patterns of facial and visual interaction at 4 months, like those of vocal rhythm, can be considered as later predictors of infant attachment at 1 year (Beebe et al., 2003, 2007; Koulomzin et al., 2002; Sarro, Goldstein, Zicht et al., 1993; Weinberg & Tronick, 1998).

Research by Beebe et al. (2007) includes a series of studies that focus on such diverse measures of infant-adult relational behavior as facial affect, visual attention, vocal affect, and spatial orientation in relation to a partner. This research has explored relations between: 1) 6-week maternal depression and insecure attachment at 1 year, 2) 6-week maternal depression and 4-month mother-infant facial-vocal affect communication, 3) 4-month mother-infant facial-vocal affect coordination and security of attachment at 1 year, and 4) the impact of maternal depression at 6 weeks and infant insecure attachment at 12 months on 4-month interactions (versus maternal depression and secure infant attachment).

From this research, many interesting findings have been demonstrated. Of note, the presence of maternal depression, at infant ages 6 weeks and 4 months, did not directly predict infant insecure attachment outcomes at 1 year. However, the presence of early maternal depression did predict the degree of coordination in the mother-infant facial-vocal affect interaction at 4 months. Mothers who were depressed at infant age 6-weeks and 4 months (and their infants) demonstrated coordination of facial and vocal affect outside of the midrange, in both the low and high range of coordination depending on facial-vocal modality (gaze, face, vocal affect, spatial orientation). The quality of the face-to-face interaction, assessed by degrees of coordination (low, midrange, high) of mother-infant facial and spatial behaviors, predicted infant attachment at 1 year. In this way, the preverbal 4 month dyadic interaction was interpreted as a measure of the quality of early mother-infant relatedness (Beebe et al., 2002). In examining the interaction effects of early maternal depression and attachment status at 1 year, this study found that maternal depression impacted infants later found to be “insecure” differently in the organization of coordination of facial-vocal affect in the 4 month interaction than those who were later found to have a “secure” attachment status (Beebe, 2007, manuscript in press).

In the 4-month interaction, depressed mothers were found to be more coordinated facially with their infants, and less coordinated in gaze with their infants than the controls (Beebe et al., 2007). This is interpreted as an occurrence of "intermodal discordance," in which coordination is too high in one modality, and too low in another. This study brings to light the complexity of early non-verbal communications, and the impact of these early dyadic interactions on developing attachment representations in the infant.

These findings, emphasizing the importance of early face-to-face interactions and the process of reciprocal regulation between parents and infants as the “common final pathway” (Weinberg & Tronick, 1998), provide a further critical rationale for supporting the quality of the mother-infant face-to-face interaction in depressed mothers and infants in order to ensure optimal infant social and cognitive development, and attachment representations.

Parallel to vocal rhythm, a study by Koulomzin et al. (2002), using the Jaffe et al. (2001) sample, demonstrated the link between infant behavior and later attachment classification, showing that without considering the mother’s interaction patterns, infants later classified as demonstrating “avoidant” (A) attachment at 12 months already showed significantly different interaction patterns at 4 months when compared to “secure” infants.

At 4 months, infants later classified as “avoidant” showed more self-touch and the necessity to self-touch in order to look at mother for durations comparable to those of secure infants. These infants displayed a decreased range of positive/negative face, constricting towards a predominance of “neutral,” a dampening of facial affect. Additionally, these avoidant infants showed a disruption of the capacity to coordinate gaze and head orientation into a stable posture while demonstrating positive affect, so that infant gaze at mother with positive facial affect occurred while head was "cocked for escape" (Koulomzin et al., 2002). These avoidant infants also showed difficulty in affect regulation, showing more "labile" use of engagement states (lasting 1 sec), as compared to more "stable" use (lasting 2 secs or more) by secure infants.

These same infants were videotaped in a face-to-face play situation with their mothers at 2 years (Sarro et al., 1993). Toddlers at 2 years, who had been classified secure versus avoidant at 1 year, and their mothers showed similar patterns of mutual responsivity to gaze. Differences emerged in toddler responsivity to mother's vocalizations. Whereas secure toddlers were responsive to mother's vocalization in all modalities (gaze, orientation, self-touch, and facial expression), "avoidant" toddlers showed no responsivity in any modality to their mother's vocal behavior. The self-regulatory disturbance in "avoidant" infants at 4 months, evidenced in the need for increased self-touch in order to sustain gaze, predicts insecure/avoidant attachment at 1 year, and was then followed by a disturbance in the toddlers responsivity to the mother's language at 2 years (Sarro et al., 1993). In this way, early disturbances in self-regulation can be seen as one aspect of a maladaptive developmental trajectory that may lead to insecure attachment outcomes, and later difficulties in interactive regulation.

Early Mother- Infant Interactions and Neurobiological Development

Another area of developmental research that contributes significantly to an understanding of the infant's processing and encoding of relational information is that which describes the neurobiology of preverbal affective processing and cerebral activation patterns. In a manner similar to adults, infants as young as 10 months have been shown to process positive and negative affective stimuli in different frontal lobes. While watching a video of a laughing woman, infants showed a pattern of activation in the left frontal lobe, but while watching a crying woman, the right frontal lobe was activated (Davidson & Fox, 1982).

Building on this research, other studies have shown that infants of depressed and non-depressed mothers begin to demonstrate different cerebral activation patterns in response to affect as early as 10 months of age. Compelling research by Dawson (1992) has demonstrated that the responsivity of infants of depressed mothers is already organized differently from that of infants with non-depressed parents, implying that these infants have already begun to perceive and react to emotional stimuli differently than controls (Beebe, Jaffe, Chen et al., 2003). In this study, the same positive event (mother playing peek-a-boo, or returning following separation) that resulted in a positive affective behavior and EEG in infants of non-depressed parents, resulted in negative behavior and a negative pattern of EEG activation in infants of depressed parents.

Neurobiologists have conceptualized the internalization of early relationships in terms of neuronal activation of developing brain structures central to affect regulation in early infant development (Perry, 1996; Schore, 1994; 2002). As the infant's extremely well-developed ability to process and respond to rhythms has been demonstrated (Lewkowicz, 2000), preverbal vocal rhythm coordination describes one of many pathways of mother-infant co-regulation, and is therefore, according to these neurobiological models, likely a modality which contributes significantly to preverbal brain development.

Schore's (2002) model of brain development and early attachment relationships advances the idea that the developing relationship between an infant and primary caretaker mediates the infant's early ability to regulate emotion, and thus, the mother is instrumental in co-regulating the infant's developing autonomic nervous system (Schore,

2002). The infant's brain encodes this dyadic relationship neuronally as an "internal working model" of relatedness. Thus, this working model of the early dyadic relationship is represented in the infant's implicit, unconscious memory (Schore, 1994; Siegel, 1999; Valent, 1998).

As this early attachment relationship sets the course for neurological development, dyadic co-regulation in the infant's first year of life, experienced through nonverbal facial, gestural, sensory and vocal exchanges, plays an essential role in determining the infant's later ability to regulate internal physiological states, to experience and express emotion, and to navigate relationships (Schore, 2002). Additionally, other neuronal systems, such as the autonomic, limbic, and arousal systems, are essential in the development of the infant's ability to process social, emotional, and physiological information (Schore, 1994; Schore, 2002).

In these ways, early nonverbal forms of relatedness impact directly on the infant's developing capacity to process, interpret, and regulate his emotions. In the second year, with the advent of symbolic capacities, these processes will accrue to the toddler's sense of self. Thus, the quality of early relatedness, represented by the infant as rhythmic facial, gestural, vocal interactions, set in motion developmental trajectories that guide the infant's ability to self-regulate affect, to process social and emotional information, and to develop a secure or insecure attachment. Importantly, these neuronally encoded representations of relatedness will also contribute to the developing child's capacity to respond to later interpersonal and environmental stressors as development proceeds, either contributing to increased resilience or a predisposition to pathological outcomes.

Longitudinal Studies of Attachment Stability

The majority of longitudinal attachment studies begin with 1-year attachment classification as the earliest direct assessment of the mother-infant relationship. A few studies utilize other earlier measures, such as global measures of infant behavior and maternal responsivity (Grossman, Grossman & Waters, 2005). When these earlier measures are included, the bulk of contemporary attachment research focuses on the impact of maternal states of mind and affective attunement on 12- and 18-month infant attachment, which is then linked to social and cognitive outcomes in the preschool years. This body of literature demonstrates the current empirical emphasis on assessing insecure attachment status at one year as the primary way of understanding and predicting later psychopathology (Carlson, 1998; Grossman, Grossman, Winter & Zimmerman, 2001; Lewis, Feiring & Rosenthal, 2000; Waters, Merrick, Treboux, Crowell & Albershein, 2000).

Recently, longitudinal studies of infant attachment have begun to show the stability of both insecure and secure attachment patterns from one year through young adulthood at 21 years of age (see Grossman, Grossman & Waters, 2005; Carlson, 1998; Grossman, Grossman, Winter & Zimmerman, 2002; Waters et al., 2000). In a longitudinal study, Waters et al. (2000) assessed 50 infants for attachment security at one year in the Ainsworth SSP, and followed-up this early assessment with an evaluation of attachment security at age 21 using the AAI (Main & Goldwyn, 1988). Seventy-eight percent of these young adults retained their secure or insecure status (72% using 3 groups: secure, insecure-avoidant, and insecure-resistant).

Securely attached infants whose mothers reported one or more traumatic event, (loss of a parent, parental divorce, life-threatening illness of child or parent, parental psychiatric disorder) were 4 times more likely to change to an insecure attachment classification than secure infants whose mothers reported no traumatic life events (Waters et al., 2000). Several other studies demonstrate both the stability of attachment classification under relatively optimal developmental circumstances, and the transformational nature of attachment formation under the stress of traumatic events throughout the course of development (Howard, 2000; Tremblay & Israel, 1998; Vondra, Shaw, Swearingden et al., 2001; Waters et al., 2000; Worden & Silverman, 1996).

Additional empirical support for the stability of "internal working models of attachment" relationships from infancy to young adulthood comes from a longitudinal study conducted by Grossman et al. (2001). This study followed 49 families, including both mothers and fathers with their infants, and included many measures of parental states of mind and sensitivity, the examination of dyadic interaction patterns and parent-child play, child and mother attachment, and child discourse quality in relation to primary attachment relationships, across infancy (12 and 18 months), and ages 2, 3, 6, and 10 years. Additionally, at age 16, adolescents were assessed for flexibility of response to social rejection by a "romantic" partner, by projective stories. At age 22, the young adults were assessed with the Owens, Crowell, Pan et al. (1995) measure of security of current romantic model.

One of the two strongest predictors of adult attachment at age 22 in the Grossman et al. (2001) study was a composite measure of maternal sensitivity from infancy to 16

years. This measure defined maternal sensitivity as attentiveness to her child's communications, "correct" interpretation of her infant/child's cues, "appropriate" response, acknowledgement of her child's feelings, the ability to help her child know his/her own motives and put them into words, and the ability to explain her own motives. In addition, infant attachment status at 12 and 18 months predicted 6 year-old attachment status, and child attachment status at age 6 predicted 22 year-old attachment representations, both in relation to caretaker and romantic partner. This latter finding suggests that infant attachment affects the capacity to form adult romantic attachment representations in a transformational way, via its link to 6-year-old attachment (see Beebe & McCrorie, 1997, 1999).

The Story Stem Measures of Attachment Representations in Childhood

The story stem technique offers information about the nature of young children's attachment representations and the way in which these representations are expressed. Many studies in this literature have taken an exploratory approach to the assessment of preschool attachment representations, and thus have generated many coding themes which are varied and at times unique to the population being studied, such as child maltreatment (Buchsbaum, Toth, Clyman, Cicchetti & Emde, 1992; Rogosch, Cicchetti, Shields & Toth, 1995; Steele, Steele, Croft & Fonagy, 1999; Toth, Cicchetti, MacFie & Emde, 1997), or children of divorced parents (Page & Bretherton, 2001).

In the last two decades, researchers have focused on assessing preschool children's attachment representations and internal working models of important relationships through measures that incorporate both play and "story telling." The

narrative story stem techniques have offered researchers and clinicians tools to better understand the child's representations of self and other, by utilizing projective stories that generate verbally and symbolically enacted representations of attachment in the preschool years.

There are two primary story stem assessment batteries used by attachment researchers: the Attachment Story Completion Task (ASCT; Bretherton, Prentiss & Ridgeway, 1990; Bretherton, Ridgeway & Cassidy, 1990) and the MacArthur Story Stem Battery (Bretherton, Oppenheim, Buchsbaum & Emde, 1990). There are no differences in the method of administration of the two protocols. Differences are solely in the specific story stems provided, with each focusing on the assessment of different aspects of children's attachment representations and socioemotional functioning. The ASCT, which is used in the present study, was designed specifically to address attachment related issues, including safety, nurturance, separation and reunion, whereas the MacArthur Story Stem Battery addresses more diverse themes, including injury, rejection and neglect (Page, 2001).

The narrative story stem technique is designed to capture 3-6-year-olds representations of self and other by presenting children with the beginnings of stories intended to activate the attachment system. The stories cover a range of themes including parental disciplinary measures and punishment, child injury and parent's caregiving capacity, child's fear and sense of safety, and separation and reunion expectations.

The theory behind the story stem technique is summarized as follows (Toth et al., 2000):

> The utilization of narrative and story-telling tasks provides a vehicle for accessing the representational world of young children which draws upon theoretical conceptualizations that maintain that internal representational models arise from experiences with caregivers…These representational structures are viewed as reflecting an integration of past and current caregiving experiences and, as such, internal working models are conceptualized as capable of being retrieved…Thus, the representations contained in children's story-telling narratives can be best conceptualized as reflecting an integration of past and current caregiving experiences and as consequently affecting how children approach and respond to new relationship partners." (p. 273-274).

In this way, the assessment of childhood attachment representations has a more abstract, social focus, in contrast to the more partner-specific, behavioral assessment of the Ainsworth SSP. The narrative story stem technique offers a broadened conceptualization of "attachment" as a means of understanding the child's social and relational development, both with primary attachment figures and in the larger social world. As children in the preschool years have the ability to utilize language, yet may or may not be fully competent in its usage, the story stem technique incorporates object manipulation as a part of the child's "story."

As Page (2001) describes in a review of studies using the narrative story stem technique to assess preschool attachment, "Measurements with projective qualities, in particular those that use tangible props and play scenarios, are useful in understanding

children's perceptions of social relationships because they provide a compensating medium for limitations in children's verbal abilities," (p. 273; see also Oppenheim & Waters, 1995).

Additionally, as Toth et al. (2001) point out, this childhood assessment measure "invites children to express themselves…without (directly) arousing anxiety" (p.273). In this way, children are asked to tell a story about the caregiving environment that they expect to find as they begin to individuate and form attachments to others outside of the family. The story stem technique assesses attachment by bringing to light the child's representations of both attachment relationships with primary caregivers, and developing relationships outside of this primary relationship.

Narrative story stem techniques have demonstrated test-retest reliability (Cassidy, 1998; Salatas Waters, Rodrigues & Ridgeway, 1998). In the Cassidy (1988) study, one of the stories from the study protocol was re-administered to children one month after the original administration. Ratings from time 1 and time 2 were correlated and identical attachment classifications were assigned in 73% of the children who participated. In another study by Oppenheim, Emde and Warren (1997) the entire narrative protocol was administered one year after the initial administration; narrative variables were significantly correlated across the time points. Correlation of these relational variables across the one-year time span indicated stability of children's perceptions of important relationships over time. Finally, Salatas Waters, Rodrigues and Ridgeway (1998) looked at the original Bretherton, Prentiss and Ridgeway data (1992), in which story stem protocols were administered to children at age 37 months and at age 54 months. These

researchers also found correlation of narrative process variables, “scriptedness” and “elaboration” over a one-year period.

The story stem measure has shown validity with infant attachment assessed by the Ainsworth SSP. Importantly, Bretherton, Prentiss and Ridgeway (1990), and Bretherton, Ridgeway and Cassidy (1990) validated the ASCT and the MacArthur Story Stem Battery with attachment at age 18 months assessed by the Ainsworth SSP in a normal sample.

Methodological Considerations of the ASCT

The ASCT typically involves two levels of scoring in order to arrive at the child’s overall attachment classification: 1) Level of story, 2) Overall attachment classification. At the level of the individual story, scores are determined according to rules that emphasize a) the child’s ability to address the attachment-related theme in the content of the story, b) the child’s ability to produce a comprehensive, well-organized narrative, and c) to relay it openly and coherently to a novel partner. These three areas, which will be discussed further in the following section, are essential in determining the child’s Individual Story Score on each of the four ASCT story stems.

In both the scoring systems of Bretherton and the Continuous Attachment Scale (CAS) system used in this study, children’s individual story endings are coded “very secure,” “secure,” “insecure,” or “disorganized,” based on a thorough content analysis, and on the child’s ability to respond to the material presented with minimal prompts from the examiner (see Method).

At the second level, an overall attachment classification is determined based on the four Individual Story Scores. At this point, the Bretherton system and CAS system differ.

The Bretherton system operates by a set of classification rules and guidelines. For instance, a child who receives a "disorganized" score on any one of the four individual stories will also receive an overall classification of disorganized attachment. Similarly, Children with any "insecure" stories are classified as "insecure." Children with three "very secure" stories, with separation-reunion story 4 coded "very secure" are classified as "very secure," while children with three "very secure" stories, with the separation-reunion story 4 coded "secure" were classified as "secure," and so forth.

The CAS system bypasses the Bretherton weighting system used to derive Overall Attachment Classification, and instead utilizes a simple sum of all of the four Individual Story Scores. In this way, a child who tells an insecure (= 2 points) Story 1, a secure (= 3 points) Story 2, a very secure (= 4 points) Story 3, and a very secure (= 4 points) Story 4 would receive an Overall CAS Attachment Score of "13", which corresponds to an overall secure attachment classification (This same child would receive an overall insecure attachment according to the Bretherton system due to an insecure score on the first story; see Method).

The CAS system represents the child's overall narrative ability, over the course of a thirty-minute interaction with a novel partner. The child's production of narrative content, the narrative process and the relational capacity are assessed within each individual story score. Additionally, the child's ability to convey the nature of his/her

attachment representations is assessed across the total battery, in which some children are slow to warm up and learn the task demands, and others demonstrate declining responses as they are overwhelmed over time by these demands.

Interpretation of the ASCT Measure of Attachment Narratives

The Bretherton and the CAS systems incorporate an assessment of narrative content, process and relational capacity in the scoring of each individual attachment story stem. In addition to the use of these three concepts, in the global coding of the ASCT attachment narratives, diverse research approaches have utilized the narrative story stem technique to focus more specifically on different aspects of children's representations of attachment relationships and relational strategies.

Page (2001) offers a comprehensive summary of diverse methods of interpretation of the narrative content, narrative process and interactive themes contained in the story stem technique that have been used by attachment researchers to a) link the attachment narratives in childhood to infant Ainsworth SSP attachment at 12 months, b) link attachment representation in the preschool years to simultaneous measures of attachment and social development, and c) link preschool attachment representations to future assessments of behavior and socio-emotional functioning as the child develops.

Interpretation of the Narrative Content

Researchers have focused specifically on the interpretation of attachment related content from children's story stem narratives in numerous studies, in order to assess the child's specific, detailed accounts of interactions between family characters.

Additionally, measurement of narrative content gets at specific narrative themes around attachment related issues such as nurturance, discipline, communication, safety and competence, elicited by the ASCT (Page, 2001).

Some studies that focus on narrative content as a means of assessing preschool attachment include the child's description of empathic parental behavior (Bretherton, et al., 1990), maternal warmth (Cassidy, 1988), separation anxiety (Hubbs-Tait, Hughes, Culp et al., 1996; Page & Bretherton, 2001; Solomon, George & DeJong, 1995), and representations of the parent as frightened or helpless (Page & Bretherton, 2001; Solomon, et al., 1995; Toth, Cicchetti, MacFie & Emde, 1997).

Interpretation of the Narrative Process

Focus on the child's narrative process assesses the quality of the child's story, looking at overall story structure, character interactions and conflict resolution. In this way, this approach is more parallel to the coding and interpretation of the Adult Attachment Inventory (Main & Goldwyn, 1988), using the concepts of coherence, elaboration, emotional openness and narrative structure as indicative of secure attachment in the child.

Various themes have been explored by attachment researchers, including: integration and completeness of the story resolution (Solomon, George & DeJong, 1995), prosocial, reparative resolutions of problems (Bretherton et al., 1990; Buchsbaum et al., 1992; Cassidy, 1988; Hubbs-Tait et al., 1996), and effective management of conflict (Cassidy, 1988). Additional narrative processes explored include: emotional openness

(Oppenheim, 1997), acknowledgment of fear (Cassidy, 1988), the child's expression of distress in telling the narrative (Warren, Oppenheim & Emde, 1996), and overall absence of response to the story stem, (Bretherton et al., 1990; Buchsbaum et al., 1992; Cassidy, 1988; Waters et al., 1998).

Interpretation of the Interaction between Child and Examiner

Another way of exploring the relational information offered by the story stem technique is through the child's actual interaction with the examiner, which is assumed to be indicative of both social competence and emotional openness (Page, 2001). Themes that have been used to assess the child's engagement style with the examiner include directness and openness of response (Bretherton, Ridgeway & Cassidy, 1990), engagement with the examiner in the narrative activity (Greenberg, DeKlyen, Speltz & Endriga, 1997; Toth, et al., 1997), avoidance or extreme reluctance to engage in the story protocol (Buchsbaum et al, 1992; Solomon, George & DeJong, 1995), and controlling behavior in interaction with the examiner (Toth et al., 1997).

In the current study, the ASCT is used to assess global attachment representations and strategies in childhood. Thus, story stems are coded for overall narrative content, themes of attachment related behaviors, and "secure" resolution of "separation," "caretaking" and "parent-child conflict" problem paradigms. The process of narration is incorporated in the assessment of attachment representations in order to reflect the child's level of flexibility and thoughtfulness in engaging emotionally activating attachment themes. Additionally, the child's ability to relate openly and to share their ideas with a novel partner is important to the scoring.

Longitudinal Studies relating Attachment assessed by the Story Stem Task to Infancy:

Pioneering studies of the narrative story stem technique conducted by Bretherton, Ridgeway and Cassidy (1990) have utilized the ASCT to relate attachment at age 18 months with attachment classification in the preschool years. In the original Bretherton et al. (1990) study, attachment classifications as assessed by the Ainsworth SSP at 18 months and the ASCT at 37 months were correlated.

Not surprisingly, the Bretherton et al (1990) study found that security scores obtained by the ASCT at age 3 years were more strongly correlated with the concurrent separation-reunion security scores assessed by the Cassidy-Marvin system than with 18-month attachment assessments (Bretherton et al., 1990). Researchers hypothesized that although the relationship between mother and child may shift as a result of changing developmental needs, both of these attachment measures elicit the child's internal working models of attachment, and in this way, the Ainsworth SSP at 1 year and the ASCT at 3 years do indeed share demonstrated commonalities (Bretherton et al., 1990).

A longitudinal study by Altman, Marcus, Monk, Abrams and Ward (1991) assessed attachment in infancy and attachment in 3 ½ year olds with the ASCT. Although this study did not find a significant correlation between the two measures, findings demonstrated that 60 percent of the children maintained the same attachment classification over time, while 40 percent changed classifications. Because diverse, exploratory methods have been employed by attachment researchers focusing on the preschool years, more studies are needed to establish the reliability and validity of the story stem techniques longitudinally.

Summary

Longitudinal studies have increasingly begun to demonstrate the stability of attachment from infancy through adulthood, (Grossman, Grossman, Winter & Zimmerman, 2002; Sroufe, Egeland, Carlson & Collins, 2005; Steele & Steele, 2005; Waters et al., 2000). Interpretation of both the content and process of children's attachment narratives allows for longitudinal studies to assess childhood attachment in a manner that incorporates children's attachment representations and the relational strategies employed in interactions with novel partners. To date, little work has been done to relate preverbal vocal rhythm coordination between infants and adult partners, a relational measure distinct from attachment, to attachment representations and relational development beyond infancy and into early childhood. This study seeks to uncover a relationship between the two.

Infant attachment research has largely focused on exploring the link between preverbal relational development and the behavioral assessment of attachment in the Ainsworth SSP at 12 months. The present study explores the link between another relevant measure of the early quality of both the primary attachment relationship, and the infant's relational development through preverbal interaction with a novel partner. By assessing 4- and 12-month preverbal vocal rhythm coordination of infants with mothers, and infants with novel social partners, this study seeks to demonstrate another potentially clinically and empirically rich method of studying relational development over the course of the child's first four years.

Early vocal rhythm coordination appears to be quite effective in capturing the quality of preverbal relationships, as well as in predicting later relational and cognitive development (Beebe et al., 2000; Jaffe et al., 2001; Beebe et al., 2007). Vocal rhythm coordination in infancy may provide a powerful preverbal model of attachment relationships and relational strategies that continues to guide and inform the child's social-emotional development.

III. Method

Setting:

The present study includes 41 of the 82 mother-infant dyads recruited from Columbia Presbyterian Hospital by Drs. Jaffe and Beebe for the NIMH funded Normal Development Project (1990-1991). All data was collected in subjects' homes and in the Communication Sciences laboratory at the New York State Psychiatric Institute.

In the Jaffe et al. study, all dyads were audio-taped in the home context. Dyads were randomly assigned to either the home context only, or to both the home and lab contexts for audiotaping of face-to-face interactions between mother and infant, and stranger and infant. Approximately half of the original 82 dyads were invited for a lab audio-taping in addition to the home audio-taping at 4 months. Forty-one of the original dyads were assessed at 4 years.

In the current sample, 29 of the 41 dyads participated in both the home and lab audio-tapings at 4 and 12 months, the remaining dyads had only the home context. Of these 29, 27 mother-infant and 23 stranger-infant dyads were successfully audiotaped in the face-to-face lab interaction at 4 months. All 29 mother-infant and stranger-infant dyads were successfully audiotaped in the lab at 12 months. As for the home condition, in the current sample, 40 mother-infant and stranger-infant dyads were successfully audiotaped at 4 months, whereas 35 mother-infant and 36 stranger-infant dyads were successfully recorded at 12 months.

Sample:

This study is focused on 41 mother-infant dyads who participated in a 4-year follow-up visit in which the child's attachment representations were assessed through administration of the ASCT. These 41 dyads were previously seen at 4 and 12 months for an audiotaped "face-to-face" play session with mother and stranger.

Inclusion Criteria

Within 24 hours of delivering a healthy first-born infant, mothers were recruited from Columbia Presbyterian Hospital, a large urban university hospital, for a study of infant social development involving a home visit and a randomly assigned laboratory visit. The sample included primiparous English-speaking (as first language) women delivering full-term, healthy, singleton infants without major complications. Mothers were at least 18 years old and married or living with a partner (see Jaffe et al., 2001).

Description of the Sample: *Mothers*

Of the 41 mothers included in the sample at the 4-year follow-up point, the average age was 37 (33 at child's birth). The majority of the mothers were Caucasian, with 2 African American mothers, and 1 Asian American mother included. Forty-four percent of the mothers had pursued a graduate level education, 43% had pursued college education and 2% had not continued their education past high school. In the 4-year sample, 25% of mothers worked full-time, 57% worked part-time, and 17% were not employed. In terms of childcare, 83% of mothers who worked used the services of a babysitter (or family member) to care for their child, while 3% used day care services.

In terms of family structure at follow-up, all but one of the mothers continued to be married, while one was divorced at child age three. Of the families, 58% included a younger sibling in addition to the first-born child participating in the study, 8 % included 2 younger siblings, and 34% continued to include parents and the study child alone. Families in the 4-year follow-up were classified socio-economically as middle to upper-middle class.

Description of the Sample: *Children*

Of 41 children included in the study, 21 were female and 20 were male. All were first-born. All but one child lived with parents who were married, 82% of the children had mothers who worked outside of the home, 97% were enrolled in pre-school, while 3% attended day care, and 64% of the children in the study had one to two younger siblings.

Description of the Sample: *Strangers*

The “strangers” were 22 psychology graduate students from New York City universities, selected for a "warm interpersonal style." "Training sessions by a supervising investigator (Beebe) elaborated upon methods of playing with infants face-to-face, and involved observation of a series of criterion interactions between mothers and infants, as well as several practice play sessions with an infant. Strangers were trained to avoid 'chasing' an infant who was looking away, to be very responsive to a distressed infant, and to help such infants self-regulate" (Jaffe et al., 2001, p. 60).

Two of the strangers interacted with 13 and 17 infants, respectively. The other 20 strangers interacted with an average of approximately four infants (between 1 and 9). The contribution of individual "strangers" was controlled for in all analyses.

Procedure:

During the 4 and 12 month visits, each of the 41 infants was audio-taped with their mother and with a trained student in clinical psychology, "stranger," in a 12 minute face-to-face interaction while infants were alert and comfortable. Mothers were instructed to "play with the baby as they would at home." Directional microphones were clipped to the infant and adult's clothing at the collar. Infant play with mother and stranger were counterbalanced.

In the 4-month interaction, the infant was seated in a padded infant seat at eye level with the adult partner. No toys were included. In the 12-month interaction, infants were seated in high chairs across from the adult partner, and a puppet was included to facilitate the face-to-face play. If the infant cried for longer than 30 seconds, the interaction was interrupted and resumed after the infant was calm.

During the 4-year follow-up visit, each of the 41 children were videotaped while completing the four story-stem battery of the Attachment Story Completion Task, administered by a graduate student examiner. Children were seated in a small room at a low table across from the graduate student "examiner." This procedure took from twenty to thirty minutes, with breaks allowed as needed.

Measures:

Vocal Rhythm Behaviors and Coordinated Interpersonal Timing

The present study used measures of coordinated interpersonal vocal rhythm timing (CIT) taken at two different data collection points, 4 and 12 months, to look at 4-year old attachment outcomes assessed through children's narratives.

The primary variables for the analysis of vocal rhythm coordination were durations of "pauses", and "switching pauses." These particular vocal rhythm states were chosen because they have been found to be predictive of attachment at 12 months (see Jaffe et al, 2001; Beebe et al, 2007). Pause and switching pause durations are more flexible and social variables, in contrast to vocal duration which is a more biologically based measure of word (sound) utterances which rides on the respiration rhythm. From the durations of pause and switching pause behavior, coefficients of coordinated interpersonal timing (CIT) were derived by time series analysis.

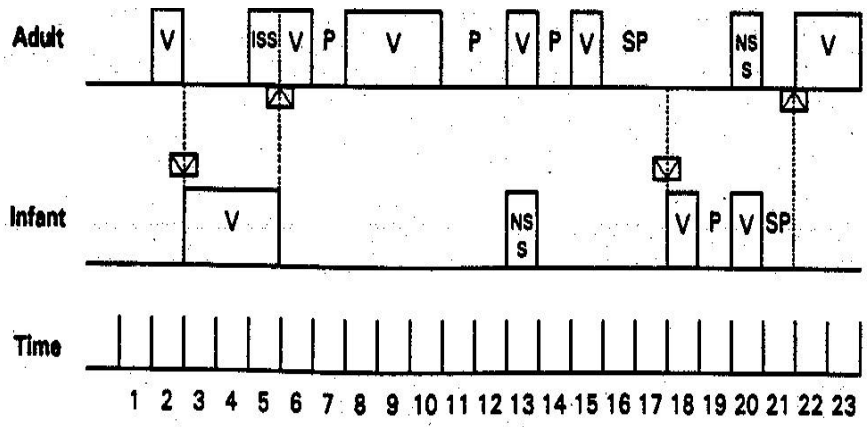
The following details of the method follow the Jaffe et al. (2001) study. Duration of each partner's vocalizations and pauses (which allow for calculation of pause and switching pause duration) were recorded on two separate channels of a stereo audiotape recorder for each interaction. These vocal behavior durations were then entered into a specialized computer system called the Automatic Vocal Transaction Analyzer (AVTA, Jaffe, Feldstein & Cassotta, 1967). Before automated vocal analysis, crying segments were deleted. See Jaffe et al. (2001) for full details of the data preparation procedure for AVTA.

The AVTA system coded the vocal behavior data by sampling both partners' sequences of signals simultaneously (every 250 msec) to determine whether the signal in each partner's channel (infant, mother, stranger) was "on" or "off." The AVTA system did not code frequency or intonational characteristics of the vocal streams. The data was comprised solely of the on-off series of the durations of sounds and silences of interacting partners.

Time series of vocal behavior were then coded as a sequence of four binary numbers: 0, 1, 2, and 3, which represented the four possible dyadic states of the dialogue: 0 = Partners I (Infant) and A (Adult; mother or stranger) were both silent; 1 = I was vocalizing while A remained silent; 2 = A was vocalizing while I remained silent; and 3 = I and A both vocalized simultaneously. In this way, the two-channel time series of the original vocal recording was directly translated into the dyadic code. Thus, the individual dyadic exchanges, and the vocal stream of each individual were preserved.

The AVTA coding classified every possible "event" in the two-person, on-off vocal stream. In this on-off system, joint action or joint silence was assigned according to a "turn rule" that determined which partner a "pause" (or "interruption") belonged to. A "turn" was defined as beginning at the instant that either participant vocalized alone, and held until the other vocalized alone, at which point the turn was exchanged. The turn rule defined the parsing of each vocal state.

Diagram of an interaction between an infant and adult partner



The time axis represents 250 msec units.
"V" stands for vocalization, "P" for pause, "SP" for switching pause, "NSS" for non-interruptive simultaneous speech, and "ISS" for interruptive simultaneous speech.
The arrow that points down marks the end of the adult's turn, and those that point up mark the end of the infant's turn.

Figure 1. Automated Vocal Rhythm Coding , taken from Jaffe et al., 2001.

Defining Vocal Behaviors

This study examined the coordination of both partners for the durations of all silences: (a) “Pauses,” and b) “Switching Pauses.” The dialogic approach of Jaffe and Feldstein (1970) was used to translate the coded vocal stream of the partners’ sounds and silences into “pause” and “switching pause” behaviors. A *pause* was defined as a joint

silence (greater than or equal to 250 msec) that was bounded by the vocalizations of the turn-holder. Thus, a pause was conceptualized as an intrapersonal regulation within the turn of the turn-holder. A *switching pause* was defined as a joint silence (greater than or equal to 250 msec) initiated by the turn-holder, but terminated by a unilateral vocalization of the partner, who then became the turn-holder. A switching pause was conceptualized as interpersonal regulation, or a pause in which the turn was passed to the other partner. The switching pause was assigned to the "speaker" who passed the turn to the partner (see Jaffe et al., 2001 for further details of the definitions).

Deriving Vocal Rhythm CIT Scores

Once vocal behaviors were defined per partner, time series regression analyses were used to evaluate whether the duration of the adult's (mother/stranger) vocal parameters (pause and switching pause) predicted those of the infant, and vice-versa.

Mother (stranger) predicting infant's prior pause and switching pause coordination (and vice versa) were expressed as an R^2, an index of Coordinated Interpersonal Timing (CIT), computed by time series regression analyses of AVTA-coded vocal data. The CIT variable indicated the strength of the correlation between the two partners' behaviors, with each partner's auto-correlation, controlled or covaried out (see Jaffe et al., 2001).

Individual CIT scores were interpreted according to the theory of the normal distribution. This method grouped each partner's vocal rhythm CIT data into a midrange (mean +/- 1SD; 68%), a low range, (< mean – 1SD; 16%), and a high range, (> mean + 1SD; 16%).

Vocal Rhythm Coordination – Clinical Definitions of Patterns

Midrange Vocal Rhythm Coordination:

This pattern is characterized by a "flexible, open" communication style. This indicates that the partner is both an active participant and an active "listener." The partner may engage in a rhythm which includes more pauses to allow the other to join, as well as more bursts of mutual interaction and vocal exchange. This interaction has a playful, spontaneous feeling in which both participants are engaged, as well as given the freedom to stay silent and observe. Moments in which both vocalize are experienced as lively exchanges, rather than as an attempt to systematically dampen the other's distress (withdrawn/inhibited pattern), or moments of mutually escalating over-arousal (vigilant pattern).

Lowered Vocal Rhythm Coordination:

This pattern is characterized by a "withdrawn" or "inhibited" communication style, or a lowered tracking of the partner's communication. This does not mean that partner is more "quiet," visually inattentive, facially blank, or less physically active. Instead, the definition of "withdrawn" vocal rhythm coordination is that the partner's vocalizations and pauses occur on the partner's own program, with little room for the infant to either respond or be responded to. In this way, while the adult partner may appear active and engaged, the infant is not being given a turn.

Heightened Vocal Rhythm Coordination:

This pattern is characterized by a "vigilant" communication style, or a heightened tracking of the partner's communication. Though the term vigilant may imply overt concern or anxiety, this type of communication may take the form of a brisk vocal turn pattern, in which the partner vocalizes immediately after the other. This tends to create an interaction in which the vigilant partner seems to "pounce" on the other's response without allowing room for a "dialogue" to develop.

When an adult evidences heightened coordination, it often takes place as the infant evidences vocal distress, such as a frequent low whimper, and may be identified with discrepant affect on the part of the adult partner during episodes of distress. This brisk exchange, in which the infant's affect is not "matched", may create an over-escalating, mocking exchange from the part of the adult partner.

The ASCT Narrative Story Stem Measure

Four-year laboratory procedures followed the sequence established by Bretherton et al. (1990; see Appendix III). In the beginning of the story stem assessment, the child was seated across a small table from the examiner and "introduced" to the family of doll figurines. If the child was male, two boy doll "children" were used; if female, two girl "children".

The examiner (always female) then followed a script, in which she first suggested that the child and examiner "make up a story together" about the dolls. The procedure began with the aid of a few simple props, to establish the doll family in a warm-up story about a birthday party. As the doll family was moved around a table with a birthday

cake, the examiner stopped the narrative and said to the child, “Tell me what happens next.” The child then finished the story on his/her own.

In each succeeding story (4 total), the same method was used, with the examiner stopping at the end of the scripted story stem (see Appendix III) and encouraging the child to finish the story. Themes of the four stories were: Spilled Juice, Hurt Knee, Monster in the Bedroom, and Departure-Reunion Story.

The interaction was videotaped by two video cameras, one focused on the child, and one focused on the examiner, recording simultaneous, split-screen, upper body views of the examiner and the child, and a full view of the doll family and props.

The examiner was instructed to ask the child once about the specific attachment related theme if it was not spontaneously addressed (“What did they do about the spilled juice?”). Prompting was allowed throughout in order to determine the next action if the child hesitated (“What happened next?”). Clarifications about the play were also permitted when the child’s actions were unclear. For a sample transcript of a full battery for a child from each attachment classification, see Appendix IV.

Coding of Attachment Narratives

The ASCT narrative attachment measure is typically scored categorically at two levels; a) at the level of the Individual Stories, and b) at the level of ***weighted*** Overall Attachment Classification (Bretherton et al., 1990). While weighted categorical scoring of overall child attachment is both useful and valid, continuous scoring was used to derive an Overall Attachment Classification in the present study because it was more

statistically and clinically relevant to the research questions. Continuous Attachment Scale (CAS) scoring will be described and reported from this point on.

Coding at the Level of the Individual Stories

The first 13 children's ASCT batteries were coded by two graduate student observers independently to establish reliability. The Intraclass Correlation for inter-rater agreement was .96 and the Kappa value was .88, indicating strong levels of agreement. The remaining two-thirds of the story stem batteries were divided in half, with each rater coding 14 batteries.

Each of the child's four story endings were coded "very secure (4)," "secure (3)," "insecure (2)," or "disorganized (1)" based on narrative content analysis and the child's ability to respond directly and coherently to the material presented with minimal prompts from the examiner (for coding method, see Bretherton et al., 1990).

Narrative story endings coded "very secure (4)" had resolutions in which the child's needs were met. These contained positive family interactions and caretaking by one or both parent figures, as well as direct resolution of the "problem" presented (i.e. cleaning up the juice and getting the child more, killing the monster in the bedroom, putting a band-aid on the hurt knee, greeting the children upon return from a trip, etc.). Furthermore, these resolutions had to be volunteered by the child in a coherent manner with no more than one direct examiner clarifying question/prompt.

Narrative story endings coded "secure (3)" had resolutions in which the child's needs were met. Just as "very secure" responses, "secure" responses for the stories

contained positive family interactions and caretaking by one or both parent figures. These story resolutions were elicited from the child with two or more clarifying questions/prompts.

Narrative story endings coded “insecure (2)” signified those in which the child ignored or avoided the story content or the examiner’s clarifying questions/prompts (i.e. the juice was left on the floor, the hurt knee never received attention, the family exhibited no positive affect upon reunion, the child said “I don’t know” to repeated prompts).

Narrative story endings coded “disorganized (1)” included any which contained bizarre or unusual content, (i.e. banging the dolls together, overturning the parents’ car, throwing the props onto the floor, responding with incoherent/nonsensical answers, etc.).

Coding at the Level of Overall Attachment: Continuous Attachment Scale (CAS) Scoring

The Bretherton (1990) and CAS systems differ in the treatment of Overall Attachment classification. In the Bretherton system, children are again grouped into four discrete categories; disorganized, insecure, secure, or very secure according to assignment derived from their ***weighted*** Individual Story scores. In the CAS system, the ***total points the child received on all four stories was retained***, regardless of the presence of disorganized or insecure stories, which automatically categorized a child as such according to the Bretherton system.

Additionally, in the CAS system, each story was treated as equally important and indicative of children's Overall Attachment, whereas the Bretherton system privileged the story about family separation and reunion (Story 4). Thus, while both methods utilized

the same scoring and classification of children's four Individual Story narratives, the CAS system represented the children's range of narrative ability and response to all attachment themed stories in the Overall Attachment score.

The Continuous Attachment Scale (CAS) score had a twelve point possible range; from an overall CAS score of "4" (all "disorganized (1)" story responses) to a CAS score of "16" (all "very secure (4)" story responses). Scores were considered as part of a normal distribution of attachment outcomes, in which studies generally report around 60 – 65% of subjects with a "secure" attachment classification.

Based on the Bretherton system, and the sample distribution of attachment outcomes at 4 years, the lowest possible score received in this sample, "10," was considered as representative of a "Disorganized - D" attachment strategy. Scores of "11" and "12" were classified as "Insecure/Anxious - C," while the highest score obtainable, "16," was classified as "Insecure/Avoidant – A". Scores in the midrange of the distribution, "13"– "15" were classified as "Secure - B" (see Appendix III).

Study Hypotheses

Hypothesis I:

Predominately non-linear associations exist between the 4- and 12-month infant-adult coordination of pause and switching pause and childhood attachment narratives. A linear relationship is one in which both variables either increase or decrease in accord with each other; a nonlinear relationship is one in which the ends of the measure are more similar in their relationship to the dependent measure.

Nonlinear relationships were specifically posited because it was hypothesized that midrange values of vocal rhythm coordination in infancy are associated with developing attachment security, whereas values outside of the midrange are associated with developing attachment insecurity.

Hypothesis II:

The ASCT childhood attachment measure has a ***nonlinear*** *relationship with vocal rhythm coordination in infancy. Thus, children with CAS* ***attachment scores at the highest and lowest end of the scale were both hypothesized to share similarly dysregulated communication patterns in infancy, either at the extreme high or low pole of interactive coordination.*** *The clinical rationale for this comes from the fact that extreme scorers, both the lowest, and the highest, demonstrate problematic approaches to dealing with the emotionally arousing content presented in the ASCT attachment themes. The research rationale is that both low and high vocal rhythm coordination scores have predicted insecure attachment in the empirical literature (Jaffe et al., 2001).*

The highest score possible, "16," indicates that on each of the four stories, the child consistently voiced a conflict resolution without prompts or tangents, indicating a pattern that may be similar to that conceptualized in adults as a "denier" of conflict, negative affect and relationship distress. In this way, children who seamlessly verbalize scripted "happy ending" stories may be conceptualized as those with Avoidant (A) attachment strategies in terms of a unwillingness and inability to address difficult feelings brought up by the ASCT stories. It was hypothesized that children who obtained the highest CAS score in the data set (16), with diverse themes ranging from injury, to

protection, to abandonment and reunion, evidence a rigidity of content and process of narration which indicates avoidance of the emotional content of the battery.

At the other end of the spectrum, children who received the lowest ASCT score, "10," by definition showed significant difficulty in coming up with an ending to the story, showed inappropriate emotion in relation to story content, and required continuing prompts and redirections, which were ultimately unhelpful or unsuccessful. This may be thought of as characterizing the problems faced by children with Disorganized (D) attachment strategies. It was hypothesized that children who obtained the lowest CAS score in the data set evidenced an inability to organize the anxiety brought up in connection to attachment-related material, and thus have extreme difficulty organizing their experiences in cognitively and emotionally coherent narratives.

The highest scorers, by definition, demonstrate the most direct and un-elicited telling of narratives, in which a child's needs are neatly and perfectly met. The lowest scores, in contrast, indicate the child's inability to address emotionally evocative relational material, and the profound cognitive and emotional disorganization that result from the suggestion of attachment related themes. Both of these "extreme narrative strategies" suggest the child's un-integrated and/or inflexible representations of attachment and difficulty grappling with difficult attachment-related content.

It was hypothesized that by viewing the CAS as nonlinear, with both low and high scores indexing insecure attachment strategies, and by exploring the relation between childhood attachment and vocal rhythm coordination in infancy, "extreme scores" on the CAS attachment narrative scale would be correlated with similarly "extreme" early

patterns of vocal rhythm coordination for children. Specifically, the lowest, D, and the highest, A, extreme scorers will likely have similar vocal rhythm coordination patterns outside of the midrange in infancy.

Overview of Analytic Strategy

Two sets of analyses were conducted in order to test study hypotheses. Analysis I tested associations of low and high 4- and 12-month vocal rhythm coordination and 4-year attachment narratives (predicting from 4- and 12-month vocal rhythm coordination → 4 year attachment), while Analysis II examined the relation between low and high attachment narrative scores at 4 years and patterns of vocal rhythm coordination at 4 and 12 months (predicting from 4 year attachment → 4- and 12 month vocal rhythm coordination).

Analysis I. *Coordinated Interpersonal Timing (CIT) derived from Vocal Behavior Data in Infancy predicts ASCT Continuous Attachment Scale Score at Child Age 4 Years*

Analysis I tested for ***hypothesized nonlinear associations between vocal rhythm coordination in infancy and childhood attachment, such that coordination outside of the midrange, at the low and/or high poles of interactive coordination, is associated with insecure attachment narratives; midrange vocal rhythm coordination in infancy is associated with optimal, secure attachment narratives at 4 years. While the hypothesized relationship is nonlinear, linear relationships were also tested in order to allow for more direct, alternate associations to emerge.*** Hierarchical multiple regression analyses that included both nonlinear and linear terms evaluated the relations of 4- and

12-month coefficients of vocal rhythm coordination to attachment representation at 4 years (CAS).

In the first step, time-series regression analyses were used to create per dyad estimates of Coordinated Interpersonal Timing (CIT) of the durations of vocal behaviors (Gottman, 1981; Ostrom, 1978; Warner, 1992). Each interaction was viewed as two parallel streams of behavior in time (a bi-variate time series). Utilizing lag correlations (controlled for autocorrelation), the analyses assessed whether each partner's stream of vocal behavior was predictable from that of the other, yielding an assessment of "direction of coordination."

Based on prior findings in the literature, vocal state durations were averaged over five second time units, yielding 144 units across the 12-minute interaction (Feldstein & Welkowitz, 1978; Jaffe & Feldstein, 1970; Jaffe et al., 2001). Infants only vocalize about 10 percent of the time, thus a 5 second unit creates a more stable measure. Given the average vocal state durations of approximately 1 sec found in the vocal rhythm literature, 5-sec units were expected to include at least one and, more often, several occurrences of a particular state.

The degree to which a partner coordinated "current" vocal rhythm behavior with the other's behavior of the previous minute was examined according to prior vocal rhythm research models (Crown, 1991; Jasnow, Crown, Feldstein, Taylor, Beebe & Jaffe, 1988; Jasnow & Feldstein, 1986; Cappella, 1996). A set of 12 successive 5-second "lags" (= 1 min) was used to examine the prediction of each participant's vocal behavior (pause and switching pause) from that of the partner's pair-wise behavior.

The statistic used to index degree of coordinated timing (CIT) was the proportion of the variance (R^2) of one partner's behavior (adult / infant) that accounted for the twelve lags of the other partner's behavior.

Multiple regression analyses were performed in order to predict 4 year continuous attachment scores from 4- and 12-month Coordinated Interpersonal Timing (CIT) of vocal rhythm variables; pause and switching pause. These analyses addressed whether, across the group, the equations using the infant's indices of pause and switching pause [(M) → **I**; (S) → **I**), as well as the equations using the adult's indices [(I) → **M**; (I) → **S**], predicted CAS attachment representations at 4 years.

Eight equations were run, each assessed for bi-directional effects of partner. Four addressed mother-infant coordination, and a parallel set addressed stranger-infant. The variables were treated as fixed effects, and home and laboratory contexts were treated as separate experiments for the statistical analyses.

The same independent variables were used in the same order in all equations. The order of the independent variables follows: a) infant gender (covariate); b) coefficients of switching pauses; c) squared switching-pause coefficient, (to assess quadratic effects); d) coefficients of pauses; e) squared pause coefficient.

For Analyses I, graphs of significant linear and nonlinear relations were interpreted according to the theory of the normal distribution. This method grouped vocal rhythm CIT data into a midrange (mean +/- 1SD; 68%), a low range, (< mean – 1SD; 16%), and a high range, (> mean + 1SD; 16%).

Analysis II. *Extreme Attachment Narrative Strategies at 4 Years are related to Extreme Patterns of Vocal Rhythm Coordination (CIT) outside the Midrange in Infancy*

A nonlinear association between 4-year Continuous Attachment Scale scores at the low and high ends, and vocal rhythm coordination scores at the low and high end in infancy at 4 and 12 months, was evaluated. Analyses assessing the associations between 4-year CAS scores as independent variable and 4- and 12-month vocal rhythm coordination as dependent variable, paralleled Analysis I, described above. The only exception was that only nonlinear associations between the independent measure, the CAS, and the dependent measure, terms of vocal rhythm CIT, were assessed.

For Analyses II, graphs of significant nonlinear relations were interpreted for the patterns of vocal rhythm coordination associated with the lowest attachment score and the highest attachment score in the sample.

IV. Results

Overview of Study Design

The present study examined infant and adult (mother/stranger) coordination of vocal rhythm behavior (pause and switching pause) at 4 and 12 months in relation to 4-year attachment representations (ASCT). The relation between developing internal working models of attachment as indexed by degree of coordination (CIT) of vocal rhythms at 4 and 12 months and later childhood attachment representations at 4 years was explored. The 4-year attachment representations were based on both the content of children's attachment narratives, and the process of the child's narration of attachment related stories with a novel partner.

The descriptive data of mother-infant and stranger-infant vocal rhythm behavior (pause and switching pause) are outlined in the following tables. This study examined the direction of influence of vocal rhythm coordination (infant's behavior is predicted from that of mother/stranger (M/S) →**I**; or vice versa) in relationship to attachment narrative outcomes in childhood.

In Analysis I, a total of 64 tests were performed: two vocal rhythm variables and their quadratic terms (switching pause, switching pause^2, pause and pause^2) in 16 contexts (8 at 4 months, Home and Lab; and 8 at 12 months; Home and Lab) were evaluated in relationship to CAS attachment.

Analysis II consisted of an exploration of attachment narrative outcomes at 4 years, and their nonlinear relationship to early vocal rhythm coordination in infancy. A

total of 32 tests were performed in Analysis II – the nonlinear relationship of CAS attachment to the coordination of two vocal rhythm variables (switching pause and pause) in 16 contexts (8 at 4 months; 8 at 12 months).

Descriptive Statistics of 4- and 12-month Vocal Rhythm CIT

Table 1 presents descriptive data for the vocal rhythm data, organized by vocal rhythm behavior, infant age, partner, direction of effects, and site. There are 8 contexts described in the 4-month data set and 8 in the twelve month data set. The R^2 values are in the same range as the Jaffe et al. (2001) sample of N=82.

Table 1: Descriptive Statistics for Vocal Rhythm Data

4 Months	N	Mean R^2	SD	Low Value	High Value
Switching Pause CIT:					
Mother SP (I - home)	40	.142	.112	.022	.519
Mother SP (I - lab)	27	.103	.975	.022	.319
Infant SP (M - home)	40	.143	.089	.026	.424
Infant SP (M - lab)	27	.140	.101	.033	.438
Stranger SP (I - home)	40	.143	.095	.026	.542
Stranger SP (I - lab)	24	.107	.085	.005	.366
Infant SP (S - home)	40	.141	.115	.033	.527
Infant SP (S - lab)	24	.129	.109	.003	.544
Pause CIT:					
Mother P (I - home)	40	.133	.096	.039	.429
Mother P (I - lab)	26	.121	.086	.020	.445
Infant P (M - home)	40	.118	.057	.032	.348
Infant P (M - lab)	26	.131	.077	.039	.302
Stranger P (I - home)	40	.115	.063	.039	.346
Stranger P (I - lab)	22	.098	.063	.025	.322
Infant P (S - home)	40	.110	.053	.026	.228
Infant P (S - lab)	22	.136	.087	.039	.376

Note. **-**Mother SP (I-Home) indicates Mother's Coordination of Switching Pause with the Infant's Switching Pause (**I→M)** in the home context.

Table 1: Continued

12 Months	N	Mean R^2	SD	Low Value	High Value
Switching Pause CIT:					
Mother SP (I - home)	35	.112	.062	.024	.279
Mother SP (I - lab)	29	.116	.062	.036	.240
Infant SP (M - home)	35	.138	.089	.043	.411
Infant SP (M - lab)	29	.131	.086	.040	.380
Stranger SP (I - home)	37	.109	.060	.005	.275
Stranger SP (I - lab)	29	.111	,066	.038	.324
Infant SP (S - home)	37	.124	.083	.003	.434
Infant SP (S - lab)	29	.153	.099	.040	.376
Pause CIT:					
Mother P (I - home)	35	.119	.081	.041	.434
Mother P (I - lab)	29	.132	.087	.034	.412
Infant P (M - home)	35	.112	.058	.029	.267
Infant P (M - lab)	29	.121	.062	.040	.356
Stranger P (I - home)	36	.112	.079	.017	.402
Stranger P (I - lab)	29	.154	.111	.017	.496
Infant P (S - home)	36	.100	.071	.019	.424
Infant P (S - lab)	29	.125	.072	.032	.305

Descriptive Statistics of 4-Year Attachment Data

In the current sample, N=41, the CAS attachment narrative outcome data covered a range of scores between "10" and "16," with no occurrence of scores of "13" in the "secure" range. Additionally, while a child could conceivably score as low as a "4" ("disorganized (1)" on all four story scores), the lowest score in this sample was a "10." Importantly, the story stem data shows varying ranges and means for each of the four individual stems. The mean CAS score across the sample was 13.56 (SD = 1.885), which falls in the lower range of the CAS "secure" classification.

CAS attachment had a .95 correlation (significant at the .01 level) with categorical ASCT attachment coding, not used in this study (see Appendix III).

Table 2: Descriptive Statistics for CAS Attachment Data

	N	Mean	SD	Low Value	High Value
CAS – Individual Story Scores:					
Story 1	40	2.75	.889	1	4
Story 2	41	3.59	.706	2	4
Story 3	41	3.71	.461	3	4
Story 4	41	3.51	.506	3	4
CAS – Overall Attachment Score:	41	13.56	1.885	10	16
Disorganized 10	5	-	-	-	-
Insecure/Anxious 11, 12	7	-	-	11	12
Secure 13, 14, 15	22	-	-	14	15
Insecure/Avoidant 16	7	-	-	-	-

Overview of Method for Reporting Results:

Results are organized in four sections by Analysis and infant age: Analysis I: 4 months, Analysis I: 12 months, Analysis II: 4 months, Analysis II: 12 months.

In the following sections, significant results will first be reported in terms of direction of effects between partners (M/S→ **I**; I→ **M/S**), vocal behavior variable (switching pause/pause), and context novelty (home/lab).

In addition, each significant linear and nonlinear model was graphed and interpreted in order to determine specific relations between degree of vocal rhythm coordination in infancy (low, midrange, high) and child CAS attachment outcomes ("A," "B," "C," and "D"). A graph of each significant model is included in Appendix II.

Linear and nonlinear relations were interpreted according to the theory of the normal distribution. This method grouped vocal rhythm CIT data into a midrange (mean +/- 1SD; 68%), a low range, (< mean – 1SD; 16%), and a high range, (> mean + 1SD; 16%).

Analysis I: Vocal Rhythm CIT Predicts Attachment at 4 Years

This section presents the results of the multiple regression equations predicting 4 year CAS attachment from 4- and 12-month vocal rhythm coordination of pause and switching pause, in mother –infant and stranger-infant pairs, in the home and lab.

Due to the exploratory nature of the study, results are evaluated with consideration of significance level, pattern of significant results, and effect size (percent of variance accounted for: R^2).

For Analysis I, nonlinear and linear relationships are reported. The presence of a positive linear relationship means that lower vocal rhythm coordination (independent variable) was associated with lower CAS attachment scores (dependent variable) [D (10), then C (11,12)], midrange vocal rhythm coordination was associated with midrange CAS scores [B (14,15] and higher vocal rhythm coordination was associated with the highest CAS attachment scores [A (16)]. The presence of a negative linear relationship between the independent and dependent variables indicates that lower vocal rhythm CIT was associated with higher CAS scores (A), midrange CIT with secure CAS scores (B) and heightened vocal rhythm coordination was associated with the lowest CAS scores (C, D).

For all analyses, the presence of a nonlinear relationship indicates that both extremes of the measure, or the low and high end of the scale, (both Vocal Rhythm CIT and CAS Attachment) are similar in their relationship to the dependent measure. For example, in Analysis I, a positive nonlinear relationship between infant pause coordination with mother and 4-year-old attachment would indicate that both low and high infant coordination of pause with mother predicts higher attachment scores (with secure midrange). A negative nonlinear relationship would indicate that both low and high coordination of vocal rhythm behavior is associated with lower attachment scores.

In Analysis II, only nonlinear relationships predicting vocal rhythm behavior in infancy from CAS attachment representations in childhood are investigated. Analysis II explored the hypothesis that the lowest and highest scores on the CAS are associated with similarly lowered or heightened vocal rhythm coordination in infancy.

In the results that follow, for each section, the results will be presented first, followed by a brief discussion.

Results IA:

The prediction of 4 year attachment from 4 month vocal rhythm coordination

Table 3. Analysis IA: 4-Month Vocal Rhythm CIT → 4-Yr CAS Attachment

4 MONTHS								
Context	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
	(I) → **M**	(I) → **M**	(M) → **I**	(M) → **I**	(I) → **S**	(I) → **S**	(S) → **I**	(S) → **I**
	Home	*Lab*	*H*	*L*	*H*	*L*	*H*	*L*
SP		† **I**						
SP [2]								* **I**
P			** **I**					
P [2]						* **I**		

Significance Level:

†	p < .10	**I** = *Analysis I*
*	p ≤ .05	H=home
**	p ≤ .01	L=lab

Table 3 presents the results of Analysis I. Of the 32 analyses conducted as part of Analysis IA, 3 were significant, with 1 significant trend (10%). One significant linear relation and one trend were identified in the 4-month mother-infant context, and two nonlinear relationships were identified in the 4-month stranger-infant context.

In the mother-infant context, infant's coordination of pause with mother in the home at 4 months has a linear relationship to child attachment. The "pause" variable represents the coordinator's own regulation of the rate of vocalization. Thus, in the infant pause coordination measure, as mother's duration of pause increases and decreases, the infant's does likewise.

Specifically, lowered infant pause coordination, a lowered likelihood that the infant matches (correlates with) the mother's pause durations, is associated with avoidant "A" attachment narratives. Heightened infant pause coordination with mother's pause coordination is associated with resistant "C" and disorganized "D" attachment narratives. Infants who are more flexible in their coordination of the pause rhythm with mother (midrange coordination) evidence secure "B" attachment representations at 4 years.

Results IA: Brief Discussion

These findings indicate that infants who are lowered or "withdrawn/inhibited" in their coordination of the pause rhythm with mothers are also "inhibited" in their avoidant "A" style of representing attachment as 4-year-old children. Interestingly, both children with resistant "C" and disorganized "D" attachment representations were found to be high or "hypervigilant" in their coordination of the pause rhythm with their mothers, suggesting an over-involvement with mother. Finally, as hypothesized, infants who coordinate the pause rhythm with mothers in the midrange evidence secure attachment narratives in childhood. Thus, these findings depict an optimum midrange coordination pattern for secure "B" attachment, with "A" too low, and "C" and "D" too high.

In the mother-infant context, there was also a trend ($p=.07$) toward a nonlinear relationship between mother's coordination of switching pause with the infant's switching pause in the lab at 4 months and attachment in childhood. The "switching pause" variable represents the coordinator's regulation of the "turn" rhythm in relation to that of the partner.

Specifically, lowered mother coordination of the switching pause with infant switching pause rhythm is associated with anxious "C" attachment narratives. Heightened mother switching pause coordination with infant turn rhythm is associated with avoidant "A" attachment narratives. Again, as hypothesized, mothers who flexibly coordinate (in the midrange) their turn-taking pattern with that of their infants' are associated with children who evidence secure attachment narratives.

Taken together, the mother-infant findings represent opposite sides of the same relational pattern. Just as lowered infant pause coordination with mother is associated with avoidant attachment in childhood, heightened mother switching pause coordination is also associated with avoidant attachment. Thus, the infant "withdraws" from the engagement as the mother demonstrates interactive "hypervigilance," an infant "withdraw" - mother "approach" pattern. Similarly, infants that demonstrate heightened pause coordination with mother, and mothers who evidence lowered switching pause coordination with their infants are both associated with resistant and disorganized childhood attachment representations. For children with "C" and "D" attachment representations, the findings suggest an infant vigilant to the partner's pause rhythm (rate of speech) at the expense of interpersonal flexibility, and a mother whose turn-taking rhythms are not well synchronized with those of the infant.

In the stranger-infant context at 4 months, both the stranger and the infant's communications were associated with later child attachment narratives. Both demonstrated a nonlinear relationship between vocal rhythm coordination in infancy and later attachment representations. Specifically, in the lab at 4 months, lowered stranger

coordination of "pause," rate of vocalization, with infant pause was associated with anxious "C" attachment at 4 years. While the findings occur in different vocal parameters, both mother and stranger lowered vocal rhythm coordination with the infant at 4 months predicted anxious attachment representations in childhood. As in the mother-infant findings, midrange stranger coordination of pause with infant pause predicted secure attachment representations in childhood.

In the stranger-infant context, it was found that infant coordination of the "switching pause," the turn-taking rhythm, with stranger switching pause in the lab at 4 months has a nonlinear relationship to child attachment representations. Specifically, heightened infant switching pause coordination with stranger is associated with both avoidant "A" and resistant "C" attachment narratives. Midrange infant coordination of the turn rhythm with stranger predicted optimal, secure attachment outcomes at 4 years.

Taken together, these findings indicate that at 4 months, similar patterns emerge both in the mother-infant and the stranger-infant interaction. Specifically, mother and stranger lowered coordination of vocal patterns with infants predicts resistant "C" child attachment representations. The infant's behavioral coordination of the vocal exchange is also highly informative. Infants that are inhibited in their coordination of the pause rhythm in face-to-face interaction with mothers in the familiar home environment are more likely to also be withdrawn in their emotional communication at age four, evidenced by the prediction of avoidant attachment representations.

Importantly, both the novel partner and the novel context are essential to a developing picture of the ways in which early patterns of communication relate to and

indicate the child's developing internal working models of attachment representations. Interpretation of both nonlinear and linear models indicates that overall, midrange coordination of vocal rhythm is optimal for secure childhood attachment outcomes, both when infants coordinate with mother and an adult partner and when adults coordinate with infants.

Results IB:

The prediction of 4-year attachment from 12-month vocal rhythm coordination

Table 4. Analysis IB: 12-Month Vocal Rhythm CIT → 4-Yr CAS Attachment

	12 MONTHS							
Context	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
	(I) → **M**	(I) → **M**	(M) → **I**	(M) → **I**	(I) → **S**	(I) → **S**	(S) → **I**	(S) → **I**
	Home	*Lab*	*H*	*L*	*H*	*L*	*H*	*L*
SP					* **I**			
SP ^{2}						** **I**		
P								
P ^{2}								

Significance Level:

†	p < .10	**I = *Analysis I***
*	p ≤ .05	H=home
**	p ≤ .01	L=lab

Results now turn to a set of analyses similar to Analysis IA. In this set, 4-year attachment narratives are predicted from 12-month vocal rhythm coordination. Of the 32 analyses conducted as part of Analysis IB, 2 were significant. One nonlinear and one

linear relationship were revealed in the 12-month stranger-infant context. Both findings involved the stranger's coordination of vocal rhythm behavior with the infant.

In the stranger-infant context at 12 months, it was found that the stranger's coordination of the turn rhythm with the infant's turn rhythm, both in the home (linear relation) and lab (nonlinear relation), predicted the child's attachment representations.

Specifically, heightened stranger coordination of switching pause, indexed in the turn taking rhythm, with infant switching pause in the home is associated with both resistant "C" and disorganized "D" attachment narratives. As in the 4-month findings, the stranger's midrange coordination of switching pause with the infant predicted secure attachment outcomes.

The other finding in the stranger-infant lab context compliments the home finding. The stranger's lowered coordination of the switching pause with the infant's switching pause predicts avoidant "A" attachment in childhood. Heightened stranger switching pause coordination again predicts anxious "C" attachment in childhood. Here again, midrange stranger coordination of vocal rhythm behavior with that of the infant predicts secure "B" attachment at child age four years.

Results IB: Brief Discussion

These significant 12 month findings further support the important role of the stranger-infant interaction found at infant age 4 months. In the 12-month analyses, the stranger-infant interaction, not the mother-infant interaction, contains the information about the early interaction’s relationship to later childhood attachment. Even more

strikingly, the 12-month home and lab findings form a comprehensive picture of the relational pull of the infant with the stranger. Strangers who withdraw in their coordination with infants predict avoidant "A" child attachment narratives, those who heighten their coordination with the infant predict resistant "C" narratives, and those who coordinate in the midrange with infants predict secure "B" child attachment narratives. The combined interpretation of these findings indicates that the stranger's vocal rhythm coordination with the infant at 12 months shows a distinct pattern that predicts 4-year attachment outcomes.

Analysis I: Summary of Results

Of the total statistical tests run for Analysis I, 9% revealed significant effects (6 significant findings derived from 64 tests; almost two times the level expected by chance). Of the 6 total significant findings, 4 of 6 resulted from the ***4-month data***, 4 of 6 were revealed in the ***novel lab context***, and 4 of 6 with the ***novel partner***, the stranger. Four of the six findings involved the ***switching pause***, which is interpreted as a partner's coordination of turn-taking rhythms with that of the other, making it an interpersonal variable by definition. Only two of the findings resulted from the partner's coordination of their own rate of vocalization, "pause", with that of the partner.

Only two of the significant findings concerned the coordination of the infant's vocal rhythm behavior with an adult partner. ***Half of the findings revealed that later attachment in childhood can be predicted from the stranger's manner of coordinating her vocal rhythm behavior with the infant.*** Mother's behavioral coordination with infant

was minimally predictive of child attachment, as was the infant's coordination of vocal rhythm behavior with the mother, both surprising findings.

Analysis II:

Low and high CAS attachment scorers show similar vocal rhythm CIT patterns in infancy

In the second set of analyses, the child's manner and process of responding to the attachment related content in the ASCT story stems was assessed in relationship to early vocal rhythm coordination. In these analyses, the 4 year continuous attachment score was used as the independent variable (nonlinear term), and adult-infant vocal rhythm coordination (linear term) as the dependent variable.

This second set of analyses sought to compare the lowest and highest CAS attachment narrative outcomes to patterns of vocal rhythm coordination in infancy. Those children who were disorganized in their responses and in their manner of addressing emotion were hypothesized to be similar to those children who avoided engaging the emotional aspect of the material, providing a cognitively rigid, and somewhat limited set of responses. Therefore, extreme low and high attachment scorers were hypothesized to share vocal rhythm coordination patterns outside of the optimal midrange in infancy.

Results IIA:

Prediction of 4-month vocal rhythm coordination from 4-year attachment

Table 5. Analysis IIA: 4-Year CAS Attachment[2] → 4-mo Vocal Rhythm CIT

4 MONTHS								
Context	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
	(I) → **M**	(I) → **M**	(M) → **I**	(M) → **I**	(I) → **S**	(I) → **S**	(S) → **I**	(S) → **I**
	Home	*Lab*	*H*	*L*	*H*	*L*	*H*	*L*
SP					* **II**	* **II**	** **II**	
P						* **II**		

Significance Level:

†	p < .10	**II** = *Analysis II*
*	p ≤ .05	H=home
**	p ≤ .01	L=lab

Of the 16 analyses conducted as part of Analysis IIA, 4 were significant (25%). All analyses tested for a nonlinear association between the predictor, CAS childhood attachment narratives, and vocal rhythm coordination patterns in infancy.

All 4-month findings emerged in the stranger-infant context. Stranger's vocal rhythm behavior with the infant, that is, the stranger's degree of coordination, was predicted from CAS attachment narratives in three of the four findings. In one of the findings, infant's vocal rhythm coordination with the stranger was predicted from CAS attachment scores.

The results indicated that children who received the lowest (D) and highest (A) CAS attachment scores shared similar interactive patterns with the stranger at 4 months. Specifically, children who told disorganized and avoidant attachment narratives when

they were four years old participated in interactions in infancy (both home and lab), in which the stranger significantly lowered coordination of the switching pause, or turn rhythm, with the infant. The same pattern was revealed in which both the lowest and highest CAS attachment scores were associated with the stranger's lowered coordination of her pause, an index of the rate of her own vocalization with the infant. All three 4-month findings are indices of the stranger's withdrawal in the face-to-face interaction.

Similarly, it was found that children who tell disorganized and avoidant attachment narratives at 4 years, as infants, show lowered coordination of the switching pause, regulating the turn rhythm, with the stranger in the home at 4 months. Again, infant withdrawal with a novel partner is indicated.

Results IIA: Brief Discussion

Lowered coordination, interpreted as interactive “inhibition” or "withdrawal," likely has different meanings for strangers versus infants. Strangers are trained to interact with, and to "join" the infant, in an engaging, playful exchange. To withdraw from coordinating the turn rhythm with an infant could mean that the infant is exceedingly difficult to coordinate with, due to a high degree of internal instability of interactive rhythms, or that the infant is somehow not engaging, or not engageable. It may be difficult for the stranger to sense the infant's turn rhythm.

On the part of the infant, interactive withdrawal from coordinating the turn rhythm with the stranger suggests avoidance of novelty, particularly in the familiar home environment, perhaps due to an increased need for sameness/stability, or a preoccupation

with self-regulation. From a different perspective, the infant's withdrawal could indicate early relational difficulty, such as a decreased ability to read and interpret social cues, particularly in the context of a novel partner.

These findings lend strength to the findings of Analysis I. Here, in Analysis II, the stranger's vocal rhythm coordination with the infant is the primary source of information about the relationship between the poles of CAS insecure attachment outcomes and patterns of vocal rhythm coordination in infancy. All 4 significant relationships are revealed within the stranger-infant interaction.

In summary, interpretation of the findings of Analysis IIA indicates that low stranger coordination with infant, and low infant coordination with stranger are associated with both "D" and "A" attachment outcomes in childhood. In three of four findings, it is the stranger's inhibition of coordination with the infant at 4 months that predicts both extremely disorganized "D" and extremely rigid "A" attachment narratives in childhood.

Results IIB:

Prediction of 12-month vocal rhythm coordination from 4-year attachment

As in Analysis IIA, all analyses tested for a nonlinear relationship between CAS childhood attachment narratives as the independent variable, and vocal rhythm coordination patterns in infancy as the dependent variable.

Table 6. Analysis IIB: 4-Year CAS Attachment → 12-mo Vocal Rhythm CIT

	12 MONTHS							
Context	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
	(I) → **M**	(I) → **M**	(M) → **I**	(M) → **I**	(I) → **S**	(I) → **S**	(S) → **I**	(S) → **I**
	Home	*Lab*	*H*	*L*	*H*	*L*	*H*	*L*
SP								
P				* **II**		* **II**		

Significance Level:

†	p < .10	**II** = *Analysis II*
*	p ≤ .05	H=home
**	p ≤ .01	L=lab

Of the 16 analyses conducted as part of Analysis IIB, 2 were significant. 12-month findings both emerged in the novel lab context, one in the mother-infant and one in the stranger-infant context. Both 12-month findings involved the pause variable, which assesses the coordination of the partner's rate of vocalization with that of the other.

Results IIB: Brief Discussion

Infant vocal rhythm behavior with the mother at 12 months was predicted from CAS attachment narratives. Unlike all of the other findings of Analysis II, lowered infant pause coordination with mother pause was associated with only avoidant "A" attachment narratives, and not specifically with disorganized "D" attachment narratives as well. Here, rigid, avoidant attachment narratives told by four-year-olds are associated with infant inhibition of vocal rhythm coordination with mother in the 12-month interactive exchange in a novel lab environment.

In the second finding, children who told both disorganized and avoidant attachment narratives at age four participated in interactions at 12 months in which the stranger lowered her pause coordination with that of the infant, interpreted as lowering the coordination of her rate of vocalizing with that of the infant, a form of interactive withdrawal.

Interpretation of these findings indicates that both lowered infant and lowered stranger coordination of vocal rhythm behavior at 12 months are associated with disorganized ”D” and rigid “A” attachment narratives in childhood.

Analysis II: Summary of Results

Of the total statistical tests run for Analysis II, approximately 19% revealed significant effects (6 significant findings derived from 32 tests, almost four times the level expected by chance).

Half of these findings showed that both the lowest and highest CAS attachment scorers, those children conceptualized as “disorganized,” and “insecure/avoidant,” respectively, shared related patterns of the stranger’s coordination of vocal rhythm behavior with the infant.

In total, 5 of 6 findings concerned the stranger-infant dyad. Of these, 4 were based on the stranger’s vocal rhythm coordination, with two findings for “switching pause” and 2 for “pause.” Of the 6, only two findings concerned the infant’s coordination of vocal rhythm behavior, one in the stranger-infant context, and one in the mother-infant context.

Interestingly, all of the findings showed that ***"A" and "D" infants elicited significantly lower coordination in the stranger, or participated in significantly lowered vocal rhythm coordination with stranger (and mother) themselves***. Of the six findings, 4/6 were discerned in the ***4-month, novel partner context***. In summary, the findings reported in Analysis II showed clearly that "insecure/avoidant" and "disorganized" children elicited similarly lower coordination in the stranger with respect to both switching pause and pause in infancy as compared to "insecure/anxious" and "secure" children.

Summary of Findings

When the findings of Analyses I and II were viewed overall, meaningful patterns emerged. Of a total of 96 analyses performed in Analysis I and II, 12 findings were discerned, 12.5% (versus 5% expected by chance). Following from the current study's midrange hypotheses, the specific exploration of nonlinear relationships between vocal rhythm coordination in infancy and later attachment in childhood was essential, with 75% of the significant study findings having described nonlinear trends.

Table 7: Summary of Findings – Analyses I and II

	4 MONTHS											12 MONTHS				
Context	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
	(I) → **M**		(M) → **I**		(I) → **S**		(S) → **I**		(I) → **M**		(M) → **I**		(I) → **S**		(S) → **I**	
	home	*lab*	*h*	*l*	*h*	*l*	*h*	*l*	*h*	*l*	*h*	*l*	*h*	*l*	*h*	*l*
SP		† I			* II	* II	** II						* I			
SP [2]								* I						** I		
P			** I			* II						* II		* II		
P [2]						* I										

Significance Level:
† p < .10
* p ≤ .05
** p ≤ .01

Effect of Partner:

Not surprisingly, the most novel condition brought to light the association of vocal rhythm coordination in infancy to later child attachment. Three quarters of the study findings were in the context of stranger-infant face-to-face interactions, early preverbal play with a novel partner. Over half of the significant results pointed to the importance of the stranger's non-conscious behavioral reaction to, and manner of relating with, the infant.

In this study, the mother was conspicuously absent as a predictive presence. Only 3 of 12 findings emerged in the early mother-infant face-to-face context, and 2 of these were based on the infant's coordination of vocal rhythm behavior with the mother.

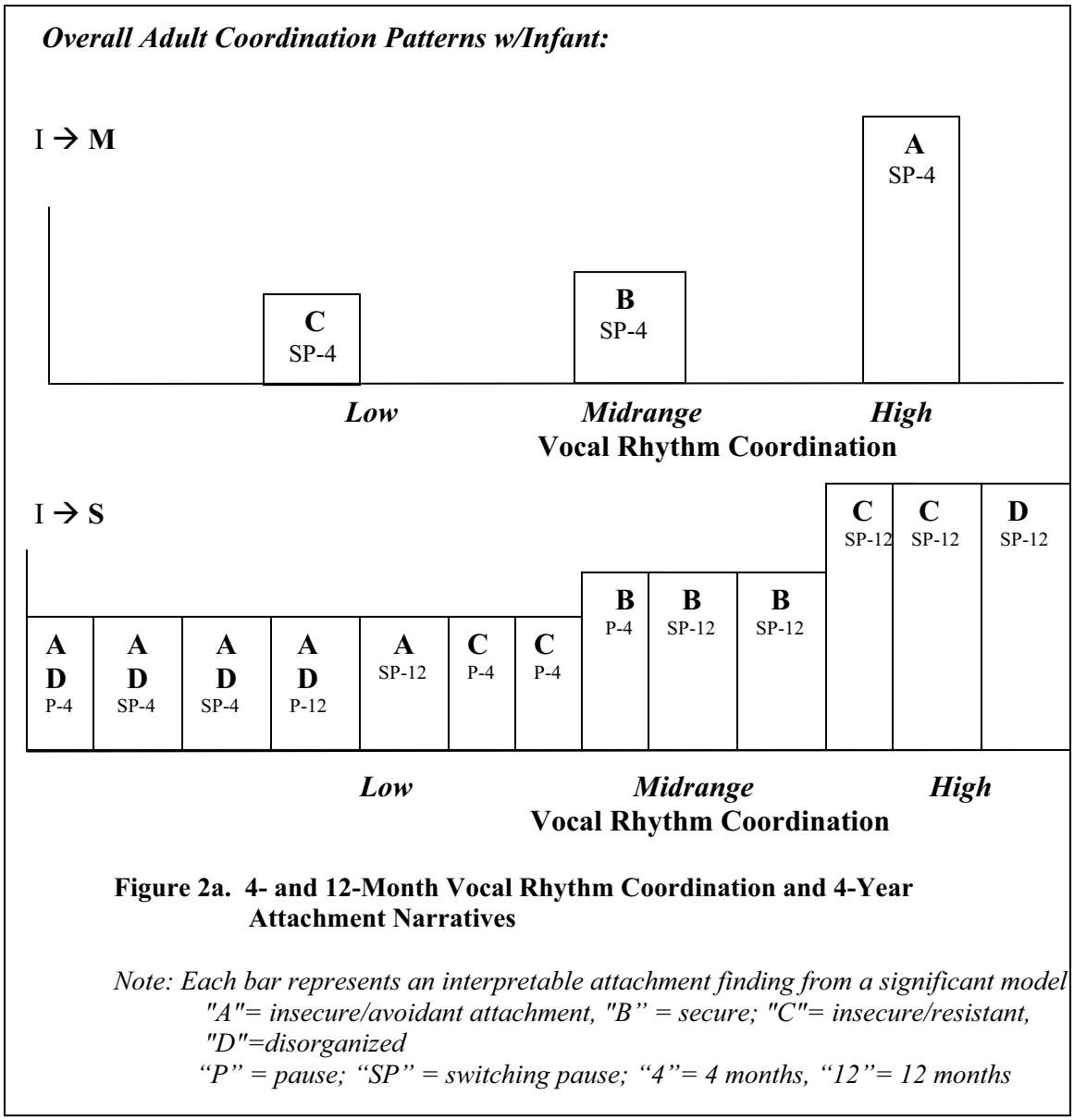


Figure 2a. 4- and 12-Month Vocal Rhythm Coordination and 4-Year Attachment Narratives

Note: Each bar represents an interpretable attachment finding from a significant model
"A"= insecure/avoidant attachment, "B" = secure; "C"= insecure/resistant, "D"=disorganized
"P" = pause; "SP" = switching pause; "4"= 4 months, "12"= 12 months

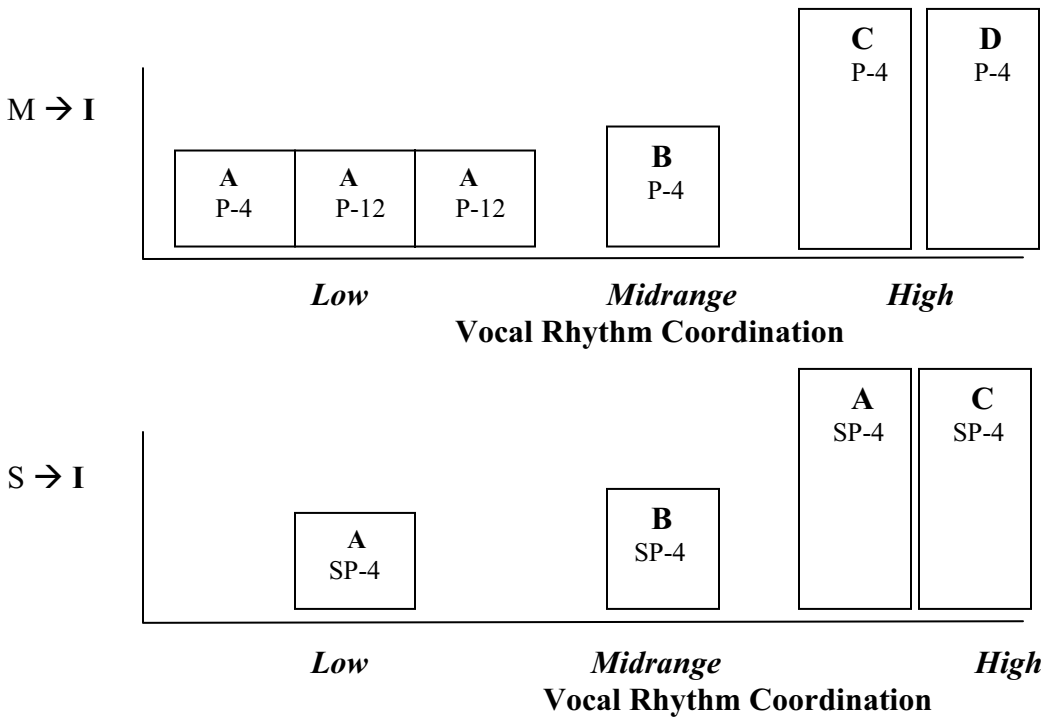


Figure 2b. 4- and 12-Month Vocal Rhythm Coordination and 4-Year Attachment Narratives

Note: Each bar represents an interpretable attachment finding from a significant model
"A"= insecure/avoidant attachment, "B" = secure; "C"= insecure/resistant, "D"=disorganized
"P" = pause; "SP" = switching pause; "4"= 4 months, "12"= 12 months

Effect of Infant Age:

Two-thirds of the overall findings emerged in the earlier of the two interactions at 4 months. At 4 months, the stranger and infant, both in the home and in the lab, were relating in ways particular to the child's developing manner of being with another. In this way, the bulk of the study findings brought forth the potentially predictive and diagnostic power of the 4 month face-to-face relationship between stranger and infant.

In the condition of the most novelty, and potentially most anxiety, and also of the greatest opportunity for exploration and communication, both strangers and infants who were playful and flexible with one another, in the "optimal midrange" of vocal rhythm coordination indexed strong possibilities for developing attachment security. In contrast, those who fell at the low end of "withdrawn/inhibited" interactive coordination, and at the high end of "hypervigilant" interactive coordination, showed the beginnings of attachment-related relational difficulty before language develops.

Overall, security of attachment in childhood was related to patterns of early interactive vocal rhythm coordination of both an intrapersonal measure of vocal regulation, the pause, and an interpersonal regulation of communication between partners, the switching pause.

Analysis I explored the relationship of both mother-infant and stranger-infant vocal rhythm coordination at 4 months to childhood attachment at 4 years. To summarize the significant findings, midrange coordination, especially in the stranger-infant interaction in the lab, was indicated for developing attachment security, while both low and high vocal rhythm coordination between the stranger and infant was especially related to problematic, insecure attachment strategies (A, C, and D), demonstrated through narrative assessment of attachment in childhood.

In Analysis II, lowest and highest scores on the 4-year ASCT assessment of attachment were explored in relationship to patterns of early vocal rhythm coordination at 4 and 12 months. The hypothesis of Analysis II was strengthened, and the Continuous Attachment Scale shown to be of empirical and clinical use in generating results showing

optimal flexibility and organization in children's narration of attachment relationships are associated with midrange vocal rhythm coordination in infancy.

Taken together, these analyses demonstrated that both a disorganized, incoherent, and tangential approach to content and narration, and an overly rigid, narrow, and non-explorative approach to attachment narration in childhood (avoidant) are indicative of problematic internal working models of attachment representations and relational strategies which begin in infancy in patterns of vocal rhythm coordination.

Both overly loose and rigid approaches to representing and narrating important emotional attachment-related themes were shown to be related to significantly lowered patterns of vocal rhythm coordination in infancy, at 4 months, especially in the novel stranger-infant interaction.

Summary of Findings by Communication Pattern:

A. Midrange Coordination Findings [a]

Analysis I:

Mother's Midrange VR Coordination with Infant predicts:
(SP-4) Secure "B" Attachment Narratives (1) [b]

Infant's Midrange VR Coordination with **Mother** predicts:
(P-4) Secure "B" Attachment Narratives (1)

Stranger's Midrange VR Coordination with Infant predicts:
(P-4), (SP-12), (SP-12) Secure "B" Attachment Narratives (3)

Infant's Midrange VR Coordination with **Stranger** predicts:
(SP-4) Secure "B" Attachment Narratives (1)

Overview of Midrange Coordination:

All M-I and S-I Interactions Predict Secure Attachment Narratives

Note:
[a] Analysis I: 6 Significant Linear/Nonlinear Models defined lowered, midrange and heightened coordination as defined by standard deviations from mean: <1 SD from mean = lowered; >1 SD from mean = heightened.

Analysis II: 6 Significant Linear/Nonlinear Models defined lowered, midrange and heightened coordination as defined by standard deviations from mean: <1 SD from mean = lowered; >1 SD from mean = heightened.

[b] Represents number of models from which specific attachment style (Analysis I) and coordination pattern (Analysis II) could be predicted.

c P-4 = Pause coordination at 4 month, SP-12 = Switching pause coordination at 12 months. When 2 identical entries occur, i.e. (SP-12), (SP-12), this indicates that one significant model was generated from the home data, and one from the lab data.

B. Lowered Coordination Findings

Analysis I:

Mother's Lowered VR Coordination with Infant predicts:
(SP-4) Resistant "C" Attachment Narratives (1)

Infant's Lowered VR Coordination **with Mother** predicts:
(P-4) Avoidant "A" Attachment Narratives (1)

Stranger's Lowered VR Coordination with Infant predicts:
(SP-12) Avoidant "A" Attachment Narratives (1)
(P-4) Resistant "C" Attachment Narratives (1)

Analysis II:

Infant's Lowered VR Coordination with Mother is predicted by:
(P-12) Avoidant Attachment Narratives (1)

Stranger's Lowered VR Coordination with Infant is predicted by:
(P-4), (SP-4), (SP-4), Avoidant Attachment Narratives (4)
(P-12) Disorganized Attachment Narratives (4)

Infant's Lowered VR Coordination with Stranger is predicted by:
(SP-4) Avoidant Attachment Narratives (1)
(SP-4) Disorganized Attachment Narratives (1)

Overview of Lowered Coordination:

Mother-Infant Interaction
(I) → **M**: ***Resistant*** Attachment Narratives
(M) → **I** : ***Avoidant*** Attachment Narratives

Stranger-Infant Interaction
(I) → **S**: ***Avoidant, Resistant*** and ***Disorganized*** Attachment Narratives
(S)→ **I** : ***Avoidant and Disorganized*** Attachment Narratives

Analysis I: **Stranger's Lowered Coordination→**:

- "Avoidant" Attachment Narratives
- "Resistant" Attachment Narratives

Analysis II: **Stranger's Lowered Coordination is predicted by**:

- "Avoidant" Attachment Narratives
- "Disorganized" Attachment Narratives

C. Heightened Coordination Findings

Analysis I:

Mother's Heightened VR Coordination with Infant predicts:
(SP-4) Avoidant "A" Attachment Narratives (1)

Infant's Heightened VR Coordination **with Mother** predicts:
(P-4) Resistant "C" Attachment Narratives (1)
(P-4) Disorganized "D" Attachment Narratives (1)

Stranger's Heightened VR Coordination with Infant predicts:
(SP-12), (SP-12) Resistant "C" Attachment Narratives (2)
(SP-12) Disorganized "D" Attachment Narratives (1)

Infant's Heightened VR Coordination with Stranger predicts:
(SP-4) Avoidant "A" Attachment Narratives (1)
(SP-4) Resistant "C" Attachment Narratives (1)

Overview of Heightened Coordination:

Mother-Infant Interaction
(I)→ **M**: ***Avoidant*** Attachment Narratives
(M)→ **I** : ***Resistant*** and ***Disorganized*** Attachment Narratives

Stranger-Infant Interaction
(I) → **S**: ***Resistant*** and ***Disorganized*** Attachment Narratives
(S) → **I**: ***Avoidant*** and ***Resistant*** Attachment Narratives

V. Discussion

Introduction

This study explored the association between early nonverbal relational patterns and later representations of attachment security in childhood. The central goal was to explore continuities in relational patterns spanning the child's first four years.

The present study focused on nonverbal vocal rhythm "dialogues" of infants at 4- and 12 months with their mothers and novel partners. Coordinated Interpersonal Timing (CIT) of vocal rhythm behavior between infants and adult partners served as the relational measure in infancy. CIT measured the degree to which each individual adjusted, or coordinated, his/her vocal rhythm with that of the partner. Midrange degrees of infant-adult coordination were hypothesized as optimal for childhood attachment representations, following the Jaffe et al., 2001 model.

In childhood, children's representations of attachment relationships were measured with the ASCT narrative story stem task, widely used in longitudinal attachment research. The child's ability to address difficult emotional themes, and to tell coherent, yet flexible stories about relationships to a novel partner was also conceptualized as optimal. Thus, this study focused on extending the literature on the impact of nonverbal relational processes in infancy on developing attachment representations and narrative capacities in childhood.

The following section will move from discussion of overall study findings, to a more global discussion about the application of longitudinal developmental research to

clinical theory. Then, potential application of study findings to risk assessment and early intervention treatment models will be discussed. In addition, the findings will be considered in relation to the process of child treatment. Finally, the limitations of the study and directions for future research will be considered.

The conclusions that emerged most clearly from the findings were the following:
1) Attachment representations in childhood assessed at 4 years of age were predicted by early patterns of vocal rhythm coordination in infancy. The association between 4-month (versus 12-month) vocal rhythm coordination and childhood attachment representations was especially salient.

2) The stranger-infant interaction was key in predicting all four attachment classifications in the current study. The stranger's degree of vocal rhythm coordination of pause and switching pause with those of the infant was most predictive of childhood attachment narratives. Stranger pause coordination measured the degree to which the stranger adjusted her rate of vocalization to the vocalization rate of the individual infant. Stranger switching pause measured the degree to which the stranger adjusted her turn-taking rhythm to the rhythm of the individual infant. Stranger's coordination of the turn-taking rhythm with the infant's rhythm, assessed by the switching pause, was especially salient in predicting attachment representations in childhood, with lowered stranger switching pause coordination consistently predictive of A and D attachment classification in childhood.

3) Children who avoided the emotional content of attachment themed stories in two different ways (both those that evidenced chaotic disorganized "D" narrative strategies, and those that evidence rigid avoidant "A" narrative strategies) shared similar communication patterns in infancy. Strangers lowered, or "inhibited" their degree of vocal rhythm coordination with these children when they were 4 months of age, a form of interactive withdrawal.

4) Midrange communication strategies in infancy were found to be predictive of midrange representational narrative strategies in childhood.

a) Midrange coordination of nonverbal communication at 4 and 12 months was found to be predictive of optimal attachment security. In this study, as in prior studies, the low and high ends of the vocal rhythm coordination distribution in infancy both indexed a less flexible relational system, and were related to developing insecurity of attachment (Jaffe et al., 2001). Specifically, midrange levels of coordination of vocal rhythm patterns between infants and novel partners in infancy predicted optimal secure child attachment narratives at 4 years.

b) Children's narratives about attachment relationships that demonstrated active engagement with the emotional content of the material and flexibility of narrative process and communication were associated with engaged, flexible nonverbal play interactions with novel partners in infancy.

Prior longitudinal studies have largely failed to document correlations between 12-month attachment and symbolic, narrative measures of attachment at four years. Using a measure of vocal-rhythm coordination, however, this study, along with prior vocal rhythm research, has demonstrated that early relational patterns, in the context of the stranger-infant interaction, predicted attachment at 12 months (Jaffe et al., 2001) and 4 years. Despite its distance in time from both attachment measures, the 4-month preverbal face-to-face exchange is remarkably sensitive.

To understand these findings, it is important to consider the scope of the analyses conducted. Both 4- and 12- month vocal rhythm data gathered in face-to-face nonverbal play with attachment figures (mothers) and novel relational partners (strangers) were analyzed, for infant and adult partners. It is particularly striking, then, that the data proved richest in the 4-month context, before object play, and with the stranger, who served as both a clinically trained partner for the infant, and as an amplifier for the infant's relational manner of being with another.

These findings are consistent with prior vocal rhythm research (Jaffe et al., 2001; Beebe et al., 2007). Whereas the prior research showed the power of 4- and 12- month vocal rhythm coordination to predict 12-month attachment, the current study showed the power of 4-month vocal rhythm coordination to predict attachment at four years. Together, these studies support the idea that early, pre-verbal vocal rhythm patterns of communication in infancy capture important aspects of the child's social-emotional development and "ways of being".

In the face-to-face preverbal "play" interaction, in the behavioral assessment of the infant's emotional and intentional management of separation and reunion from the primary caregiver during toddler play at 12 months, and in the narrative "play" of the 4-year-old with a novel partner about fear, injury, abandonment and subsequent comfort, the child's flexibility, emotional openness and freedom to "move" between dependency and independence, closeness and separation, are essential. This concept underlies the assessment of attachment across the lifespan.

An individual's flexibility in making meaning of ambiguous affective material, in exploring difficult emotional states and situations, and in relating these processes thoughtfully and openly to others in the world, are essential components of healthy development, and contribute to therapeutic change (Bruschweiler-Stern et al, 2005; Harrison, 2003; Slade, 1994). Children who were more flexible in their narrative strategies elicited midrange, more flexible stranger coordination at 4 months. However, children at either extreme, who told either disorganized (D) or rigid (A) narratives about their attachment representations, elicited the novel partner's interactive withdrawal, or inhibition of vocal rhythm coordination, as early as 4 months. The present findings support prior empirical, theoretical, and clinical citing of relational flexibility as central to both optimal development and to therapeutic change.

Application of the Research

In addition to illustrating various links between preverbal relational patterns and later manifestations of attachment organization, the present study may also shed light on the application of developmental research to varied theoretical and clinical literatures,

including the understanding of therapeutic change, the nature of early risk factors in infancy for developing pathological emotional regulation and relational functioning, and the process of clinical treatment. These three applications will be considered in the following sections.

Preverbal Relational Patterns and Treatment Theory

Ethological, neurological, and developmental research have offered compelling findings suggesting that nonverbal communication can indeed provide the therapist with a glimpse into the patient's unconscious and non-conscious emotional world. This research suggests that nonverbal communication between therapist and patient can have an emotional impact beyond words for both. As psychoanalytic theory has progressed, interpersonally informed schools have increasingly emphasized the therapist's reaction to the patient through countertransference as a useful therapeutic tool in conceptualizing the course and progress of the treatment and in conducting the treatment itself. Reflection on these spontaneously arising bodily and physiological signal behaviors can provide the therapist with a direct emotional link to the unspoken nature of the therapeutic alliance, and provide a mirror of what it is like to be with the patient in the relational present (Beebe, 2003; Beebe & Lachmann, 2002; Bruschweiler et al., 2005; Ehrenberg, 1992; Lyons-Ruth, 1999).

In the absence of access to the declarative realm of communication, the nonverbal, behavioral realm serves as a means of understanding the patient's modes of relating that have not been, or may not be able to be, verbally expressed. Defenses and resistance, or expressive language delays that prevent the naming of experiences and impulses, may be revealed as "pantomimic announcement(s)" of unconscious wishes and

fantasies (Freud, 1905). By acknowledging the link between the unconscious and overt behavior, Freud recognized that behavior can in fact bring the repressed to the surface, free from the patient's censorship.

Researchers have postulated that at times of "rhythmic matching," therapists are demonstrating active empathic listening, as well as displaying an ability to participate in heightened forms of interactive regulation with the patient (Freedman & Lavendar, 1997). Researchers and theorists have also attempted to identify and understand the procedural processes behind nonverbal behavior and countertransference for the therapist. At times when the therapist's nonverbal rhythms are distinctly unmatched with the patient, therapists may be displaying a need to shift the balance toward self-regulation, reflecting a countertransference reaction to defend against the patient's transference. In this way, the therapist's attention to behaviors focused on self-regulation may be instructive in understanding the patient's material that is especially charged for the therapist, or the point at which there is a disruption in the relationship, or when the patient may be inaccessible.

While these nonverbal relational patterns between therapist and patient are largely out of awareness, infants in the present study, who were later identified as utilizing disorganized and avoidant relational strategies in childhood, showed tendencies to engage in both withdrawn and hypervigilant relational coordination with the novel, clinically-trained partner pre-verbally, as early as 4 months of age. These patterns suggest an implicit relational pull for both tightly coordinated rhythmic matching in communication and for relational withdrawal of rhythmic coordination. These infants (and strangers) seem to bring their own relational rhythm and the relational rhythm of the novel partner

to the forefront. The partner may experience both a disruption in the ability to self-regulate, and a disturbed ability to perceive subtle, nonverbally mediated relational "disconnects."

Explicit attention to vocal rhythm coordination patterns, and the gaze, postural and facial patterns to which they are linked, may serve as a clinical tool in which the partner can experience relational disturbances in the moment, as well as understand shifts that may take place with intervention. In thinking about the possibility of clinical intervention and therapeutic change, it is important to consider the therapeutic action as taking place in the context of "implicit relational knowing" between child and partner (Stern, Sander, Nahum et al., 1998).

In the classical view of linguistically-based therapy, change occurs intrapsychically by making the unconscious conscious, through verbal or imagistic representation. By incorporating an understanding of nonverbal communication, therapeutic change can be understood as possible in infancy, as it may offer infants the opportunity to participate in new relationships which offer them an enhanced ability to integrate affect, cognition, and behavioral and relational dimensions (Stern et al., 1998; Lyons-Ruth, 1999; Beebe & Lachmann, 2002).

In this conception, transference represents the patient's use of implicit relational knowing developed through interactions over the course of development, and is manifested in relational behavior enacted according to learned expectancies. In this way, change is a process made possible by the inter-weaving of self- and interactive regulation, and does not necessarily need to be arrived at consciously, through declarative knowledge. This conceptualization of the therapeutic process necessarily postulates the

locus of change at the point of intersubjective "attunement" between partners, much of which occurs at the nonverbal, procedural level, and is therefore at the forefront in infancy. As Lyons-Ruth (1999) describes, much of what is known by both therapist and patient is never translated into words.

In light of the findings of vocal rhythm research, a central goal of treatment with young children at risk for developing attachment insecurity, and especially those with a history of early loss and attachment disruption, might be thought of as the mutual regulation of dyadic process, a concept borrowed from the earliest moments of infant interactions with caretakers. The therapeutic action takes place as “moments of meeting,” moments of disruption, error, and repair, as well as periods of “ongoing regulation,” allowing the co-construction of a relationship that is “implicitly known” and internalized in the patient (Stern et al., 1998; Lyons-Ruth, 1999; Beebe & Lachmann, 2002).

Ethological and developmental research provide some preliminary evidence that early deficits in the communication and interpretation of nonverbal behavior may be intimately connected to early difficulties in attachment strategies and later difficulties in formation of interpersonal relationships. These early patterns may contribute to later difficulties in both attunement with a partner and open communication, and therefore lead to the continual experience of unsuccessful interpersonal interactions. In this way, expectancies of "non-attunement" are confirmed, and “accomplices” are recruited as disturbed nonverbal communication continues to operate at the root of disconnected, non-empathic interactions (Wachtel, 1993).

Treatments that are informed by intersubjective and systems perspectives focus on attempts to create a safe space in which moments of disruption, dysregulation, and failures to match, do not destroy the relationship, but instead are a part of the regulation of internal and relational anxiety within the context of the co-constructed relationship. In the words of Ehrenberg (1992), the therapeutic action takes place as a result of the therapist's "ability to stay with… and to let (the individual) know (themselves) *'from the inside, not from the outside'*," (Ehrenberg, p. 21). By sharing in the task of the regulation of intense affect as well as encouraging flexibility and exploration, the therapeutic relationship can become a model that may be eventually internalized, allowing the individual an increased capacity to tolerate intense affective states as a result of a more developed ability to engage in both self- and interactive regulation, without evoking relational withdrawal or vigilant anxiety in the partner.

Intersubjective theories provide support for the therapeutic significance of nonverbal affective communication in helping patients to become both more intimately aware of their own internal processes, and to understand the process of engaging in meaningful relationships with others. Additionally, the therapist's experience of the nonverbal rhythms in the relationship can become another way of knowing and understanding both the individual and the relationship, and communicating what it feels like to "be with" the patient in the intersubjective present. In this way, knowledge of internal states and relational states can be gained through nonverbal interactions, paving the way toward the development of a more integrated internal and external world, even before language and symbolic play capacities have been achieved.

Preverbal Relational Patterns and Early Risk Assessment

In order to identify potential early risk factors for insecure attachment in early childhood, the novel partner emerged as essential in the 4-month, 12-month and 4-year data (Beebe et al., 2007; Jaffe et al., 2001; Markese, 2007). Interaction with a novel partner taps into both the infant's internalized representations of relatedness and the ability to interpret, organize and respond to emotionally meaningful material in a new social situation. The fact that the stranger-infant context at 4 months is particularly sensitive, and therefore, allows the elucidation of all four attachment strategies, makes the stranger-infant CIT patterns described important in their ability to determine potential directions for the development of assessment tools in the preverbal period of child development.

Without a clinical application, this work would remain an interesting addition to the empirical literature on the role of preverbal relational patterns and early "proto-narrative" attachment representations in determining the trajectory of relatedness and affective regulation (Stern, 1985). However, the clinical importance of the 4 month stranger-infant interaction has clearly emerged from the study findings, which are also supported by previous research (Jaffe et al, 2001; Beebe et al, 2007). In contrast to many other longitudinal attachment studies, the present study findings emerged in the stranger-infant relationship. In this study, neither maternal behavior with the infant, nor the infant's behavior with the mother was salient in the prediction of attachment patterns in childhood. Instead, the clinically trained stranger's non-conscious sensitivity to the infant's state and method of relating to the partner predicted later emotional and relational development in childhood.

Psychology graduate students, trained to be maximally sensitive to infant distress, and encouraged to actively engage in both playful and regulating forms of vocal rhythm coordination, react significantly differently to infants at 4 months who will evidence attachment insecurity versus security in childhood at age 4**.** Specifically, at 4 months, the stranger withdraws in the preverbal "play" interaction with children who will later be classified as "avoidant" and "disorganized" at four years of age. This finding emerged in many contexts, and was by far the most robust in relationship to childhood behavioral and narrative representations of attachment as assessed by the Attachment Story Completion Task (Bretherton et al., 1990).

Vocal rhythm research consistently suggests that the stranger is experiencing a significant relational pull from the infant. A secure infant elicits a midrange level of coordination of the turn rhythm with the stranger. This might be thought of as a more exciting, stimulating relatedness. It is more open, playful and co-constructed, and the stranger feels free to "play" with the baby without devoting undue attention to subtle shifts of attention and affect. By contrast, children whose attachment trajectory is directed towards insecurity seem either to push the stranger to interactive withdrawal (avoidant and disorganized children), or to elicit intensely vigilant stranger responses (anxious/resistant children).

To imagine this face-to-face lab paradigm as a brief "clinical intake" reveals important information about the infant's early relatedness. A stranger who is "pulled to withdraw" might be thought of as avoidant themselves of some relational undertone of rejection, dismissal or anxious avoidance in the partner. At the other end, a stranger who

is "pulled toward vigilance" and concern with the infant's distress may be made anxious and overwhelmed in their own relational capacity. In this way, the stranger in the research serves to reveal important information about the preverbal/pre-symbolic child before language and play evaluations are possible.

Both interactive "withdrawal" in the inhibition of coordination and interactive "vigilance" in heightened coordination with the infant limit the stranger's ability to engage the infant in a developmentally stimulating yet containing interchange. This suggests the disturbing point that infants who are developing insecure attachment representations at 4 months are already increasingly limited in their ability to engage in positive, developmentally supportive interpersonal exchanges. Present in primary attachment relationships (Beebe et al., 2007; Jaffe et al., 2001), and in newly developing relationships, these early relational patterns likely drive and contribute to the stability of insecure attachment and problematic relational patterns over time, increasing the risk for child psychopathology.

Importantly, children later classified as disorganized and avoidant in their childhood attachment representations elicit, and participate in, a lowered coordination of the turn rhythm with the stranger. These children have been described in the research literature as the most sensitive to relational stress, as evidenced in elevated cortisol levels, often in the absence of overt behavior (Spangler & Grossman, 1993; Field, 1998). These are the children who are the most inhibited in terms of their interactive potential in novel relationships.

Because these relational patterns reveal themselves pre-verbally, and in pre-symbolic play, through use of an automated measure of the coordination of partners' sound and silence, it is possible that clinical assessment and therapeutic interventions for mother-infant dyads might allow clinicians to intervene early in order to prevent narrowing of the child's relational opportunities through extremely subtly communicated interaction patterns.

Preverbal Relational Patterns and Treatment Application

Extensive research has been conducted in the area of the impact of maternal psychopathology on infant development. It has been hypothesized that depressed mothers do not respond appropriately to their infants' cues. Thus, these infants develop defensive regulatory mechanisms in the absence of co-regulation, forcing them to adopt a "disengaged and self-directed" regulatory style that becomes automatic over time (Tronick & Weinberg, 1997). Consistent with present study findings, it has been shown that as early as 6 months, infants of depressed mothers generalize their more negative style of relating to the stranger (Field et al., 1988).

Infants of depressed mothers have been shown to have more avoidant interactive patterns, and appear less alert than infants of non-depressed mothers, despite physiological over-arousal, based on elevated heart-rate and cortisol (Field, 1995). Despite their over-arousal in response to relational stressors, these infants show more turning away from the dyadic partner, and often a loss of postural control. They also show preoccupied forms of self-regulation, such as oral self-comfort and self-touch, at the expense of interactive regulation (Tronick, 1989). To underscore the range of organized, pathological relational patterns utilized by distressed infants in response to

parental psychopathology, infants of emotionally and behaviorally withdrawn and intrusive mothers were found to exhibit different relational patterns (Field, 1998; Tronick & Weinberg, 1997). When mothers are withdrawn (defined as flat affect, looking away, slouching back, passively watch without responding), infants show more vocal distress and protest. When mothers are intrusive (more angry faces or poking), infants are more avoidant of eye contact.

The literature on the impact of maternal unresolved distress and pathology on dyadic face-to-face non-verbal communication suggests that there are interactional patterns that mothers can learn to attune to through therapeutic intervention. These methods of early intervention combine psychoanalytic exploration of the mother's experience and its relation to her experience of her infant, with more behavioral and educational methods used to assist mothers in becoming more attuned to the nonverbal patterns of communication that characterize the developing dyadic relationship.

One such early intervention program has been implemented specifically in response to the needs of new mothers who were widowed as a result of the World Trade Center Disaster (Beebe & Jaffe, 2002). This approach to primary prevention rests on the hypothesis that the early face-to-face interaction between mothers and their 4 month-olds can be valuable clinically, both for the assessment of risk, and as a powerful tool enabling clinicians to help grieving mothers attune to the signals and needs of their infants, and understand the developing nature of their early relationship to their infant (Cohen & Beebe, 2002).

Other similar models for at-risk mother-child dyads, such as the Circle of Security Project (Hoffman, 2002; Marvin, Cooper, Hoffman & Powell, 2002), and the behavioral

approach to treating depressed mother described by Malphurs & Field (1996) are also based on the intersection of developmental research and the design of effective intervention. Mother-infant and mother-child video bonding consultations have been developed in order to help mothers to be more attuned to both their own, and their child's non-verbal communication, as well as the importance of interactive regulation for both the mother-child bond, and the child's developing security of attachment (Beebe & Jaffe, 2002; Cohen & Beebe, 2002).

In terms of parent-infant treatment, the present study findings suggest that early relational patterns may be identified at four months, and therefore targeted interventions may be applied early in the course of relational and social emotional development. These findings offer support to existing research that suggests that the infant's particular relational difficulty can be addressed with directive and specific parent-child intervention strategies (Malphurs & Field, 1996). Much like the literature on treating depressed and traumatized mothers, infants might be optimally engaged through supportive, directive work with the mother. Infants who are withdrawn and who elicit withdrawn interactive styles from sensitive partners, might need to experience more predictable, yet engaging interactions with caregivers. Infants who characteristically participate in hypervigilant interactions may be helped to engage more optimally by a consistently soothing, yet affectively present response (Cohen & Beebe, 2002; Field, 1995; Field, Healy, Goldstein & Guthertz, 1990).

Although this work is still in the preliminary stages, the fact that a clinically trained stranger reacts with interactive withdrawal to infants evidencing distressed and

inhibited early relational patterns, brings up the possibility that consistent therapeutic stranger-infant interactions, in combination with parent-infant treatment, might be another way of supporting successful clinical interventions with at-risk infants.

Additionally, clinicians who are made aware of the particular reactions that may be evoked by distressed infants, not just heightened affect on the part of the clinician, but also a pull to disengage, may consistently engage "difficult to engage" infants in carefully designed interactions. These interactions may provide the infant with the chance to learn to interact in positive exchanges apart from what may be a problematic mother-child attachment relationship.

Further, the findings suggest what may underlie the efficacy of child treatment in the pre-school years. Play therapy may function to shift developing attachment representations and relational development, apart from the context of the immediate family, in ways that are generalizable to a wide array of valuable social partners in the child's expanding social world. Through narrative play and interpersonal interaction with the clinician, the child is both placed in a sensitive environment and given the opportunity to be heard, experienced and related to in a new, more open and flexible way, nonverbally as well as verbally.

Limitations and Implications for Future Research:

This study builds on important previous work (see Beebe et al., 2007; Jaffe et al., 2001). Vocal rhythm coordination continues to be explored as a method of assessing and describing early development (Fox, Hane & Perez-Edgar, 2006; Hane, Feldstein & Derentz, 2003). While findings of the present study strongly parallel those previously

described, and methods build on the empirical literature, the present sample is small, and is therefore limited in its scope.

An area of particular limitation, especially in terms of application of findings to the formulation of early risk factors, is the limited range of the study population, which was a highly educated, middle to upper-middle class Caucasian sample of intact families. As has been described in all areas of research on childhood risk factors for developing psychopathology (Abela et al., 2005; Field, 1995, Field et al., 1990; Lyons-Ruth, 1996; Lyons-Ruth, 1998; Murray, 1982), this population does not capture the range of environmental difficulties experienced by an urban, clinical sample. While this is a limitation in terms of capturing the range of relational difficulties observed in the population, it is noteworthy that findings were obtained.

Another area of limitation for this study, and for studies of preschool attachment in general, is the inconsistent use and empirical investigation of coding methods for pre-school narrative batteries. This work attempted to adapt categorical coding of overall attachment in childhood into more nuanced classifications which may capture both the behavioral and verbal expression of children's attachment representation and relational strategies. While remarkable coherence between these study findings, and those which investigated the association between vocal rhythm coordination in infancy and 12-month attachment was found (see Jaffe et al., 2001), further research is needed in order to assess this method's utility.

Although simultaneous vocal rhythm data at 4 years of age has been collected, it has not yet been analyzed. Parallel interactive coordination and attachment classification

data, in combination with behavioral measures of children's social-emotional functioning, might shed light on developing relational patterns in childhood.

Summary:

Developmental and clinical theories have contributed enormously to the development both of the study hypotheses and goals, at present and in the long term. It has been emphasized that "play" is essential to optimal development, and to the child's sense that change is both possible and welcomed (Slade, 1994; Stern, 2001). It makes clinical sense that flexibility and the ability to tell a nuanced, coherent narrative about the safety of the world are essential to mental health across the course of developments, as language develops and onward into adulthood.

It has been more difficult to uncover and systematically explore preverbal, empirically testable measures of developing preverbal attachment representations and relational strategies. It is hoped that this study will contribute to both the empirical literature which has preceded it, as well as to a developing clinical and theoretical dialogue about the presence and assessment of early risk factors. This study may also contribute to the conceptualization and design of preventive interventions that will allow infants that are already subtly involved in less optimal emotional and cognitive exchanges, even with a new partner, to be engaged in interpersonal exchanges which will strengthen and promote optimal emotional regulation capacities.

Appendix IA.

Significant Tests: Analysis I

4- and 12-Month Vocal Rhythm Coordination → 4-Year Attachment Narratives

I: Vocal Rhythm CIT [2] in Infancy predicts Childhood Attachment CAS

"Switching Pause"
I) - 1:
Mother Switching Pause (w/Infant; Lab) at 4 Mos
FPLOT y=11.735 + 1.198 * (.44) + 9.906 * (x); XMIN=.022 XMAX= .319 TITLE= 'Mother Switching Pause CIT (w/Infant; *Lab)* at 4 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Mother Switching Pause CIT (w/Infant; *Lab*) at 4 Mos' YLABEL= '4 Year Continuous Attachment'

I) - 2:
Infant Switching Pause (w/Stranger; *Lab*) at 4 Mos
FPLOT y=13.863 + 1.53 * (.45) - 21.906 * (x) + 45.153 * (x) * (x); XMIN= .003 XMAX= .544 TITLE= 'Infant Switching Pause CIT (w/Stranger; *Lab*) at 4 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Infant Switching Pause CIT (w/Stranger; *Lab*) at 4 Mos' YLABEL= '4 Year Continuous Attachment'

I) - 3:
Stranger Switching Pause (w/Infant; Home) at 12 Mos
FPLOT y=15.005 + .168 * (.47) - 14.436 * (x); XMIN= .005 XMAX= 0.275 TITLE= 'Stranger Switching Pause CIT (w/Infant; *Home*) at 12 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Stranger Switching Pause CIT (w/Infant; *Home*) at 12 Mos' YLABEL= '4 Year Continuous Attachment'

I) - 4:
Stranger Switching Pause (w/Infant; *Lab*) at 12 Mos
FPLOT y=17.278 + .884 * (.52) - 67.575 * (x) + 188.549 * (x) * (x); XMIN=.038 XMAX= 0.324 TITLE= 'Stranger Switching Pause CIT (w/Infant; *Lab*) at 12 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Stranger Switching Pause CIT (w/Infant; *Lab*) at 12 Mos' YLABEL= '4 Year Continuous Attachment'

"Pause"
I) - 5:
Infant Pause (w/Mother; Home) at 4 Mos
FPLOT y=14.805 + .184 * (.50) + 9.764 * (.143) – 26.773 * (.143) * (.143) - 16.022 * (x); XMIN=.032 XMAX= .348 TITLE= 'Infant Pause CIT (w/Mother; *Home*) at 4 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Infant Pause CIT (w/Mother; *Home*) at 4 Mos' YLABEL= '4 Year Continuous Attachment'

I) - 6:
Stranger Pause (w/Infant; *Lab*) at 4 Mos
FPLOT y=9.304 + .927 * (.45) + .674 * (.107) – 2.33 * (.107) * (.107) + 51.096 * (x) - 137.478 * (x) * (x); XMIN=.025 XMAX= .322 YMIN=10 YMAX=16 TITLE= 'Stranger Pause CIT (w/Infant; *Lab*) at 4 Mos predicts 4 Yr Continuous Attachment' XLABEL= 'Stranger Pause CIT (w/Infant; *Lab*) at 4 Mos' YLABEL= '4 Year Continuous Attachment'

I) – 1

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	13.22	2.152	23
0=Male, 1=Female	.35	.487	23
VR_APSP_RSQ_LMI_4	.1076201	.07908116	23
ASPLMI4SQ	.0092	.01017	23
VR_APP_RSQ_LMI_4	.1193547	.09006692	23
APLMI4SQ	.0100	.01177	23

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.228[a]	.052	.007	2.145	.052	1.153	1	21	.295
2	.427[b]	.183	.101	2.041	.131	3.197	1	20	.089
3	.550[c]	.302	.192	1.935	.119	3.249	1	19	087

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LMI_4

c. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LMI_4, ASPLMI4SQ

i. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

I) - 2

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	12.85	2.084	20
0=Male, 1=Female	.40	.503	20
VR_IPSP_RSQ_LSI_4	.1404497	.11437854	20
ISPLSI4SQ	.0321544	.06436310	20
VR_IPP_RSQ_LSI_4	.1301300	.08899901	20
IPLSI4SQ	.0244586	.03485826	20

Model Summary[k]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.362[a]	.131	.083	1.997	.131	2.709	1	18	.117
2	.379[b]	.144	.043	2.039	.013	.253	1	17	.621
3	.601[c]	.361	.241	1.816	.217	5.442	1	16	.033
4	.615[d]	.378	.212	1.850	.017	.417	1	15	.528
5	.654[e]	.427	.223	1.838	.049	1.197	1	14	.292
6	.678[f]	.460	.211	1.851	.033	.793	1	13	.389

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_LSI_4

c. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_LSI_4, ISPLSI4SQ

d. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_LSI_4, ISPLSI4SQ, VR_IPP_RSQ_LSI_4

e. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_LSI_4, ISPLSI4SQ, VR_IPP_RSQ_LSI_4, IPLSI4SQ

f. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_LSI_4, ISPLSI4SQ, VR_IPP_RSQ_LSI_4, IPLSI4SQ

k. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

I) – 3

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	13.50	2.034	34
0=Male, 1=Female	.44	.504	34
VR_APSP_RSQ_HSI_12	.1094250	.05366066	34
ASPHSI12SQ	.0148	.01569	34
VR_APP_RSQ_HSI_12	.1170481	.07743290	34
APHSI12SQ	.0195	.03000	34

Model Summary[k]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.044[a]	.002	-.029	2.063	.002	.063	1	32	.803
2	.383[b]	.147	.092	1.938	.145	5.272	1	31	.029
3	.395[c]	.156	.072	1.960	.009	.323	1	30	.574
4	.409[d]	.167	.052	1.980	.011	.383	1	29	.541
5	.412[e]	.170	.021	2.012	.003	.090	1	28	.767
6	.428[f]	.183	.002	2.032	.013	.445	1	27	.510

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_HSI_12

c. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_HSI_12, ASPHSI12SQ

d. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_HSI_12, ASPHSI12SQ, VR_APP_RSQ_HSI_12

e. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_HSI_12, ASPHSI12SQ, VR_APP_RSQ_HSI_12, APHSI12SQ

f. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_HSI_12, ASPHSI12SQ, VR_APP_RSQ_HSI_12, APHSI12SQ

k. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

I) – 4

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	13.32	2.001	28
0=Male, 1=Female	.50	.509	28
VR_APSP_RSQ_LSI_12	.1125179	.06707135	28
ASPLSI12SQ	.0169982	.02240606	28
VR_APP_RSQ_LSI_12	.1566881	.11188725	28
APLSI12SQ	.0366228	.05437849	28

Model Summary[k]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.091[a]	.008	-.030	2.031	.008	.217	1	26	.646
2	.248[b]	.062	-.013	2.014	.053	1.425	1	25	.244
3	.571[c]	.326	.242	1.742	.265	9.424	1	24	.005
4	.578[d]	.334	.218	1.770	.007	.254	1	23	.619
5	.581[e]	.337	.187	1.804	.004	.123	1	22	.729
6	.581[f]	.338	.148	1.847	.000	.005	1	21	.943

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_12

c. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_12, ASPLSI12SQ

d. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_12, ASPLSI12SQ, VR_APP_RSQ_LSI_12

e. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_12, ASPLSI12SQ, VR_APP_RSQ_LSI_12, APLSI12SQ

f. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_12, ASPLSI12SQ, VR_APP_RSQ_LSI_12, APLSI12SQ

k. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

I) – 5

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	13.66	1.893	38
0=Male, 1=Female	.47	.506	38
VR_IPSP_RSQ_HMI_4	.1439086	.09134403	38
ISPHMI4SQ	.0288338	.03825093	38
VR_IPP_RSQ_HMI_4	.1165245	.05850723	38
IPHMI4SQ	.0169110	.02041955	38

Model Summary[k]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.089[a]	.008	-.020	1.911	.008	.288	1	36	.595
2	.093[b]	.009	-.048	1.938	.001	.023	1	35	.881
3	.249[c]	.062	-.021	1.912	.053	1.936	1	34	.173
4	.546[d]	.298	.213	1.680	.236	11.075	1	33	.002
5	.546[e]	.298	.188	1.705	.000	.005	1	32	.943
6	.566[f]	.320	.189	1.705	.023	1.032	1	31	.317

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_HMI_4

c. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_HMI_4, ISPHMI4SQ

d. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_HMI_4, ISPHMI4SQ, VR_IPP_RSQ_HMI_4

e. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_HMI_4, ISPHMI4SQ, VR_IPP_RSQ_HMI_4, IPHMI4SQ

f. Predictors: (Constant), 0=Male, 1=Female, VR_IPSP_RSQ_HMI_4, ISPHMI4SQ, VR_IPP_RSQ_HMI_4, IPHMI4SQ,

k. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

I) – 6

Descriptive Statistics

	Mean	Std. Deviation	N
Bretherton Continuous Score - Total 4 Story Score	12.85	2.084	20
0=Male, 1=Female	.40	.503	20
VR_APSP_RSQ_LSI_4	.1064523	.08833087	20
ASPLSI4SQ	.0187443	.03261191	20
VR_APP_RSQ_LSI_4	.0994237	.06631959	20
APLSI4SQ	.0140634	.02262447	20

Model Summary[i]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.362[a]	.131	.083	1.997	.131	2.709	1	18	.117
2	.362[b]	.131	.029	2.054	.001	.010	1	17	.922
3	.363[c]	.132	-.031	2.117	.000	.003	1	16	.956
4	.415[d]	.172	-.048	2.134	.041	.740	1	15	.403
5	.611[e]	.373	.149	1.923	.200	4.474	1	14	.053
6	.617[f]	.380	.094	1.984	.008	.160	1	13	.696

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_4

c. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_4, ASPLSI4SQ

d. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_4, ASPLSI4SQ, VR_APP_RSQ_LSI_4

e. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_4, ASPLSI4SQ, VR_APP_RSQ_LSI_4, APLSI4SQ

f. Predictors: (Constant), 0=Male, 1=Female, VR_APSP_RSQ_LSI_4, ASPLSI4SQ, VR_APP_RSQ_LSI_4, APLSI4SQ

i. Dependent Variable: Bretherton Continuous Score - Total 4 Story Score

Appendix IB.

Significant Tests: Analysis II

4-Year Attachment Narratives → 4- and 12-Month Vocal Rhythm Coordination

II: Childhood Attachment CAS has a Nonlinear Relationship to Vocal Rhythm CIT in Infancy

"Switching Pause"

II) - 1:
Non-Linear ASCT predicts Stranger Switching Pause CIT (w/Infant; Home) at 4 Mos
FPLOT y= -.050 - .054 * (.47) + .205 * (x) – .041 * (x) * (x); XMIN=-1 XMAX=5 YMIN=0 YMAX=.2 TITLE= ' Non-Linear ASCT predicts Stranger Switching Pause CIT (w/Infant; *Home*) at 4 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Stranger Switching Pause CIT (w/Inf; *Home*) 4 Mos'

II) - 2:
Non-Linear ASCT predicts Stranger Switching Pause CIT (w/Infant; Lab) at 4 Mos
FPLOT y=-2.354 - 0.030 * (.36) + .399 * (x) – 0.016 * (x) * (x); XMIN=8 XMAX=18 YMIN= 0 YMAX= 0.2 TITLE= ' Non-Linear ASCT predicts Stranger Switching Pause CIT (w/Infant; *Lab*) at 4 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Stranger Switching Pause CIT (w/Inf; *Lab*) 4 Mos'

II) - 3:
Non-Linear ASCT predicts Infant Switching Pause CIT (w/Stranger; Home) at 4 Mos
FPLOT y=-3.159 – 0.092 * (.47) +.528 * (x) – 0.020 * (x) * (x); XMIN= 0 XMAX= 0.5 TITLE= ' Non-Linear ASCT predicts Infant Switching Pause CIT (w/Stranger; *Home*) at 4 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Inf Switching Pause CIT (w/Stranger; *Home*) 4 Mos'

"Pause"

II) - 4:
Non-Linear ASCT predicts Stranger Pause CIT (w/Infant; Lab) at 4 Mos
FPLOT y=-1.834 – 0.043 * (.40) + .307 * (x) - 0.012 * (x) * (x); XMIN=8 XMAX=18 YMIN= 0 YMAX= 0.15 TITLE= ' Non-Linear ASCT predicts Stranger Pause CIT (w/Infant; *Lab*) at 4 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Stranger Pause CIT (w/Inf; *Lab*) 4 Mos'

II) - 5:
Non-Linear ASCT predicts Infant Pause CIT (w/Mother; Lab) at 12 Mos
FPLOT y=-1.390 – 0.066 * (.46) + .248 * (x) – .010 * (x) * (x); XMIN=8 XMAX=18 YMIN= 0 YMAX= 0.15 TITLE= ' Non-Linear ASCT predicts Infant Pause CIT (w/Mother; *Lab*) at 12 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Inf Pause CIT (w/Mother; *Lab*) 12 Mos'

II) - 6:
Non-Linear ASCT predicts Stranger Pause CIT (w/Infant; Lab) at 12 Mos
FPLOT y= -2.813 - 0.091 * (.50) + .478 * (x) – 0.019 * (x) * (x); XMIN=8 XMAX=18 YMIN= 0 YMAX= 0.15 TITLE= ' Non-Linear ASCT predicts Stranger Pause CIT (w/Infant; *Lab*) at 12 Mos' XLABEL= 'Non-Linear ASCT' YLABEL= 'Stranger Pause CIT (w/Inf; *Lab*) 12 Mos'

II) - 1

Descriptive Statistics

	Mean	Std. Deviation	N
VR_APSP_RSQ_HSI_4	.1430610058	.09426579068	38
0=Male, 1=Female	.47	.506	38
Overall Bretherton Con	13.58	1.940	38
BrethertonCon.SQ	188.0526	49.95076	38

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.166[a]	.027	.000	.09424461299	.027	1.017	1	36	.320
2	.169[b]	.029	-.027	.09552746410	.001	.040	1	35	.843
3	.425[c]	.180	.108	.08902228933	.152	6.302	1	34	.017

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Overall Bretherton Continuous

c. Predictors: (Constant), 0=Male, 1=Female, Overall Bretherton Continuous, BrethertonCon.SQ

d. Dependent Variable: VR_APSP_RSQ_HSI_4

II) – 2

Descriptive Statistics

	Mean	Std. Deviation	N
VR_APSP_RSQ_LSI_4	.1047958	.08799290	22
0=Male, 1=Female	.36	.492	22
Bretherton Continuous Score - Total 4 Story Score	13.09	2.136	22
Brethertonconsq	175.7273	54.41479300	22

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.147[a]	.022	-.027	.08918509	.022	.442	1	20	.514
2	.157[b]	.025	-.078	.09136680	.003	.056	1	19	.815
3	.508[c]	.258	.134	.08188106	.233	5.657	1	18	.029

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score

c. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score, Brethertonconsq

d. Dependent Variable: VR_APSP_RSQ_LSI_4

II) - 3

Descriptive Statistics

	Mean	Std. Deviation	N
VR_IPSP_RSQ_HSI_4	.142505391	.11786431088	38
0=Male, 1=Female	.47	.506	38
Bretherton Continuous Score - Total 4 Story Score	13.58	1.940	38
Brethertonconsq	188.0526	49.95076	38

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.063[a]	.004	-.024	.11925129569	.004	.144	1	36	.706
2	.099[b]	.010	-.047	.12058881301	.006	.206	1	35	.653
3	.426[c]	.182	.109	.11122541457	.172	7.141	1	34	.011

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score

c. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score, Brethertonconsq

d. Dependent Variable: VR_IPSP_RSQ_HSI_4

II) – 4

Descriptive Statistics

	Mean	Std. Deviation	N
VR_APP_RSQ_LSI_4	.0994237	.06631959	20
0=Male, 1=Female	.40	.503	20
Bretherton Continuous Score - Total 4 Story Score	12.85	2.084	20
Brethertonconsq	169.2500	52.55060218	20

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.044[a]	.002	-.054	.06807069	.002	.035	1	18	.854
2	.223[b]	.050	-.062	.06835470	.048	.851	1	17	.369
3	.517[c]	.267	.130	.06185436	.218	4.761	1	16	.044

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score

c. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score, Brethertonconsq

d. Dependent Variable: VR_APP_RSQ_LSI_4

II) – 5

Descriptive Statistics

	Mean	Std. Deviation	N
VR_IPP_RSQ_LMI_12	.1187822	.06212230	28
0=Male, 1=Female	.46	.508	28
Bretherton Continuous Score - Total 4 Story Score	13.36	2.022	28
Brethertonconsq	182.3571	52.11327711	28

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.259[a]	.067	.031	.06114777	.067	1.867	1	26	.183
2	.268[b]	.072	-.002	.06219354	.005	.133	1	25	.718
3	.483[c]	.233	.137	.05770590	.161	5.040	1	24	.034

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score

c. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score, Brethertonconsq

d. Dependent Variable: VR_IPP_RSQ_LMI_12

II) – 6

Descriptive Statistics

	Mean	Std. Deviation	N
VR_APP_RSQ_LSI_12	.1566881	.11188725	28
0=Male, 1=Female	.50	.509	28
Bretherton Continuous Score - Total 4 Story Score	13.32	2.001	28
Brethertonconsq	181.3214	51.51918274	28

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.098[a]	.010	-.028	.11346497	.010	.254	1	26	.618
2	.100[b]	.010	-.069	.11569108	.000	.009	1	25	.925
3	.436[c]	.190	.089	.10680334	.180	5.334	1	24	.030

a. Predictors: (Constant), 0=Male, 1=Female

b. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score

c. Predictors: (Constant), 0=Male, 1=Female, Bretherton Continuous Score - Total 4 Story Score, Brethertonconsq

d. Dependent Variable: VR_APP_RSQ_LSI_12

APPENDIX II: GRAPHS FOR ANALYSES I AND II

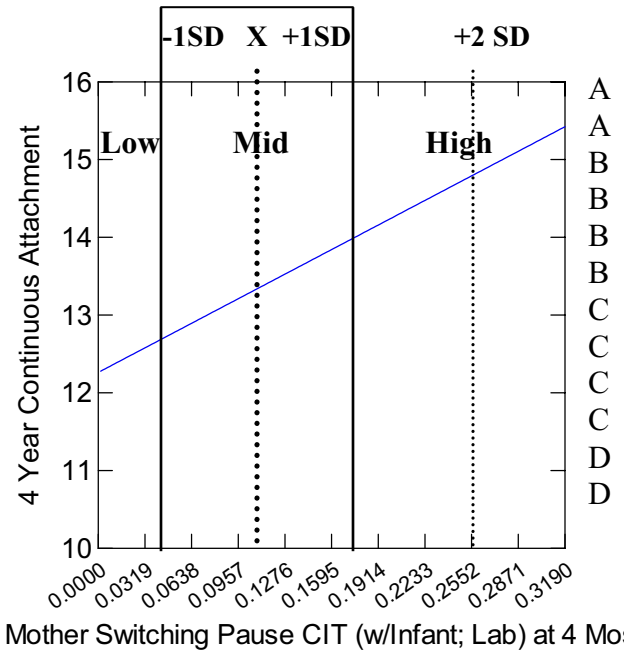
Appendix IIA: Graphs of Significant Models - Analyses I

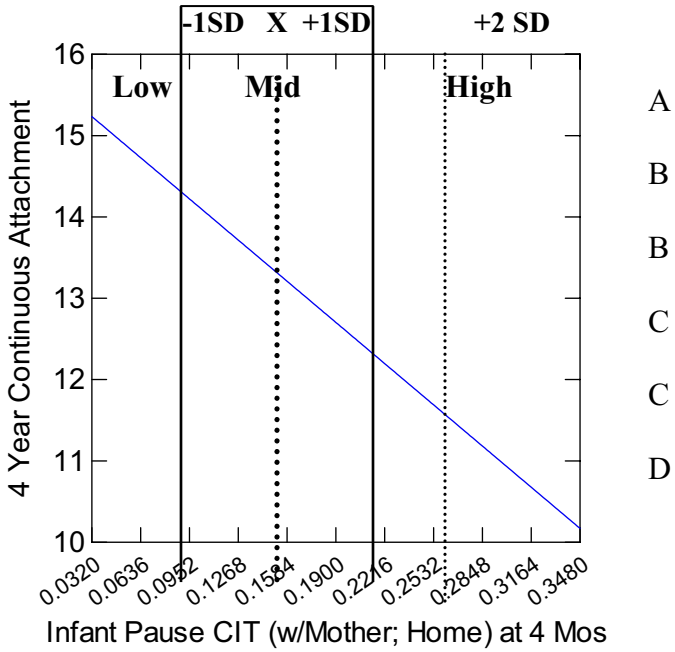
ANALYSIS I:

Understanding the Relation between Patterns of
Vocal Rhythm Coordination (CIT) in Infancy and
Attachment Narratives in Childhood

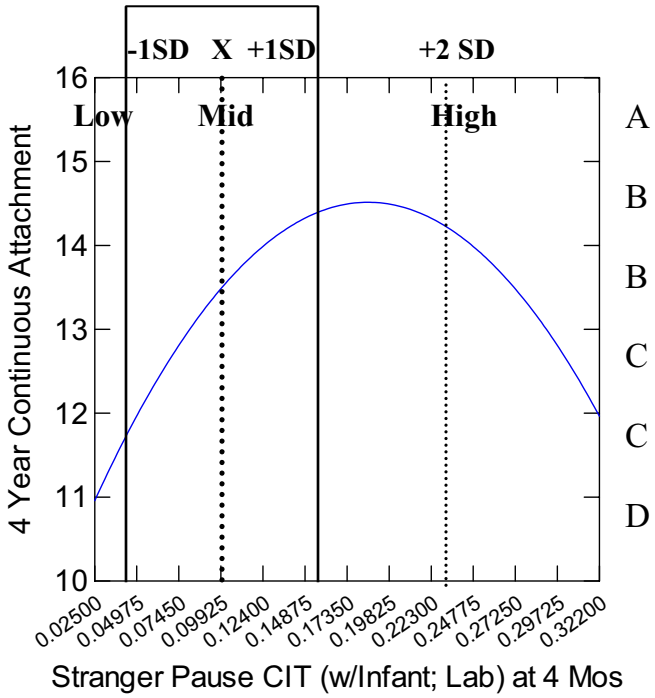
4- and 12-Month Vocal Rhythm Coordination → 4-Year Attachment

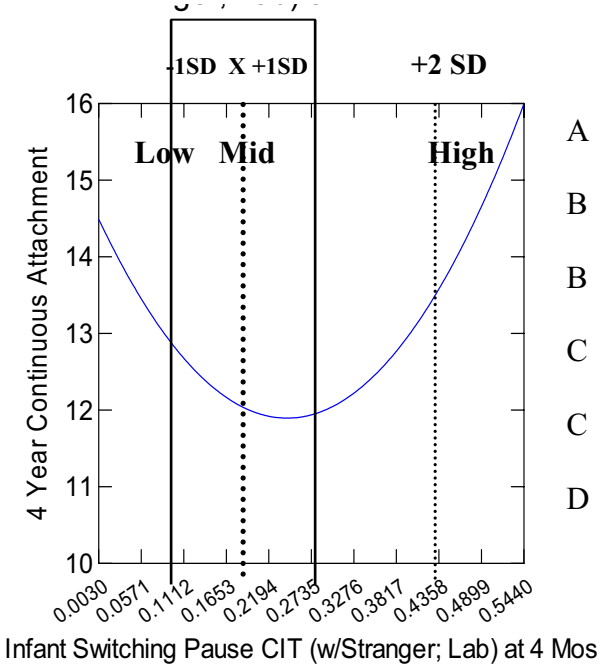
Analyses I: 4-Month Data



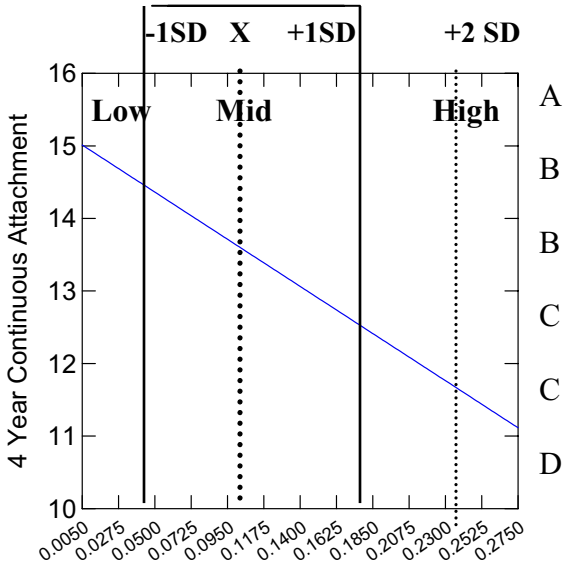


Analyses I: 4-Month Data

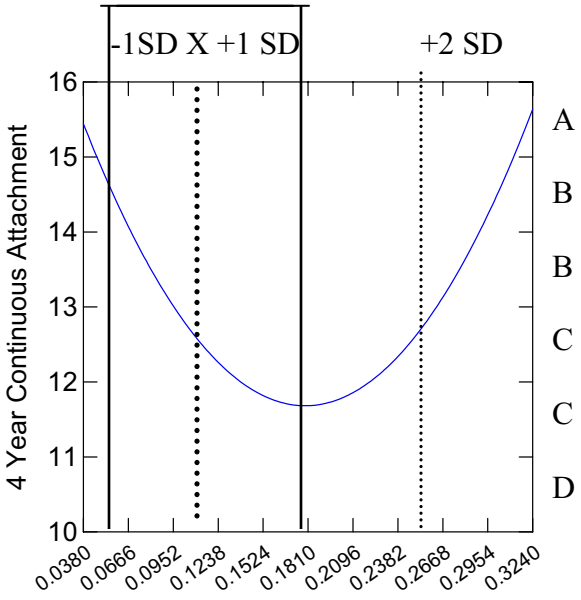




Analyses I: 12-Month Data



Stranger Switching Pause CIT (w/Infant; Home) at 12 Mos



Stranger Switching Pause CIT (w/Infant; Lab) at 12 Mos

Appendix IIB: Graphs of Significant Models - Analyses II

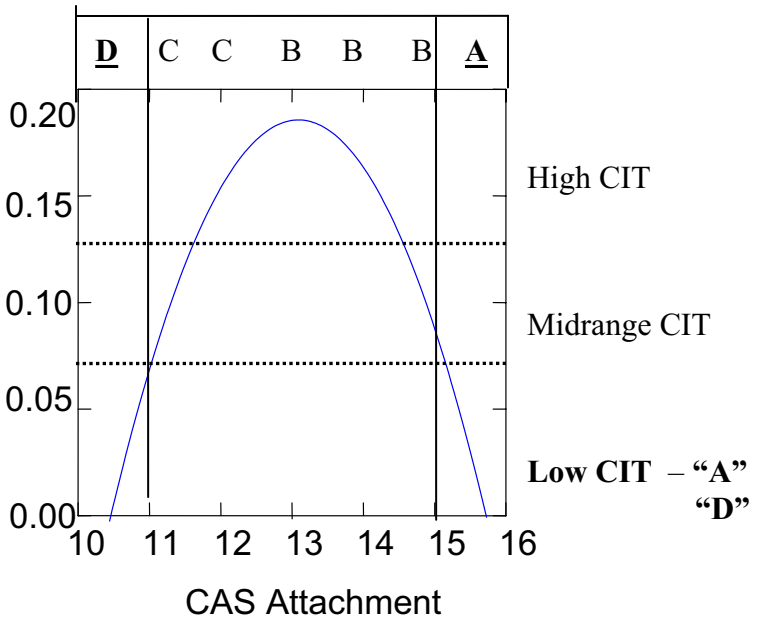
Analyses II:

Understanding the Relation between
Extreme Low (D) and High (A) CAS Attachment in Childhood
and Patterns of Vocal Rhythm Coordination (CIT) in Infancy

4- Year Attachment → 4- and 12-Month Vocal Rhythm Coordination

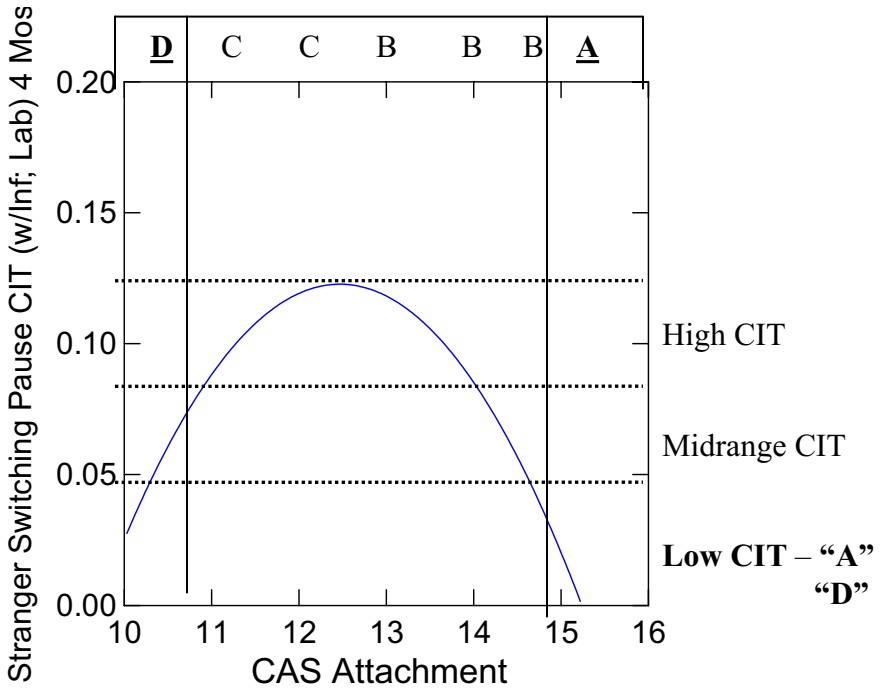
ANALYSIS II: 4-MONTH DATA

4 Yr CAS Attachment is related to
Stranger Switching Pause CIT
(w/Infant; Home) at 4 months



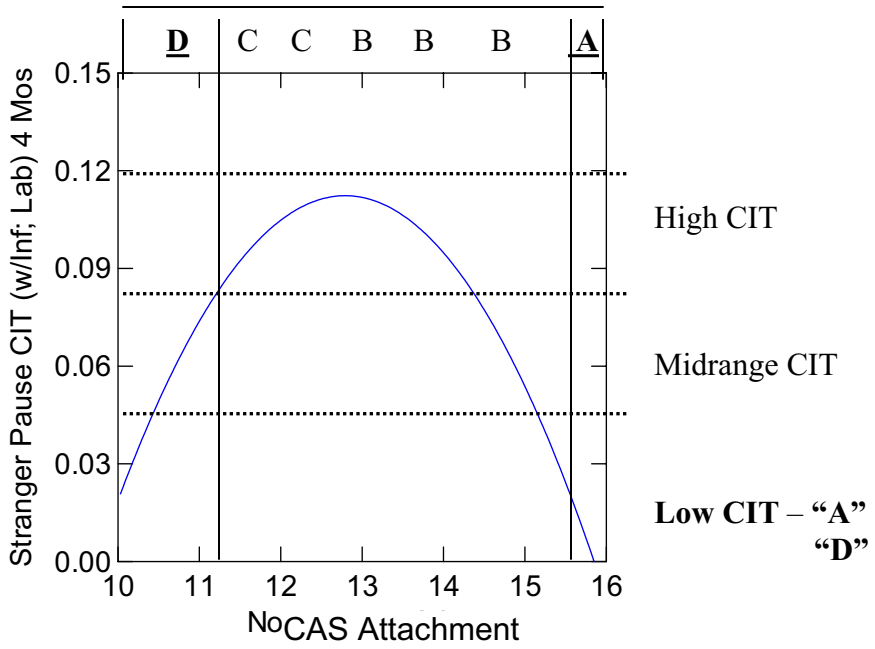
Low Stranger Switching Pause CIT (w/Infant; *Home*) at 4 months is associated with both the ***Lowest (10="D") and Highest (16="A")*** **CAS Scores** at 4 Years

4 Yr CAS Attachment is related to
Stranger Switching Pause CIT
(w/Infant; Lab) at 4 months



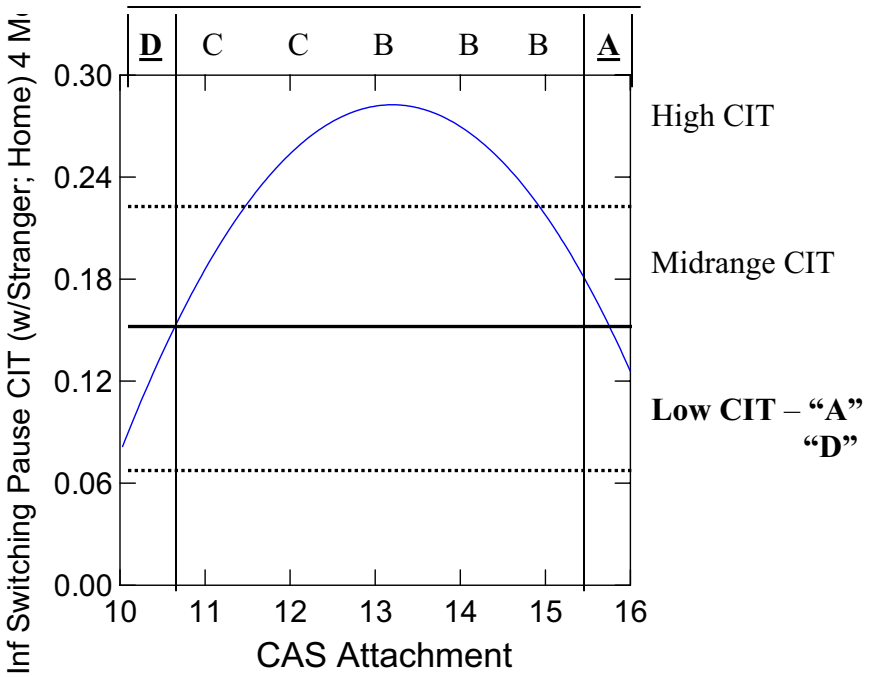
Low Stranger Switching Pause CIT (w/Infant; *Lab*) at 4 months
is associated with both the ***Lowest (10="D") and Highest (16="A")***
CAS Scores at 4 Years

4 Yr CAS Attachment is related to
Stranger Pause CIT
(w/Infant; Lab) at 4 months



Low Stranger Pause CIT (w/Infant; *Lab*) at 4 months
is associated with both the ***Lowest (10="D") and Highest (16="A")***
CAS Scores at 4 Years

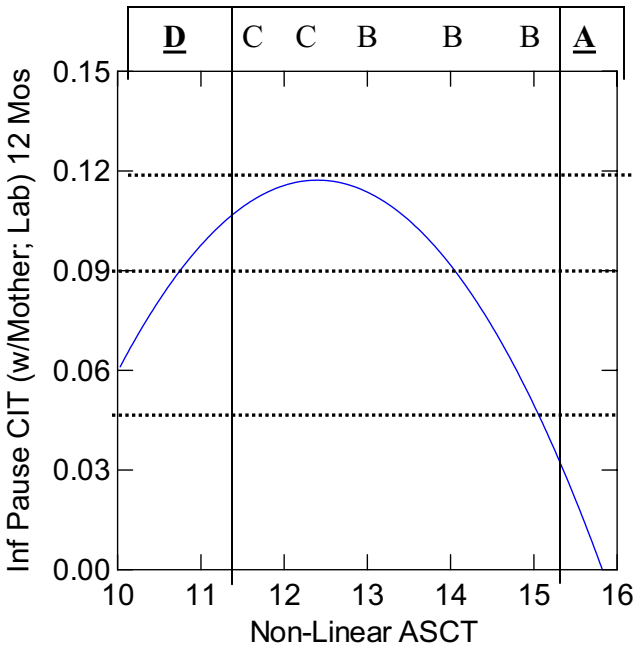
4 Yr CAS Attachment is related to
Infant Switching Pause CIT
(w/Stranger; Home) at 4 months



Low Infant Switching Pause CIT (w/Stranger; *Home*) at 4 months is associated with both the ***Lowest (10="D") and Highest (16="A")*** **CAS Scores** at 4 Years

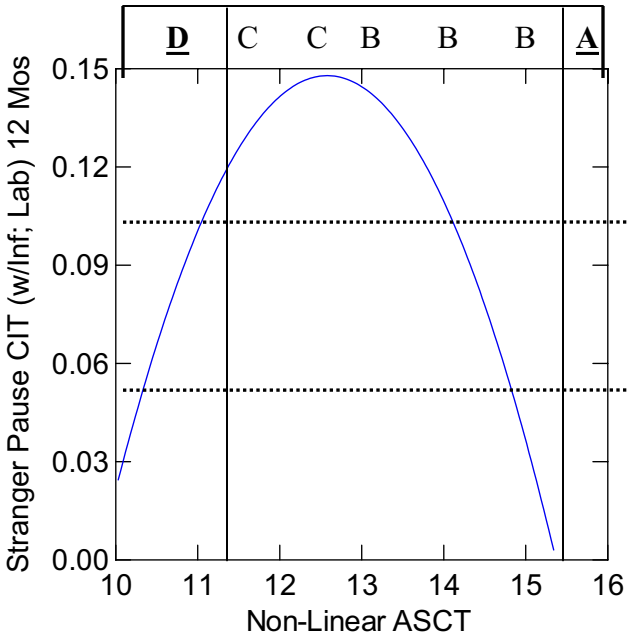
ANALYSIS II: 12-MONTH DATA

4 Yr CAS Attachment is related to
Infant Pause CIT
(w/Mother; Lab) at 12 months



Low Infant Pause CIT (w/Mother; *Lab*) at 12 months
is associated with the ***Highest (16="A")*** **CAS Scores** at 4 Years

4 Yr CAS Attachment is related to
Stranger Pause CIT
(w/Infant; Lab) at 12 months



High CIT

Midrange CIT

Low CIT – "A"
"D"

Low Stranger Pause CIT (w/Infant; *Lab*) at 12 months
is associated with both the ***Lowest (10="D") and Highest (16="A")***
CAS Scores at 4 Years

Appendix III A.

Administration of the Attachment Story Completion Task
(Bretherton, Ridgeway & Cassidy, 1990)

PROCEDURE FOR THE BRETHERTON STORIES

Story 1 (Props included father, mother, two children, a table set with plates and cups, and four chairs): The family was seated around the table eating and doll child spilled his juice. The mother reprimanded the child mildly. The examiner then said “now tell me what happens next”.

Story 2 (Props included father, mother, two children, a green cloth representing grass, and a rock): The family was walking in the park which had a high rock. The child asked thr parents to watch him climb. He then climbed to the top and fell off, crying. The examiner asked the child to continue.

Story 3 (Props included mother, father, two children, and a bed placed some distance from the grouped family): The family was in the family room and the child was told by the parents to go to bed. He did, but returned to his parents, shouting that there was a monster in his bedroom. The examiner asked the child to continue.

Story 4: Part I (Props include father, mother, two children, grandmother, car, and green cloth representing grass):
The family was on the front lawn, and the parents got in the car to go on a trip and said good—bye. A grandmother doll remained to watch the children. The examiner asked the child to continue.

Story 4: Part II (Props included father, mother, two children, grandmother, and car): The grandmother looked out the window and exclaimed to the children that their parents were home from their trip. The parents drove up. The examiner asked the child to continue.

Note: The examiner was permitted to ask once about the story’s attachment related issue (i.e., “what did they do about the spilled juice?”, “what do they do now that mom and dad are home?”) and could prompt with “and what happens next?” as many times as necessary. She could also ask clarification questions when the child’s actions were unclear (i.e., “what is he doing under the covers?”)

THE ASCT STORIES

Introduction of Figures:
Stranger/Examiner: "Look who we have here" (Bring out family.) 'Here's our family. Look. This is the grandma, this is the daddy, this is the mommy, and these are the girls, Jane and Susan (and these are the boys, Bob and George)." (Show them to the child as you name them.)

S: "Who've we got?" (Point to family figures.) "You know what? I've got an idea. Let's pretend to make up some stories about them. Tell you what, how about if I start a story about our family and you finish it."

Warm-up: Birthday Story.
(Figures/Props: 2 Children, Mother, Father, Grandmother; table, dishes, cake.)

S: "Here's their table and what's this?" (Show cake to child and wait for child to name it.) "What kind of cake?" Yes, it's a birthday cake. You listen carefully lo the story. The mommy has baked this beautiful birthday cake and she calls out*, '*Come on grandma, come on Dad, come on boys (girls), let's have a birthday party.'"
S: "Show me what happens now." (inviting tone of voice; let the child play with the figures or tell a story yourself if the child does not.)

Story I: "Spilled Juice"
(Figures/Props: 2 Children, Mother, Father; table, dishes.)

S: "O.K. I think I have an idea for a new story." (Put away the grandmother and set out the figures as below, away from the table.)

S: (Shake the box with the silverware.) "Can you help me set the table for dinner?" (Give box to child, *wait* till child has set the table, help if necessary.)

S: "Now put the family around the dinner table so they're ready to eat" (Wait until child has placed the figures.)

S resumes: "Here is our family eating dinner and Bob (Jane) gets up and reaches and spills his juice" (Make child figure knock cup off toy table so cup is visible to child,), and the mother says, 'Oh, Bob (Jane) you spilled your juice!" (Reproachful tone of voice, but don't overdo; turn Mother toward Bob or Jane, and move her up and down while she talks).

S: "Show me what happens now."

Prompting Procedure

Prompt if child does not spontaneously mention: “What do they do about the spilled juice?” Prompt if child gives only one response: “Anything else?” “What else?” or “Then what?” If child performs ambiguous actions with figures, ask “What are they doing?” and if the child uses an ambiguous pronoun when talking about the figures, ask “Who was doing it?” Stranger can also repeat the child’s statement in question form, to verify what the child said (“The mommy wiped the juice? And then what?”).

If the child asks for the grandmother, say “She’s not in the story. We’ll bring her out again later.” If the child asks for other props, like a bed, etc., bring them out.

Note that these prompts are designed not to suggest precise ideas to the child. The only exception is the prompt that focuses the child’s attention on the attachment related issue (spilled juice) if it has not been addressed.

If the child seems to have finished, or becomes repetitive, say: “All done? Shall we try another? Let’s put these away.”

Story II: “Hurt Knee”
(Figures/Props: Mother, Father, 2 Children, felt for grass, sponge for rock)

S: “O.K. I have an idea for another *story. You* put our family here and get them ready for the next one while I put these away.” S points to the side of the table. (It is important that the rest of the family be about 30 cm away from the rock the story child will climb.)

“O.K. Look what I’ve got.” (Set out piece of green felt and sponge rock.) “This is the park. Do you sometimes go to the park with your mom and dad?’ “Here is our family and they’re out walking in the park, and at this park there is this high, high rock. And (Jane/Bob) says, ‘Look, mommy and daddy. Watch me climb this high, high rock,’ (Make child figure climb rock, then fall off.) “’Boo-hoo (or ouch). I’ve hurt my knee (crying voice).’ Show me what happens now.”

Prompt if child does not mention spontaneously. “What do they do about .the hurt knee?” If necessary, use other prompts.

Story III: "Monster in the Bedroom"
(Figures/Props: 2 Children, Mother, Father; bed with felt blanket)

S: "Can you get the family ready for the next one?" (Help child to set out the props). Again, it is important to have the rest of the family at least *30cm from* the bed in the "bedroom.")

S: "Look what happens now. Listen carefully."
(Face Mother toward story child and move her slightly as she speaks.) "Mother says, 'It's bedtime. Go up to your room and go to bed. And father says, 'Go up to bed now.'"(Same action as with Mother doll with deep voice.), and the boy/girl says 'O.K., mommy and daddy. I'm going.'" (Make child figure walk to bed.)

S comment: "So he/she goes upstairs to the bedroom, and then he/she says, 'Mommy! Daddy! There's a monster in my room! There's a monster in ray room!" (Alarmed tone of voice.). "Show me what happens now."

Prompt if child does not mention spontaneously. "What do they do about the monster in the room*?"* If necessary, use other prompts.

Story IV: "Departure Story"
Part I: Departure
(Figures/Props: 2 Children, Mother, Father, Grandmother; felt grass, box for car)

S: "Let's use the grandmother this time." (Set out family and grandmother at side of table, with green felt and car; it is important to have the car in front of the child. and the two parents facing the grandmother and two children.)

S: "Here we have their front lawn, and here we have their car, this is the family car." (Make mom and dad face the children and grandma, with car in front of child.)

S: "You know what it looks like to me? It looks like the mommy and the daddy are going on a trip. So, the mommy says, 'O.K. boys (girls). Your dad and I are going on a trip. We are leaving on our trip now." (Move Mother slightly as she speaks to the children.) And the father says, 'See you tomorrow. Grandma will stay with you.' (Move Father slightly, like Mother). "Show me what happens now."

Important: T should let the child put the figures in the car and make the car drive off. Only intervene if the child seems unable to make the car drive off. If the child puts the children in the car say, "No. only The mom and dad are going." If necessary, help to make the car drive off, and put the car under the table; out of sight. If the child wants to retrieve the car, reply, "No. They aren't coming back yet."

S: "And away they go." (As the car is moved under the table.)

Prompt if child does not spontaneously mention. “What do the children do while the mom and dad are gone?” and use other prompts as necessary.

Part II: Reunion
(Same Props as Part I: Departure)
Bring the car with the two parents back out from under the table and set it on the table a distance from the family (i.e., keep it near so the child has to reach for it and an make it drive “home”). If the child has put the child and grandmother figures in be middle of the table during the previous story, put them back close to the child to create distance between the returning car and the child figures).

S: “O.K. And you know what? It’s the next day and the grandma looks out of the window (make Grandma look toward car, move her as she speaks) and she says, ‘Look boys (girls), here come your mommy and daddy. They’re home from their trip.’ Show me what happens now.” (Let child drive car toward “home,” intervene only if the child does not do so.)

Prompt if child does not spontaneously take the figures out of the car. “What do they do now that the mom and dad are home?” Use other prompts as needed.

Appendix III B.

Comparison of Bretherton Weighted v. Continuous Attachment Scale Scoring

Description of the Continuous Attachment Scale (CAS) System of Coding the ASCT

In order to extend the scope of this data set by making it more directly comparable to other studies of attachment over the life span, the original method of categorizing children's attachment strategies in terms of increasing levels of security was re-conceptualized. In keeping with both the theory and clinical utility of attachment theory, both as it applies to infancy and adulthood, children's narratives were re-scored and classified according to a Continuous Attachment Scale (Markese, 2007), which was both created and empirically tested in this study.

CAS scoring was designed to unpack ASCT categorical coding by representing a sum of all the child's scores in relationship to all four attachment story stems of the ASCT. Thus, a more nuanced range of scores was elucidated. The CAS not only allowed for all stories to be represented in the analysis, it provided a needed method of exploring the theoretical and clinical concept of the importance of flexibility, creativity and emotional engagement in developing attachment security and optimal relational development.

Those children who were at the lowest and highest ends of the CAS spectrum were thought to demonstrate an extreme strategy of either becoming disorganized and dysregulated in the face of difficult emotional themes, or of becoming overly "busy" and focused on neat problem solving strategies at the expense of engaging the content and process of the attachment measure in a creative, explorative manner optimal for socio-emotional development, and indicative of optimally developing symbolic play skills.

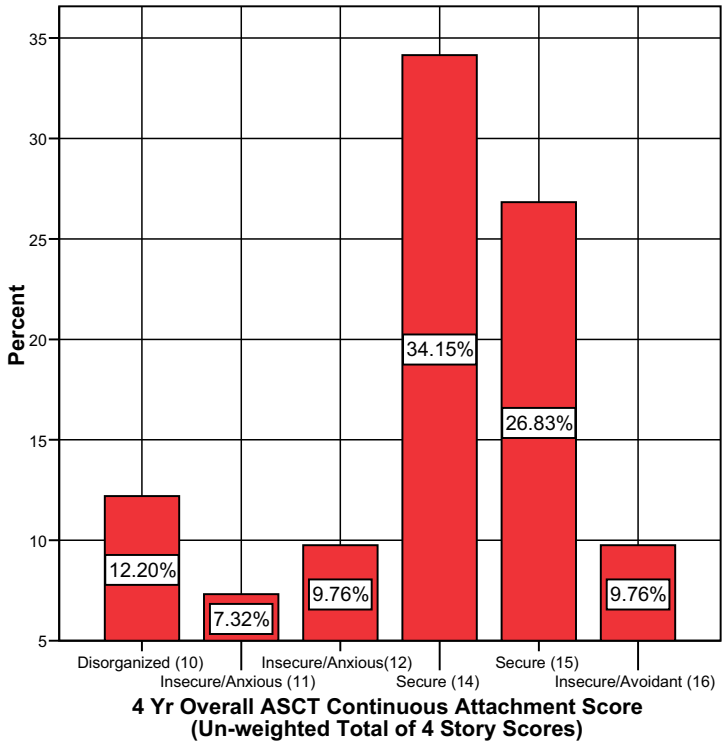
The theory of the importance of a flexible co-constructed system for optimal social- emotional development guided the analyses, and served as the argument for translating the original system of categorization to one that parallels the attachment classifications of the longitudinal literature, both in infancy and adulthood. Re-thinking ordinal attachment coding of the ASCT measure specifically affected the interpretation of those children who achieved "perfect" scores, indicating minimal prompting by the examiner during the narrative play task and maximal focus on addressing the attachment-related "dilemma" on all four stories. While it only affected the classification of a few extreme cases, this shift re-conceptualized pre-school attachment as more similar to both the behavioral assessment of infant attachment and the narrative assessment of adult attachment.

Pre-school children engage in play behaviors while using their conceptual and cognitive skills to generate a coherent, meaningful story which is told in relation to a novel play partner. "Solving" the problem without creative, playful diversions, or the exploration of meaningful narrative paths does not have the feeling of a child who explores and organizes the world in a balanced manner. Therefore, these children were re-classified according to the CAS as demonstrating Insecure/Avoidant patterns of attachment representations.

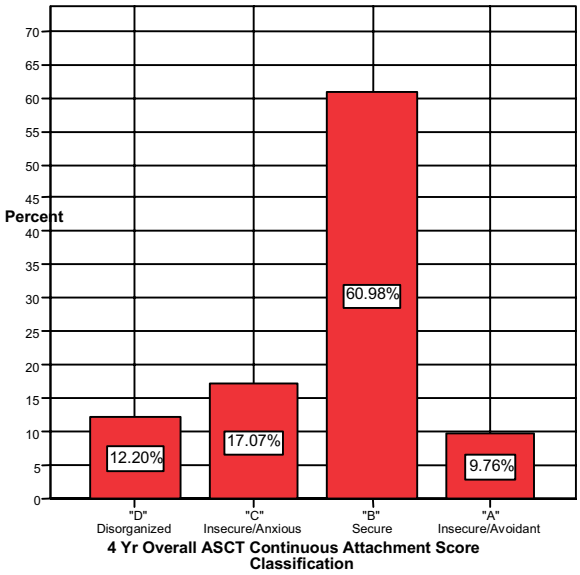
Thus, the development and investigation of the CAS sought to empirically investigate the theoretical concept that a balanced, open and flexible approach to affective meaning-making is optimal for children's social and emotional development (see Oppenheim, 2006), as well as to translate clinically observed child attachment.

Continuous Attachment Scale System:

1) Level of **Individual Stories** (***Sum*** of 4 Individual Story Scores)



2) Level of **Overall Attachment Classification**



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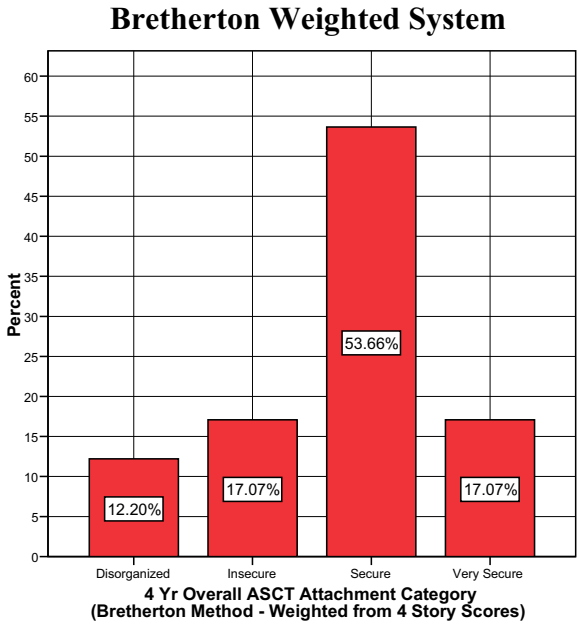
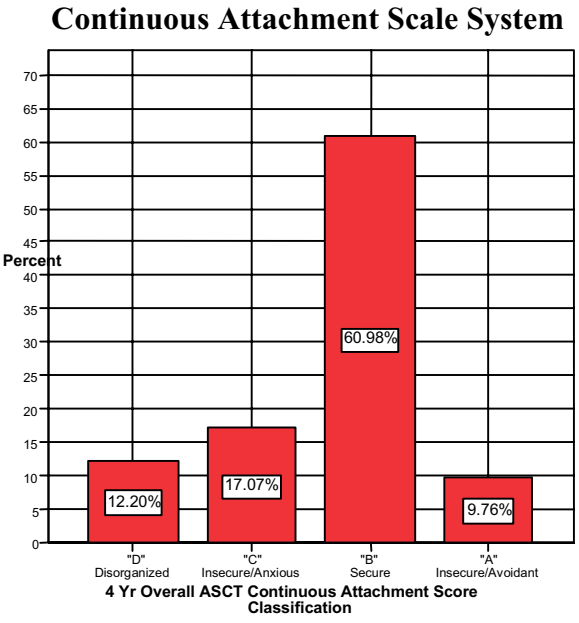
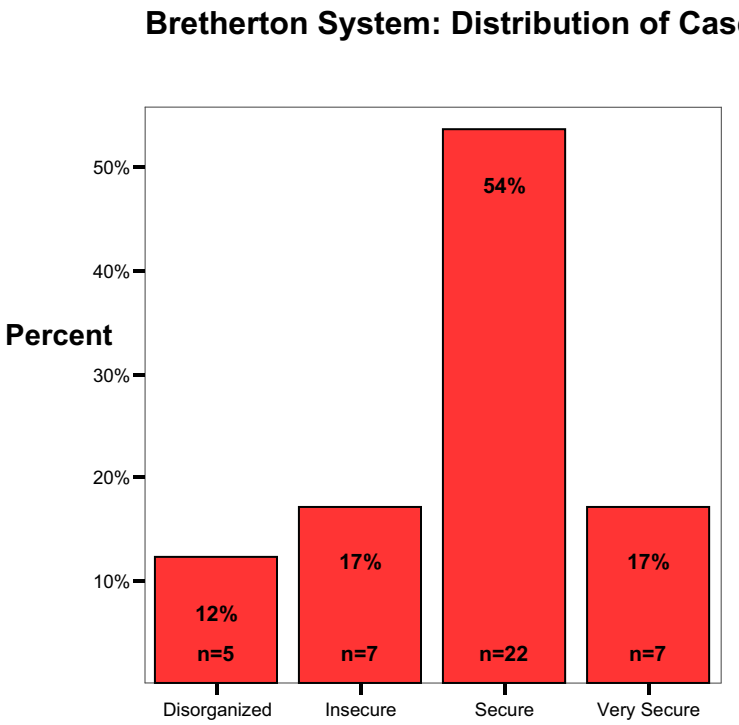




Bretherton Weighted System - *Overall Attachment Classification*

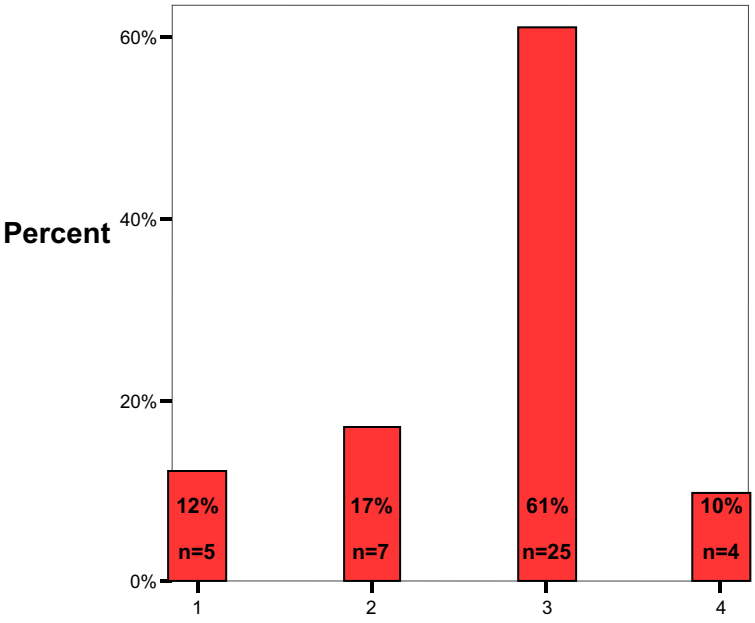


1 = Disorganized (Overall Classification)
2 = Insecure (Overall Classification)
3 = Secure (Overall Classification)
4 = Very Secure (Overall Classification)

Continuous Attachment Scale - *Overall Attachment Classification*

Sum of 4 Individual Story Scores Equivalent Category	CAS Classification Label	Bretherton
10	Disorganized	(1)
11	Resistant	(2)
12	Resistant	(2)
14	Secure	(3)
15	Secure	(3)
16	Avoidant	(4)

Continuous Attachment Scale: Distribution of Cases



1 = Disorganized (Continuous Score - 10)
2 = Resistant (Continuous Score - 11, 12)
3 = Secure (Continuous Score - 14, 15)
4 = Avoidant (Continuous Score - 16)

Bretherton Weighted Classification v. CAS Continuous Classification:
Case by Case Comparison

				CAS Classification
Bretherton Classification	Disorganized	1		Disorganized
		2		Disorganized
		3		Disorganized
		4		Disorganized
		5		Disorganized
		Total	N	5
	"Insecure"	1		"Resistant"
		2		"Resistant"
		3		"Resistant"
		4		"Resistant"
		5		"Resistant"
		6		"Resistant"
		7		"Resistant"
		Total	N	7
	Secure	1		Secure
		2		Secure
		3		Secure
		4		Secure
		5		Secure
		6		Secure
		7		Secure
		8		Secure
		9		Secure
		10		Secure
		11		Secure
		12		Secure
		13		Secure
		14		Secure
		15		Secure
		16		"Secure"
		17		Secure
		18		Secure
		19		Secure
		20		Secure
		21		Secure
		22		Secure
		Total	N	22
	"Very Secure"	1		"Secure"
		2		"Secure"
		3		"Secure"
		4		"Avoidant"
		5		"Avoidant"
		6		"Avoidant"
		7		"Avoidant"
		Total	N	7
	Total	N		41

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Appendix IV:

ASCT Attachment Narratives – Child Transcripts

I. Avoidant Attachment – CAS ASCT Score = 16

II. Secure Attachment – CAS ASCT Score = 14

III. Resistant Attachment – CAS ASCT Score = 12

IV. Disorganized Attachment – CAS ASCT Score = 10

Avoidant Attachment Narratives
[4-year-old Male]

Story I: "Spilled Juice"

S: "Mommy says, 'Oh, Bob, you spilled your juice'…What happens then?"

C: [Carefully stands up overturned cup]

S: "What happens next?"

C: "George reaches up for his juice but he doesn't spill his juice."

S: "But what do they do about the spilled juice?

C: "Wipe it clean!"

S: "Anything else?"

C: "Nope."

Story II: "Hurt Knee"

S: "The boy says, 'Watch me climb this high rock. Boo, hoo, I hurt my knee.' What happens next?"

C: "Then he gets a band aid."

S: "Anything else?"

C: [Shakes head "no"]

S: "Who puts the band aid on him?"

C: "His dad."

S: "Oh, okay."

Story III: "Monster in the Bedroom"

S: "The boy walks up to bed and he says, 'Mommy, Daddy, there's a monster in my room!'"…
"Show me what happens now."

C: "You know what they do, they have a big fight!"

S: "But what do they do about the monster?"

C: "They kill him."

S: "Who kills him?"

C: "George (boy)…with a bow and arrow"

S: "Does anything else happen?"

C: [Shakes head "no"]

Story IV: "Separation/Reunion"

Part I - Separation:

S: "Mommy says, 'Okay boys we're going on a trip,' and dad says, 'Okay, we're going on a trip, Grandma will take care of you'…What happens next?"

C: "And then, they watch a movie!

S: "But what happens first, do they get in and drive away?"

C: "Yes, but then they watch a movie."

S: "And then what happens?"

C: "These guys, ww…www…watch, these guys www…www…watch Robin Hood."

S: "Okay, so what happens now, now they're gone?"

C: "Now they eat macaroni and cheese, and then they take a bath…"

S: "And what else?"

C: "And then they go to bed. And then she takes care of them (grandma), then she goes to bed."

Part II - Reunion:

S: "It's the next day, and the grandmother looks out the window and says, 'Look boys, here come your mommy and daddy! They're home from their trip.' Show me what happens now."

C: "Then…then…then. We better get them to stand up [works at turning the dolls' legs].

S: "What happens then, what do they do now that mom and dad are home?"

C: "Now, now, the boys sit down and watch Robin Hood!"

S: "Who did they watch Robin Hood with?"

C: "With their mom! With their dad!" [Sits boys, then mom and dad down together].

Secure Attachment Narratives
[4-year-old Female]

Story I: "Spilled Juice"

S: "Mommy says, 'Oh, Jane, you spilled your juice'…What happens then."

C: "Then she cleans it up."

S: "Who cleans it up? The mother or Jane?"

C: [Points to mother].

S: "Does anything else happen?"

C: "No."

S: "So, what do they do after the juice is cleaned up?"

C: "She doesn't reach for her juice. She just…It's too full right now!

S: "Umm, so what does she do?"

C: "She just takes a sip without reaching for it."

S: "Umm. Anything else?"

C: [Shakes head "no"].

Story II: "Hurt Knee"

S: "The girl says, 'Watch me climb this high rock. Boo, hoo, I hurt my knee.' What happens next."

C: "But then, Jane gets up and goes home with her family. They take a choo choo train to her house.

S: "But what do they do about her hurt knee?"

C: "Well, they put a band aid on it I guess. But the dog can't be on the choo choo train, so they come back to get their dog. Then they all go home!"

Story III: "Monster in the Bedroom"
S: "The girl walks up to bed and she says, 'Mommy, Daddy, there's a monster in my room!'"…"Show me what happens now."

C: "They say it's just an… it's just your imagination!"

S: "And what happens then, what does she do?"

C: "Goes back to bed."

S: "And what happens with the monsters?

C: "What?"

S: "Where do the monsters go?"

C: "Hiding!"

S: "Is she afraid anymore?"

C: "No, but maybe she needs another blanket to cover her up! And her and her sister can share the bed."

Story IV: "Separation/Reunion"
Part I - Separation:
S: "Mommy says, 'Okay girls we're going on a trip,' and dad says, 'Okay, we're going on a trip, Grandma will take care of you while we're away'…What happens next?"

C: [Puts mom and dad in car].

S: "Okay, so mom and dad are going away on their trip. What happens then?"

C: "They're in the car driving away. Bye, bye!"

Part II - Reunion:

S: "It's the next day, and the grandmother looks out the window and says, 'Look girls, here come your mommy and daddy! They're home from their trip.' Show me what happens now."
C: [Takes mom and dad out of the car]

S: "What happens now that mom and dad are home?"

C: "Well, I guess they will have some dinner. Here are there dinner things, so I guess they will set the table." [Sets up dinner table carefully]. "Oh, and here's a cake, for dessert!"

Resistant Attachment Narratives
[4-year-old Female]

Story I: "Spilled Juice"

S: "Mommy says, 'Oh, Susan, you spilled your juice'…What happens then."

C: "I don't know."

S: "What are they going to do about the spilled juice?"

C: "Wipe it."

S: "Who is going to wipe it up?"

C: [Points to girl]

S: "And then what are they going to do?"

C: "Have dinner again."

S: "What's mommy going to do?"

C: "Where is the birthday cake? Where is the grandma?" [Goes under table].

S: "So, what do they do about the spilled juice?

C: "Wipe."

S: "Who wiped it up?"

C: [Points to the girl].

S: "The little girl, Susan. And what did mommy do?

C: "Helped her."

Story II: "Hurt Knee"

S: "The girl says, 'Look mommy and daddy! Watch me climb this high rock. Boo, hoo, I hurt my knee.' What happens next."

C: [Long shrug, smiling, looking shyly partially towards examiner].
"She have to have a band aid on it."

S: "What do they do about her hurt knee?"

C: "Put a band aid on it.

S: Who puts the band aid on it?

C: [Points to father]

S: "Daddy puts the band aid on her?"

C: [Nods "yes" leaning far back in chair with shrugged shoulders and hands in the air].

Story III: "Monster in the Bedroom"

S: "The girl walks up to bed and she says, 'Mommy, Daddy, there's a monster in my room!'"…
"Show me what happens now."

C: "I don't know." [Smiles shyly, sitting half off of chair].

S: "What do they do about the monster?"

C: [Shrugs shoulders in short burst repeatedly, looking askew at examiner].

S: "What are they going to do when she comes down and says, 'There's a monster in my room.'"

C: "I don't know" (*low, serious tone*).

S: "You don't know what they're going to do?"

C: [Shakes head "no"].

S: "You don't know what mommy and daddy are going to do?

C: [Shakes head "no"]. "Will you tell me?" (*speaks in low growl voice with mouth closed*).

S: “You can tell me. What could they do about the monster?”

C: “Kill the monster.” (*low growl*).

S: Who would kill the monster?

C: [points to father].

S: The daddy? And then the little girl could go to bed?

C: [Shakes head “yes”, begins sucking thumb and pulling at her earlobe].

Story IV: “Separation/Reunion”

Part I - Separation:

S: “Mommy says, ‘Okay girls we’re going on a trip,’ and dad says, ‘Okay, we’re going on a trip, Grandma will take care of you while we’re away’…What happens next?”

C: “I don’t know.” (*low growl voice*).

S: “Okay, they get in the car and they drive away, and then what happens?”

C: “They go in to the garden!” [Bounces girl up and down, from table to the top of her head].

S: “Okay, and then what happens next?”

C: “I don’t know.” [Turns girl to sitting position, back and forth]

Part II - Reunion:

S: “It’s the next day, and the grandmother looks out the window and says, ‘Look girls, here come your mommy and daddy! They’re home from their trip.’

C: “Now why don’t they all go on a trip? Let’s all go on a trip.” [Grabs car with mom and dad from examiner and starts to shove girl doll inside].

S: “No, but now they’re coming back. What happens when mom and dad come back?”

C: “Oh…(*sad voice*) [sits back from the table] I don’t know.” [Puts girl in her mouth with both hands]

S: “What do they do now that the mom and dad are home?

C: “Come inside.” [Puts arm over her head across her eyes].

S: “Come inside. And what do they do then?”

C: [Shrugs with eyes scrunched, sitting back from table].

S: “You don’t know?”

C: [Shakes head “no”].

Disorganized Attachment Narratives
[4-year-old Male]

Story I: "Spilled Juice"

S: "Mommy says, 'Oh, Bob, you spilled your juice'…Tell me what happens next."

C: "They die, die." *(whisper/growl voice)* [Takes father and kicks boys from their chairs].

S: "Oh. What do they do about the spilled juice?

C: "They kill, kill….pachoo, pachoo…" *(whisper/growl voice)* [Moves father up and down].

C: "Then someone spills something else (other "boy") and he kills, blahhh….." [Moves father towards other boy lying on the ground].

S: "Anything else?"

C: "Then she spills hers, ahhh, haaaa… (*drawn out growl/laugh*)." [Knocks over mother and her juice with the father].

….Ended by examiner

Story II: "Hurt Knee"

S: "The boy says, 'Watch me climb this high rock. Boo, hoo, I hurt my knee.' Show me what happens next."

C: "I don't know"

S: "What do they do about the hurt knee?"

C: "They put a band aid on it."

S: "Anything else?"

C: "He says 'why'd you climb this rock'…ahhh, plllhhh….." [Takes other "boy" and knocks down mother and father]

S: "What do they do about this boy's hurt knee?"

C: Inaudible, child climbs under table, covering mouth and making noises.

….Ended by examiner

Story III: "Monster in the Bedroom"

S: "The boy walks up to bed and he says, 'Mommy, Daddy, there's a monster in my room!'"…
"Show me what happens now."

C: "So here's his bed." [Picks up bed, knocking figure off bench].

S: "Okay, but, show me what happens now."

C: "They say, 'it's just a dream!'" (*mocking tone)*

S: "But what do they do about the monster?"

C: "Nothing. 'It's just a dream (*mocking tone*), now go back to bed!' So here's his blankie, so he went back to bed. And then the twins, they don't need blankies, then the two go, 'c'mon E., go back to bed…inaudible...They have a dream that's really bad about the monster."

S: "What happens next?"

C: "Then the family doesn't know where they are, where E. and R. (boys) are sleeping." [Turns the bed upside down and hides the boys under the overturned bed, covered by the blanket].

S: "What happens next?"

C: "Then the other girl comes and then they find them, and take it off (blanket) and find the two boys that are asleep together." [Hides father under bed alone].

….Ended by examiner

Story IV: "Separation/Reunion"

Part I - Separation:

S: "Mommy says, 'Okay boys we're going on a trip,' and dad says, 'Okay, we're going on a trip, Grandma will take care of you'…What happens next?"

C: "Grandma says 'Go to sleep.' And they don't go to sleep."

S: "And then what happens?"

C: "She says 'If you don't go to sleep, I'll beat you.'"

S: “And then what happens?”

C: “I don’t know where the grandpa is?” [Crawls under table].

S: “What do they do now that mom and dad are gone?”

C: “They say, ‘Mommy, wah, wah,…inaudible...’ and then they hit their grandma.” [Takes both boy dolls and knocks grandmother over].

S: “Okay.” [Begins moving mother doll back to table for story end]

C: “‘Yippee, yippee, yippee’, and then they hit her.” [Takes both boy dolls and hits mother]. “Then she’s dead.” [Looks up and smiles].

S: “Okay, ready for the next part of the story.”

….Ended by examiner

Part II - Reunion:

S: “It’s the next day, and the grandmother looks out the window and says, ‘Look boys, here come your mommy and daddy! They’re home from their trip.’”

C: “‘Blawee, blawee…inaudible…” [Moves boy dolls above his head]

S: “Show me what happens now.”

C: “They got in.” [Takes mom and dad out of car…looks at mom doll silently]

S: “What do they do now that mom and dad are home?”

C: [Silently moves mom doll’s legs, looking down, unresponsive]. Pause
“I don’t know!” [Moves one boy and then the other next to the mom doll].

S: “What do they do now that mom and dad are home?”

C: “They sit and read a book. It’s night time.”

S: “Umm, hmm, anything else?”

C: [Inaudible, leaves chair to look under table. Brings out bench and lays mom doll down]

S: “Okay, now you can play with those for a few minutes.”

….Ended by examiner

References

Abela, J., Hankin, B., Haigh, E., Adams, P., Vincakuroff, T., Trayhern, L. (2005). Interpersonal vulnerability to depression in high risk children: The role of insecure attachment and reassurance seeking. *Journal of Clinical Child and Adolescent Psychology, 34(1),* 192-194.

Ainsworth, M. D., & Wittig, B. A. (1969). Attachment and exploratory behavior in one-year-olds in a strange situation. In B.M. Foss (Ed.), *Determinants of infant behavior* Vol. 4. London: Methuen.

Ainsworth, M., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Altman, S., Marcus, L., Monk, C., Abrams, K., & Ward, M. (1991, April). *Adolescent mothers and their children: Attachment at 12 months and children's doll play at 42 months*. Paper presented at the biennial meeting of the Society for Research in Child Development, Seattle.

Bayley, N. (1969). *Manual for the Bayley Scales of Infant Development*. New York: Psychological Corporation.

Beebe, B. (1985). Interpersonal timing: the application of an adult dialogue model to mother-infant vocal and kinesic interactions. In T. Field and N. Fox (Eds.), *Social Perception in Infants.* Norwood: Ablex.

Beebe, B. (2000). Co-constructing mother-infant distress: The micro-synchrony of maternal impingement and infant avoidance in the face-to-face encounter. *Psychoanalytic Inquiry, 20*(3), 421-440.

Beebe, B., Jaffe, J., Chen, H., Cohen, P., Buck, K, Feldstein, S. et al. (2003). Mother-Infant Self- and Interactive Regulation and Distress at 4 Months: Maternal States of Mind, Mother and Infant Behavioral Distress Patterns, and 12 Month Infant Attachment. Report to NIMH RO1 MH 56130.

Beebe, B. (2003). Faces-in-relation: Forms of intersubjectivity in adult treatment of early trauma. *Psychoanalytic Dialogue* (in press).

Beebe, B. (2005). Mother-infant research informs mother-infant treatment. *Psychoanalytic Study of the Child, 60,* 7-47.

Beebe, B., Alson, D., Jaffe, J. (1988). Vocal congruence in mother-infant play. *Journal of Psycholinguistic Research, 17(3),* 245-259.

Beebe, B., & Gerstman, L. (1980). The "packaging" of maternal stimulation in relation to infant facial-visual engagement: A case study at four months. *Merrill-Palmer Quarterly, 26*(4), 321-339.

Beebe, B., Jaffe, J., Cohen, P., Chen, H., & Buck, K. (2000). Systems models in development and psychoanalysis: The case of vocal rhythm coordination and attachment. *Infant Mental Health Journal 21: 99-122.*

Beebe, B., J. Jaffe, Cohen, P., Chen, H., & Buck, K. (2003). *Mother-infant self- and interactive regulation as a function of maternal states of mind.* Unpublished NIMH Report.

Beebe, B., Jaffe, J., Feldstein, S., Hane, A., Crown, C., Markese, S., Jasnow, M., & Moore, M. (2007). *Heterotypic and homotypic continuity in vocal rhythm coordination from 4 months to 12 months*. Unpublished Manuscript, New York State Psychiatric Institute.

Beebe, B., Jaffe, J., & Lachmann, F. (1992). A dyadic systems view of communication. In N. Skolnick & S. Warshaw (Eds.), *Relational Perspectives in Psychoanalysis,* pp. 61-81. Hillsdale, NJ: Analytic Press.

Beebe, B., Lachmann, F., & Jaffe, J. (1997). Mother-infant interaction structures and presymbolic self- and object representations. *Psychoanalytic Dialogues, 7 (2),* 133-182.

Beebe, B. & Lachmann, F. (2002). *Infant research and adult treatment: Co-constructing Interactions.* New York: Analytic Press.

Beebe, B., & McCrorie, E. (1997). A model of love for the 21st century: Literature, infant research, adult romantic attachment, and psychoanalysis. *Self Psychology Conference Proceedings, Washington, D.C.*.

Beebe, B., & McCrorie, E. (1999). A model of love for the 21st century: Literature, infant research, adult romantic attachment, and psychoanalysis. *Division 39 Conference Proceedings, Denver, Colorado.*

Beebe, B., Stern, D., & Jaffe, J. (1979). The kinesic rhythm of mother-infant interactions. In A. Siegman & S. Feldstein (Eds.), *Of speech and time: Temporal speech patterns in interpersonal contexts* (pp. 23-34). Hillsdale, NJ: Erlbaum.

Belsky, J., Rovine, M. J., & Taylor, D. G. (1984). The Pennsylvania infant and family development project III. The origins of individual differences in infant-mother attachment: Maternal and infant contributions. *Child Development, 55*, 718-728.

Bretherton, I. (1985). Attachment theory: Retrospect and prospect. In I. Bretherton & E. Waters (Eds.), *Growing points in attachment theory and research: Monographs of the society for research in child development (3-35) 50 (1-2) Serial No. 209.*

Bretherton, I., Prentiss, C., & Ridgeway, D. (1990). Children's representations of family relationships in a story completion task at 37 and 54 months. In I. Bretherton and M. Watson (Eds.), *Children's perspectives on the family*. *(New Directions in Child Development series*, vol. 48, pp. 85-105). San Francisco: Jossey-Bass.

Bretherton, I., Oppenheim, D., Buchsbaum, H., Emde, R. N., & The MacArthur Narrative Group (1990). MacArthur Story Stem Battery. Unpublished manuscript.

Bretherton, I., Ridgeway, D., & Cassidy, J. (1990). The role of internal working models in the attachment relationship: Can it be studied in three-year-olds? In M. Greenberg, D. Cicchetti, & E.M. Cummings (Eds.), *Attachment during the preschool years: Theory, research, and intervention*. Chicago: University of Chicago Press.

Bruschweiler-Stern, N., Harrison, A., Lyons-Ruth, K., Morgan, A., Nahum, J., Sander, L., Stern, D., & Tronick, E. (2005). The “Something More” than Interpretation Revisited: Sloppiness and Co-Creativity in the Psychoanalytic Encounter. *Journal of the American Psychoanalytic Association.*

Bucci, W. (2001) Pathways of Emotional Communication. *Psychoanalytic Inquiry, 21(1), 40-70.*

Buchsbaum, H., Toth, S., Clyman, R., Cicchetti, D., & Emde, R. (1992). The use of narrative story stem technique with maltreated children: Implications for theory and practice. *Development & Psychopathology, 4*, 603–625.

Cappella, J. N. (1996). Dynamic coordination of vocal and kinesic behavior in dyadic interaction: Methods, problems, and interpersonal outcomes. In J. H. Watt & C. A. VanLear (Eds.), *Dynamic patterns in communication processes* (pp. 353–386). Thousand Oaks, CA: Sage.

Cassidy, J. (1988). Child-Mother Attachment and the Self in Six-Year-Olds. *Child Development*, 59, 121-134.Chapple, E. (1970). *Culture and biological man*. New York: Holt, Rhinehart & Winston.

Cohen, P., & Beebe, B. (2002). Videofeedback with a depressed mother and her infant: A collaborative individual psychoanalytic treatment and mother-infant treatment. *Journal of Infant, Child and Adolescent Psychotherapy, 2.*

Crown, C. L. (1991). Coordinated interpersonal timing of vision and voice as a function of interpersonal attraction. *Journal of Language and Social Psychology, 10(1)*, 29-46.

Davidson, R., & Fox, N. (1982). Asymmetrical brain activity discriminates between positive versus negative affective stimuli in human infants. *Science, 218,* pp. 1235-1237.

Dawson, G. (1992). Frontal lobe activity and affective behavior of infants of mothers with depressive symptoms. *Child Development, 63,* pp. 725-737.

DeCasper, A., & Carstens, A. (1980). Contingencies of stimulation: Effects on learning and emotion in neonates. *Infant Behavior and Development, 9*, 19-36.

DeCasper, A., & Fifer, W. (1980). Of human bonding: Newborns prefer their mothers' voices. *Science, 208*, 1174.

Dennett, D. (1987). *The Intentional Stance.* Cambridge: MA. Bradford Books/MIT Press.

Ehrenberg, D. B. (1992). *The Intimate Edge: Extending the Reach of Psychoanalytic Interaction.* New York: Norton & Company, Inc.

Feldstein, S. (1988). Some non-obvious consequences of monitoring time in conversations. In M. Palmer & G. Barnett (Eds.), *Mutual influence in interpersonal communication. Theory and research in cognition, affect, and behavior*: *Progress in Communication Sciences (14), p. 163 -190*. Norwood, N.J: Ablex.

Feldstein, S., Alberti, L., & BenDebba, M. (1979). Self-attributed personality characteristics and the pacing of conversation interaction. In A.W. Siegman & S. Feldstein (Eds), *Of speech and time* (pp.73-87). Hillsdale, NJ: Erlbaum.

Feldstein, S. & Field, T. (2002). Vocal behavior in the dyadic interactions of preadolescent and early adolescent friends and acquaintances. *Adolescence, 37, 495-513.*

Feldstein, S., & Welkowitz, J. (1978). A chronography of conversation: In defense of an objective approach. In A. W. Siegman & S. Feldstein (Eds.), *Of speech and time* (pp.73-87). Hillsdale, NJ: Erlbaum.

Field, T. (1985). Attachment as psychobiological development: Being on the same wavelength. In M. Reite & T. Field (Eds.), *Psychobiology of Attachment and Separation* (pp. 415-454). NY: Academic.

Field, T., Healy, B., Goldstein, S., Perry, S., Bendall, D., Schanberg, S., Zimmerman, E., Kuhn. C. (1988). Infants of depressed mothers show "depressed behavior", even with nondepressed adults. *Child Development, 59,* 1569-1579.

Field, T., Healy, B., Goldstein, S., & Guthertz, M. (1990). Behavior state matching and synchrony in mother-infant interactions of nondepressed versus depressed dyads. *Developmental Psychology, 26*(1), 7-14.

Field, T. (1995). Infants of depressed mothers.*Infant Behavior and Development,18*,1-13.

Field, T. (1998). Maternal depression effects on infants and early interventions. Preventive Medicine, 2, 200-203.

Fonagy, P., Gergely, G., Jurist, E., & Target, M. (2002). *Affect Regulation, Mentalization and the Development of the Self.* New York: Other Press.

Fox, N., Hane, A., & Perez-Edgar, K. (2006). Psychophysiological methods for the study of developmental psychopathology. In D. Cichetti (Ed.), D*evelopmental Psychopathology, 2nd edition,* (pp. 381-426). Hoboken, NJ: Wiley & Sons, Inc.

Freedman, N. & Lavender, J. (1997). On receiving the patient's transference: the symbolizing and desymbolizing countertransference. *Journal of the American Psychoanalytic Association, 45*(1), 79-103.

Freud, S. (1905). *Dora: An Analysis of a Case of Hysteria*. New York: Touchstone.

Gergely, G. (2000). Mahler reapproached: New perspectives on normal autism, symbiosis, splitting and libidinal object constancy from cognitive development theory. *Journal of the American Psychoanalytic Association, 48,* 1197-1228.

Gergely, G., Nadasdy, Z., Csibra, G., & Biro, S. (1995). Taking the intentional stance at 12 months. *Cognition, 56,* 165-193.

Gergely, Nadasdy, Csibra & Biro, (1995).

Gottman, J. (1981). Time-series analysis: A comprehensive introduction for social scientists New York: Cambridge University Press.

Greenberg, M., DeKlyen, M., Speltz, M., & Endriga, M. (1997). The role of attachment processes in externalizing psychopathology in young children. In: L. Atkinson & K. Zucker (Eds.), *Attachment and Psychopathology* (pp. 197-222). New York: Guilford.

Grossmann, K., Grossmann, K., & Waters, E. (2005). Attachment from infancy to adulthood: The major longitudinal studies. New York, NY, US: Guilford

Grossman, K.E., Grossman, K., Winter, M., & Zimmerman, P. (2002). Attachment relationships and appraisal of partnership: From early experiences of sensitive support to later relationship representation. In L. Pulkkinen & A. Caspi (eds.), *Paths to successful development* (pp.73-105). Cambridge, UK: Cambridge University Press.

Hane, A. A., Feldstein, S., Dernetz, V. H. (2003). The relation between coordinated interpersonal timing and maternal sensitivity in four-month-old infants. *Journal of Psycholinguistic Research*, *32*(5), 525-539.

Harrison, A. (2003). Change in Psychoanalysis: Getting from A to B. *Journal of the American Psychoanalytic Association, 51(1),* 221-256.

Hofer, M. (1994). Hidden regulators in attachment, separation and loss. In N. Fox (Ed.), The development of emotion regulation: Biological and behavioral considerations. *Monographs of the Society for Research in Child Development, 59* (2-3, Serial No. 240), 192-207.

Hoffman, K. (2001). Circle of Security Project, Marycliff Institute and the University of Virginia. Unpublished manuscript.

Holtz**,** P**.** (2004). The self- and interactive regulation and coordination of vocal rhythms, interpretive accuracy, and progress in brief psychodynamic psychotherapy. [Dissertation Abstract] *Dissertation Abstracts International: Section B: The Sciences and Engineering, 64(7-B),* 3526*.*

Howard, D. (2000). An exploratory study of attachment and coping for bereaved elementary school children. *Dissertations Abstracts International, A (Humanities and Social Sciences), 61, (5-A), 1752.*

Hubbs-Tait, L., Hughes, K., Culp, A., Osofsky, J., Hann, D., Eberhart-Wright, A., & Ware, L. (1996). Children of adolescent mothers: Attachment representation, maternal depression, and later behavior problems. *American Journal of Orthopsychiatry, 66*, 416–426.

Isabella, R. A., & Belsky, J. (1991). Interactional synchrony and the origins of infant-mother attachment: A replication study. *Child Development, 62*, 373-384.

Jaffe, J., Feldstein, S., Cassotta, L. (1967). Markovian Models of Dialogic Time Patterns. *Nature,* 216, 5110, 93-94.

Jaffe, J., & Feldstein, S. (1970). *Rhythms of dialogue*. New York: Academic Press.

Jaffe, J., Beebe, B., Feldstein, S., Crown, C. L., & Jasnow, M. (2001). Rhythms of dialogue in infancy. *Monographs of the Society for Research in Child Development*, *66*, (Serial No. 265).

Jasnow, M., & Feldstein, S. (1986). Adult-like temporal characteristics of mother-infant vocal interactions. *Child Development, 57,* 754-761.

Jasnow, M., Crown, C. L., Feldstein, S., Taylor, L., Beebe, B., & Jaffe, J. (1988). Coordinated interpersonal timing of down-syndrome and nondelayed infants with their mothers: Evidence for a buffered mechanism of social interaction. *Biological Bulletin, 175*, 355-360.

Koos, O., & Gergely, G. (2001). A contingency-based approach to the etiology of 'disorganized' attachment: The 'flickering switch' hypothesis. *Bulletin of the Menninger Clinic, 65 (3),* 397-411.

Koulomzin, M., Beebe, B., Anderson, S., Jaffe, J., Feldstein, S., & Crown, C. (2002). Infant gaze, head, face, and self-touch at four months differentiate secure vs. avoidant attachment at one year: A microanalytic approach. *Attachment and human development*.

Lewis, M., & Feiring, C. (1989). Infant, mother and mother-infant interaction behavior and subsequent attachment. *Child Development, 60*, 831-837.

Lewis, M., Feiring, C., & Rosenthal, S. (2000). Attachment over time. *Child Development, 71(3), 707-720.*

Lewkowicz, D. (1989). The role of temporal factors in infant behavior and development. In I. Levin & D. Zakay (Eds.), *Time and human cognition: A life-span perspective* (pp. 9-62). Amsterdam: North-Holland.

Lewkowicz, D. (2000). The development of intersensory temporal perception: An epigenetic systems/limitations view. *Psychological Bulletin, 126*(2), 281-308.

Leyendecker, B., Lamb, M., Fracaso, M., Scholmerich, A., & Larson, D. (1997). Playful interaction and the antecedents of attachment: A longitudinal study of Central American and Euro-American mothers and infants. *Merrill Palmer Quarterly, 43*(1), 24-47.

Lyons-Ruth, K. (1996). Attachment relationships among children with aggressive behavior problems: The role of disorganized early attachment patterns. *Journal of Consulting and Clinical Psychology, 64*, 32-40.

Lyons-Ruth, K. (1998). Attachment disorganization: Unresolved loss, relational violence, and lapses in behavioral and attentional strategies. In J. Cassidy & P. Shaver (Eds.), *Handbook of attachment theory and research* (pp. 520-554). New York: Guilford Martin, J. (1972). Rhythmic (hierarchical) versus serial structure in speech and other behavior. *Psychological Review, 79*, 487-509.

Lyons-Ruth, K. (1999). The two-person unconscious. Psychoanalytic Inquiry, 19, 576–617.

Lyons-Ruth, K., Bronfman, E., & Parsons, E. (1999). Maternal frightened, frightening or atypical behavior and disorganized infant attachment patterns. In J. Vondra & D. Barnett (Eds.), *Monographs of the Society for Research in Child Development, 67-96, 64(3) Serial No. 258.*

Main, M., & Hesse, E. (1990). Parents' unresolved traumatic experiences are related to infant disorganized attachment status: Is frightened and/or frightening parental behavior the linking mechanism? In M. Greenberg & D. Cicchetti & E. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 161-182). Chicago: University of Chicago Press.

Malphurs, J., T. Field, et al. (1996). Altering withdrawn and intrusive interaction behaviors of depressed mothers. *Infant Mental Health Journal 17(2): 152-160.*

Marvin. R., Cooper, G., Hoffman, K., and Powell, B. (2002). The Circle of Security Project: attachment-based intervention with caregiver-preschool child dyads. *Attachment and Human Development*, 4(1).

Murray, L. (1982) The impact of postnatal depression on infant development. *Journal of Child Psychology and Psychiatry, 33*(3): 543-61.

Oppenheim, D. (2006). Child, parent and parent-child emotion narratives: Implications for developmental psychopathology. *Development and Psychopathology, 18,* 771 – 790.

Oppenheim, D., Emde, R., & Warren, S. (1997). Children's narrative representations of mothers: Their development and associations with child and mother adaptation. *Child Development, 68*, 127–138.

Oppenheim, D. & Waters, E., (1995). Narrative processes and attachment representations: Issues of development and assessment. *Monographs of the Society for Research in Child Development.*

Ostrom, C.W., Jr. (1978). *Time-series analysis: Regression techniques*. Beverley Hills, CA: Sage University Papers.

Owens, G., Crowell, J., Pan, H., Treboux, D., O'Connor, E., & Waters, E. (1995). The Prototype Hypothesis and the Origins of Attachment Working Models: Adult Relationships with Parents and Romantic Partners. *Monographs of the Society for Research in Child Development,* Vol. 60, No. 2/3, Caregiving, Cultural, and Cognitive Perspectives on Secure-Base Behavior and Working Models: New Growing Points of Attachment Theory and Research, pp. 216-233.

Page, T. (2001). The social meaning of children's narratives: A review of the attachment-based narrative story stem technique. *Child and Adolescent Social Work Journal, 18 (3),* 171-187.

Page, T., & Bretherton, I. (2001). Mother- and father-child attachment themes as represented in the story completions of preschoolers in post-divorce families: Linkages with teacher ratings of social competence. *Attachment and Human Development*, 3, 1-29.

Perry, B. (1996). Childhood trauma, the neurobiology of adaptation, and "use-dependent" development of the brain: How "states" become "traits". *Infant Mental Health Journal, 16*(4), Winter, 271-291.

Rogosch, F., Cicchetti, D., Shields, A., & Toth, S. (1995). Parenting dysfunction in child maltreatment. *Handbook of Parenting*. Hillsdale, NJ: Erlbaum.

Salatas Waters, H., Rodrigues, L., & Ridgeway, D. (1998). Cognitive underpinnings of narrative attachment assessment. *Journal of Experimental Child Psychology, 71*, 211–234.

Sameroff, A. (1983). Developmental Systems: Contexts and evolution. In W. Kessen (Ed.), *Mussen's handbook of child psychology* (Vol. 1, pp. 237-294). New York: Wiley.

Sarro, S., Goldstein, R., Zicht, S., Anderson, S., Beebe, B., & Jaffe, J. (1993). *Disruption of conversational responsivity and attention to maternal vocalizing at two-years of age among toddlers classified as insecurely attached by the Ainsworth test at age one* [Abstract]. Presented at the Sixth Annual New York State Office of Mental Health Research Conference, Albany, NY.

Schore, A. (1994). *Affect regulation and the origin of the self: The neurobiology of emotional development*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Schore, A. (2002). Dysregulation of the right brain: A fundamental mechanism of traumatic attachment and the psychopathogenesis of posttraumatic stress disorder. *Australian and New Zealand Journal of Psychiatry, 36*, 9-30.

Siegel, D. (1999). *The developing mind: Toward a neurobiology of interpersonal experience.* New York: Guilford Press.

Slade, A. (1994). Making meaning and making believe. In A. Slade and D. Wolf (eds), *Children at Play: Clinical and Developmental Approaches to Meaning and Representation.* New York: Oxford University Press.

Solomon, J., George, C., & DeJong, A., (1995). Children classified as controlling at age six: Evidence of disorganized representational strategies and aggression at home and at school. *Development & Psychopathology, 7*, 447–463.

Spangler, G., & Grossman, K. (1993). Biobehavioral organization in securely and insecurely attached infants. *Child Development, 64,* 1439-1450.

Sroufe, L.A., Egeland, B., Carlson, E., & Collins, W.A. (2005). The development of the person: The Minnesota Study of Risk and Adaptation from Birth to Adulthood. New York: Guilford Press.

Steele, H. & Steele, M. (2005). Understanding and resolving emotional conflict: The London Parent-Child Project. In K. Grossman, K. Grossman & E. Waters (eds), *Attachment from Infancy to Adulthood.* New York/London: The Guilford Press.

Steele, H., Steele, M., Croft, C., & Fonagy, P. (1999). Infant-Mother Attachment at One Year Predicts Children's Understanding of Mixed Emotions at Six Years. *Social Development, 8*(2), 161–178.

Stern, D., Beebe, B., Jaffe, J., & Bennett, S. (1977). The infant's stimulus world during social interaction. In H. R. Schaffer (Ed.), *Studies in mother-infant interaction* (pp. 177-202). New York: Academic Press.

Stern, D. (1971) A microanalysis of mother-infant interaction. *Journal of the American Academy of Child Psychiatry, 10,* 501-517.

Stern, D. (1985). *The interpersonal world of the infant: A view from psychoanalysis and developmental psychology*. New York: Basic Books

Stern, D., Sander, L., Nahum, J., Harrison, A., Lyons-Ruth, K., Morgan, A., Bruschweiler-Stern, N., & Tronick, E. (1998). Non-interpretive mechanisms in psychoanalytic therapy: The 'something more' than interpretation. *International Journal of Psychoanalysis, 7,* pp. 903-921.

Stern, D. (2001). Face-to-face play: Its temporal structure as predictor of socioaffective development. In J. Jaffe, B. Beebe, S. Feldstein et al., Rhythms of Dialogue in Infancy. *Monographs of the Society for Research in Child Development*, *66*, (Serial No. 265).

Toth, S., Cicchetti, D., MacFie, J., & Emde, R. (1997). Representations of self and other in the narratives of neglected, physically abused, and sexually abused preschoolers. *Development and Psychopathology*, *9*, 781-796.

Tremblay, G., & Israel, A. (1998). Children's adjustment to parental death. *Clinical Psychology-Science and Practice, 5,* (4), 424-438.

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

Tronick, E., & Weinberg, K., (1997). Depressed mothers and infants: Failure to form dyadic states of consciousness. In L. Murray and P. Cooper (Eds.), *Postpartum Depression and Child Development*. New York: Guilford.

Valent, P. *From survival to fulfillment. A framework for the life-trauma dialectic*. Philadelphia, PA: Brunner/Mazel, 1998.

Vondra, J., Shaw, D., Swearingen, L., Cohen, M., & Owens, E. (2001). Attachment stability and emotional and behavioral regulation from infancy to preschool age. *Development and Psychopathology, 13*, 13-33.

Wachtel, P. L. (1993). *Therapeutic Communication: Knowing What to Say When.* New York: The Guilford Press.

Warner, R. (1988). Rhythm in social interaction. In J. McGrath (Ed.), *The social psychology of time* (pp. 63-88). London: Sage Publications.

Warner, R. (1988). Rhythmic organization of social interaction and observer ratings of positive affect and involvement. *Journal of Nonverbal Behavior, 11*, 57-74.

Warner, R. (1992). Cyclicity of vocal activity increases during conversation: Support for a nonlinear systems model of dyadic social interaction. *Behavioral Science, 37*, 128-138.

Warren, S., Oppenheim, D., & Emde, R. (1996). Can emotions and themes in children's play predict behavior problems? *Journal of the American Academy of Child & Adolescent Psychiatry, 35*, 1331–1337.

Waters, E., Merrick, S., Treboux, D., Crowell, J., & Albersheim, L. (2000). Attachment security in infancy and early adulthood: A 20-year longitudinal study. *Child Development, 71,* 684-689.

Watson, J. (1994). Detection of self: The perfect algorithm. In S. Parker, R. Mitchell & M. Boccia (Eds.), *Self-awareness in animals and humans: Developmental perspectives* (pp. 131-148). New York: Cambridge University Press.

Weinberg, K., & Tronick, E. (1998). The impact of maternal psychiatric illness on infant development. *Journal of Clinical Psychology, 59*, 53-61.

Welkowitz, J., Cariffe, G., & Feldstein, S. (1976). Conversational congruence as a criterion of socialization in children. *Child Development, 47*, 269-272.

Worden, J., & Silverman, P. (1996). Parental death and the adjustment of school age children. *Omega, 33, 91-102.*