

On the Origins of Background Emotions: From Affect Synchrony to Symbolic Expression

Ruth Feldman
Bar-Ilan University

Guided by Damasio's (2003) formulations on background emotions, this study examined the contour of infant affect during interactions with mother and father in relation to the emergence of symbolic expression. One hundred parents and infants were observed in face-to-face interactions and in play sessions at the toddler stage. Parent's and infants' affective states were coded in 1-s frames, and synchrony was assessed. Toddlers' play was microcoded for symbolic level and for reciprocity and intrusiveness. Infant affective contour with mother was rhythmic with 1 episode of positive arousal framed by social gaze. Affective contour with father contained several peaks of positive arousal of shorter duration. Symbolic complexity was comparable and preserved the parent-specific contours, with quicker latencies, higher frequencies, and shorter durations of complex symbolic episodes with father. Sequential relations emerged between parent's and child's symbolic expression, and maternal reciprocity and intrusiveness were sequentially linked to symbolic expansion or constriction, respectively. Parent–infant synchrony and the parent's support of toddler symbolic play predicted symbolic complexity. The need to include time in research on emotions and the dyadic origins of positive emotions are discussed.

Keywords: synchrony, arousal, symbolic play, positive emotions, fathers

In his recent book on the neurobiology of emotions, *Looking for Spinoza*, Antonio Damasio (2003) differentiated three classes of emotions: primary emotions, referring to the basic Darwinian emotions observed across cultural communities and a range of mammalian species; social emotions, those related to the self-in-representations, such as empathy, shame, pity, or pride; and background emotions. Background emotions, the least researched group of the three, refer to the contour of affect as it is played out in time (e.g., surging, fading, accelerating, exploding, etc.) and mark the organization of arousal and affect into patterned configurations that, although not easily captured by the language of discrete emotions, provide an overall framework for the organization of the self and likely depend on a distinct brain circuitry (Damasio, 1999). Background emotions, therefore, define the ongoing component in emotions, and the central arena for their expression is the social context. During interpersonal communication, individuals perceive and respond to the partner's micro-level behaviors as they cohere into a unified affective message, such as tone of voice, direction of gaze, facial expressions, level of arousal, muscle tone, or body orientation, and the ability to follow second-by-second shifts in such behaviors is essential for the participation in any emotional exchange. Infants are sensitized to the temporal components of emotional communication as soon as they enter the social world, at about 2–3 months of age (D. N. Stern, 1985), through the parent's ongoing synchrony with the infant's micro-level behaviors (Tronick, 1989). Describing the parent–infant affect coordination and its transformation across the

first years of life may thus provide a window onto the origins of background emotions.

The goal of this study is to open discussion and research on the topic of background emotions—an important class of emotions that is time based—by following their first expression in the infant's earliest exchange with mother and father. A central hypothesis guiding the study is that parent–infant synchrony provides essential environmental inputs during a critical period for the maturation of the social brain that shape later development (for a review, see Feldman, 2007a; Johnson et al., 2005). In particular, synchrony describes a biologically based mechanism that sensitizes infants to the temporal relations between the discrete behaviors of self and other as they cohere into lived experiences (Fogel, 1993) and supports the development of processes that require online integration of external and internal inputs, such as self-regulation, empathy, and symbol use. In this study, links are examined between three forms of coordination in the parent's and infant's affective behavior and the emergence of symbolic competencies in toddlers. *Symbol* in toddlers is defined as an act—verbal or behavioral—that indicates that the child can substitute one thing for another, typically a word, gesture, or series of actions for objects and scenarios—for instance, talking into a block as if it were a telephone. In general, symbol as a theoretical construct is thought to develop on the basis of early nonverbal affective experiences and to be more open to ongoing inputs than other related constructs such as concept or representation (Nelson, 1985; W. Stern, 1924). Such notions are expressed in the work of Vygotsky (1978), which postulates that symbols in toddlers can develop only in the context of moment-by-moment support from an attuned adult; the psychoanalytic formulations of Winnicott (1971), suggesting that symbols emerge when the maternal physical presence and affect attunement must be replaced by a mental image; and the philosophical positions of Merleau-Ponty (1945) and Mead (1934),

Correspondence concerning this article should be addressed to Ruth Feldman, Department of Psychology and the Gonda Brain Sciences Center, Bar-Ilan University, Ramat-Gan, Israel 62900. E-mail: Feldman@mail.biu.ac.il

proposing that symbols draw on repetitive early bodily experiences and preverbal affective–motor–communicative schemas. Assessing the links between the infant’s affective coordination and the organization of symbols in the toddler’s play may thus provide a framework for the study of background emotions at the stage when nonverbal communication opens to include symbolic components into the previously established affective mutuality.

Synchrony, the matching of micro-level affective behavior between parent and child, has long been suggested as an important mechanism underlying socioaffective development (Beebe, 1982; Papousek, 1996; D. N. Stern, 1977; Trevarthen, 1993; Tronick, 1989), and longitudinal research has demonstrated its relationship to the development of self-regulation, attachment security, and empathy across childhood and up to adolescence (Feldman, 2007b; Feldman, Greenbaum, & Yirmiya, 1999; Jaffe, Beebe, Feldstein, Crown, & Jasnow, 2001). Furthermore, mother–infant synchrony has been shown to predict symbolic play at 2 years above and beyond global assessments of the relationship in terms of sensitivity or responsiveness (Feldman & Greenbaum, 1997), suggesting that temporal matching taps a unique mechanism that is distinct from the effects of general positive parenting. Perhaps one of synchrony’s special features relates to its links with biological rhythms. It has been theorized (Wolff, 1967) and recently demonstrated (Feldman, 2006) that mother–infant synchrony at 3 months is predicted by the maturation of physiological time-keeping systems, such as the biological clock and cardiac pacemaker, across the last trimester of pregnancy and the neonatal period. The experience of synchrony, therefore, may integrate biological rhythms into the rhythms of social dialogue, evolves on the basis of the newborn’s innate capacity for contingency detection (Tarabulsy, Tessier, & Kappas, 1996), and is predicted by the mother’s postpartum behavior and its coordination with the newborn’s state (Feldman & Eidelman, 2007). It is thus possible that the unique integration of biological and relational components of both mother and child during a sensitive period for social growth accounts for the long-term effects of synchrony on processes in which background emotions play an important role, such as symbol use.

The time-based relationship between parent’s and infant’s micro-level behaviors may come in one of three forms, each of which provides a different angle for the study of background emotions—concurrent, sequential, and organized in an ongoing patterned format. Concurrent relations describe the co-occurrence, or “match,” between specific relational patterns, for instance, the co-occurrence of social gaze in parent and child (Fogel, 1982), vocalizing in unison (Beebe & Gerstman, 1980), the matching of parent affectionate touch with the infant’s social gaze (Feldman & Eidelman, 2004), or the matching of positive, neutral, and negative or withdrawn arousal (Tronick et al., 2005). Sequential relations address typical two-step sequences, or the framing of specific social acts. For instance, the mother’s positive expression often precedes the infant’s becoming positive, the infant’s high arousal is often preceded by moments of quiet alertness, and mother’s vocalizations typically frame the infant’s babbling (Cohn & Tronick, 1987; Feldstein et al., 1993; Kaye & Fogel, 1980). Finally, synchrony can be defined as a continuous “dance” between two partners who maintain a patterned relationship throughout play, as measured by time-series analysis. The “coherence” or goodness of fit between the parent’s and infant’s series of behavior provides an index for the synchronous exchange and serves as a

predictor of developmental outcomes (Cohn & Tronick, 1988; Feldman et al., 1999; Lester, Hoffman, & Brazelton, 1985). D. N. Stern (1985, 1999) has termed the temporal shape of infant affect at play as *vitality contour* or *affective contour*, a construct much like background emotions, and underscored its centrality for early affective communication. It is important to note, however, that very little research has examined infants’ vitality contours or affect synchrony during interactions with their fathers, and no study to date has assessed all three forms of coordination in a single study as predictors of developmental outcomes.

Symbolic play, like synchrony, is a process that unfolds in time with clear sequential relations between the parent’s facilitation of child symbolization and the complexity of the child’s symbolic expression. Research following Vygotsky’s (1978) tradition has shown that complex symbolic episodes were typically preceded by reciprocal maternal behavior, whereas intrusive maternal acts were usually followed by functional, nonsymbolic play (Slade, 1987). Similarly, sequential relations were found between the mother’s and child’s symbolic complexity, with symbolic maternal acts often followed by an increase in the child’s symbolic complexity (Melstein-Damast, Tamis-LeMonda, & Bornstein, 1996; Rocissano, Slade, & Lynch, 1987). Maternal depression, on the other hand, decreases the sequential links between mother’s and toddler’s symbolic play and reduces the level of symbolization (Jameson, Gelfand, Klucsar, & Teti, 1997), similar to its effects on mother–infant synchrony in the first months of life (Field, Healy, Goldstein, & Guthertz, 1990). It thus appears that complex symbolic play—defined as chains of imaginary play acts that integrate or hierarchically organize several creative units into a single episode—develops in the context of the parent’s moment-by-moment support, is expressed in relationship-specific affective contours, and contains a background emotions component to which children are sensitized in infancy. The notion that symbols develop on the basis of perceptual–motor–affective sequences that are practiced during parent–infant interactions has been suggested by numerous theories (Bloom, 1970; Fein, 1981; Nelson, 1985; W. Stern, 1924) but has received little empirical support. Similarly, as is the case with synchrony, no study to date has assessed the sequential relations between the father’s and child’s symbolic play or its longitudinal associations with father–infant affect coordination.

In light of the above, the present study examined the relations between parent–infant coordination and the sequences of parent’s and toddler’s symbolic play. Both affect synchrony and symbolic play were examined in relationship-specific contexts and were assessed separately with mother and father. Although background emotions are thought to be based on the infant’s temperamental dispositions, they are also cocreated in real time from the affective behaviors of self and other. Thus, although both the degree of synchrony and the level of symbolic complexity with mother and father were expected to be interrelated, unique affective contours were expected to emerge with each parent. In assessing synchrony with mother and father in this sample at 5 months (Feldman, 2003), it was found that the degree of coherence was similar across parents, but the affective shape differed; interactions with mother typically contained one peak of high positive arousal, whereas father–child play was marked by several peaks of positive emotionality. Affective coordination in infancy in terms of the “match” or sequential relations was not addressed and is examined here to provide a full assessment of the three types of time-based relation-

ships between the affective behavior of parent and child. The sample was followed into the toddler stage, and children's symbolic play with mother and father was assessed, microcoded, and analyzed for concurrent and sequential relations between the parent's and child's symbolic acts. It was expected that although comparable levels of symbolic complexity would be observed with mother and father, the parent-specific affective contour would be preserved from infancy and complex symbolic episodes with father would be quicker, shorter, and more frequent. On the basis of research in a different sample (Feldman & Greenbaum, 1997), indicating links between mother-infant coherence and the degree of symbolic play, it was expected that synchrony with both parents would predict the complexity of toddler symbolic play with that parent. Consistent with the findings that maternal reciprocity and intrusiveness are sequentially linked with an increase or decrease in symbolic complexity (Slade, 1987), parent reciprocity and intrusiveness were examined in relation to the child's immediately following symbolic acts. Such data would represent the first comprehensive assessment of the infant's affective coordination with mother and father in relation to the temporal organization of toddlers' play with each parent, thus addressing one pathway in the development of background emotions.

Method

Participants

The sample included 100 couples and their firstborn child (48 girls and 52 boys). Mothers were on average 27.7 years old ($SD = 3.93$) and had completed 15.25 years of education ($SD = 1.69$), and fathers were 30.37 years old ($SD = 4.99$), with an average education of 14.54 years ($SD = 1.64$). All parents had completed high school, were married and employed, and were considered to be of middle-class background (Harlap, Davis, Grower, & Prywes, 1977). Initially, 110 mothers from a pool of mothers attending nationwide Well Baby clinics were approached to participate in the study. Ten mothers declined because of father's refusal or scheduling difficulties; these mothers did not differ from the participating families. Infants were 5 months old ($M = 20.51$ weeks, $SD = 3.14$) at the first observation. All infants had been healthy since birth and were born at full term in a singleton birth.

Families were visited again at the toddler stage; toddlers were on average 33.51 months ($SD = 4.43$, range = 27–40). Of the original 100 families, 86 were revisited. Four families had moved out of the country, 7 families could not be located, and 4 families declined participation. These families did not differ on demographic or study variables from the participating families.

Procedure

Infancy

Parents were contacted by phone, and a time for a home visit was scheduled when both parents were home and the infant was expected to be fed and awake. The home visit included three videotaped interactions: mother-infant, father-infant, and a family session as well as interviews and self-report measures. Data from the two parent-infant sessions was used in the present report. Parent-infant sessions were filmed in a counterbalanced order and were followed by the triadic interaction. Parents were instructed to

play with the infant as they normally did, and 5 minutes of each interaction was filmed using a mirror directed at the parent's face; the final picture contained the face of both parent and infant.

Toddler Stage

Follow-up at the toddler stage included two visits for each family. In the present study, data from the mother-child and father-child interactions were used, which included 15 min of videotaped free play between the child and each parent that were videotaped one after the other in a counterbalanced order. Parents and children were given a box of toys that had been used in previous research on symbolic play of children at this age and were selected to elicit the child's creativity and imagination (Feldman, Eidelman, & Rotenberg, 2004; Feldman & Greenbaum, 1997; Keren, Feldman, Namdari-Weinbaum, Spitzer, & Tyano, 2005; Tamis-LeMonda & Bornstein, 1994). Toys included two dolls; bottle; blanket; tea set including two cups, two plates, sugar bowl and creamer, and a boiler pan; wallet; colored necklace; a pair of plastic sunglasses; a sponge; three work tools; two small cars; telephone; two pet animals and two wild animals; and a small tool set.

Coding

Infancy

Parent-infant affect coordination. Infant-mother and infant-father interactions were analyzed separately in 1-s frames using the Monadic Phases Manual (Tronick, Als, & Brazelton, 1980). In this scheme, the stream of affective behavior for each partner is separately and continuously coded using five affective codes ("phases") for the parent and six affective codes for the infant, resulting in separate time series for parent and child. Each phase is considered to represent an affective configuration (Weinberg & Tronick, 1994) and is coded on the basis of facial expressions, vocalizations, direction of gaze, body orientation, and the level of observed positive or negative arousal. Codes include protest (infant only), avert, object attend, social attend, object play, and social play. Monadic phases are organized on a continuum from negative to positive engagement in the interaction, and the coding along a continuum enables the use of time-series analysis. In addition to the full scale of codes used for the time-series analysis, phases were composited into four constructs in line with previous research (Tronick et al., 2005; Weinberg, Tronick, Cohn, & Olson, 1999). Three constructs indexed three levels of arousal: negative/withdrawn (sum of protest and avert), neutral (sum of object attend and social attend), and positive (sum of object play and social play). Positive arousal included episodes in which infants showed clear signs of elevation in energy, laughter, and exuberance with focus on either parent or objects, and these episodes are termed here as *positive peaks*. A positive peak was coded on the basis of the degree of positive affect, was indexed by the phases of object play and social play, and required a clear expression of high positive emotionality by the infant. The fourth composite addressed periods in which the infant looked at the parent's face (sum of social attend and social play) and was termed *social orientation*. The monadic phases system has been used extensively in research on parent-infant affective matching in healthy and

high-risk populations (Cohn & Tronick, 1988; Feldman, 2003; Feldman et al., 1999; Field et al., 1990; Lester et al., 1985; Tronick et al., 2005; Weinberg et al., 1999).

Coding of the videotapes was conducted by four graduate students following extensive training. Coding was conducted in 1-s frames for 3 min of the interaction: the 2nd, 3rd, and 4th minutes, the most pronounced period of play at this age that begins after an orientation period and once the infant's gaze is focused on the parent's face. Coding resulted in separate time series for each parent and child for each observation, and each series contained 180 data points (analysis of 3 min in 1-s epochs). Interrater reliability was performed for 20 mothers and their infants and for 20 fathers and their infants. Reliability kappas were .84 for mothers' time series (range = .75–.89), .86 for infants' time series with mother (range = .74–.90), .84 for fathers' time series (range = .71–.88), and .85 for infants' time series with father (range = .71–.88).

Affective Coordination: Co-Occurrences, Sequential Relations, and Synchronous Coherence

Each of the three types of affective coordination was assessed separately in infant–mother and infant–father interactions.

1. *Co-occurrences.* Co-occurrences, or the affective match between parent and child, was examined using three conditional probabilities: parent in positive arousal given child in positive arousal, parent in neutral arousal given child in neutral arousal, and parent in negative/withdrawn arousal given child in negative/withdrawn arousal. These probabilities assess the proportion of time out of the entire interaction when parent and child matched on level of arousal, consistent with previous research (Tronick et al., 2005).
2. *Sequential relations.* The affective state preceding and following episodes of positive arousal (positive peaks) was examined using lag-sequential analysis.
3. *Synchronous coherence.* Synchrony was computed for each dyad using a time-domain time-series analysis (Cohn & Tronick, 1988; Gottman, 1981). Before the assessment of synchrony, the autocorrelated component in each time series was partialled out using autoregressive integrated moving average models for each series (Gottman, 1981). The autocorrelated component in a time series refers to associations between consecutive behaviors in the series that are internal and are not related to the behavior of the partner. Following, cross-correlation functions (CCFs) for each dyad were computed using the two series of residuals from the autoregressive integrated moving average modeling. The CCF compares the two time series of parent and infant and examines associations between the series at several time lags above and beyond the internal rhythms in each partner's affective states. The variable used from the time-series analysis was coherence, which indicates the strength of the correlations between the two time series found at any lag. Coherence is indexed by the largest

cross-correlation coefficient on the CCF plot. Coherence is a continuous variable ranging from 0 (implying no lagged associations between the two time series) to 1 (implying a perfect match).

Toddler

Symbolic play. Symbolic play was coded separately for parent and child along nine hierarchical levels of symbolic complexity. For each 10-s epoch, one out of the following nine mutually exclusive codes was applied in line with previous research (Feldman et al., 2004; Feldman & Greenbaum, 1997; Melstein-Damast et al., 1996). Child play levels included four presymbolic levels: (a) no play, (b) social play (child is oriented toward parent's face, and play is not focused on toys), (c) object manipulation (e.g., touching or throwing), and (d) functional play (use of toy in its intended way, e.g., moving the car on the floor). Two simple symbolic levels were coded: (a) self-pretend (unitary symbolic acts around the self, e.g., sleeping or combing hair) and (b) other pretend (unitary symbolic acts that include others in the pretend play, e.g., feeding a doll). Three complex symbolic levels were coded: (a) combinatorial pretend—combining several play schemes into a single act, in one of three types (a single scheme is played with several objects, e.g., feeding doll and then feeding dog; several schemes are played with the same object, e.g., feeding doll, then putting it to bed; and different schemes are organized in order, e.g., dressing doll, putting it inside a car, driving car), (b) hierarchical pretend—a single act that expresses a hierarchical scheme (e.g., a child plans ahead and fits objects to predetermined roles), and (c) substitutional pretend—child substitutes one object for another in a deliberate fashion (e.g., a stick is used instead of a car). A code was determined for the parent for playing in a certain level or for facilitating a child's play in a specific level. The child's play levels were aggregated into the following composites, in line with previous research: no play, social play, functional play (object manipulation + functional play), simple symbolic play (self pretend + other pretend), and complex symbolic play (combinatorial, hierarchical, and substitutional play). The parent's play was coded for each 10-s epoch according to similar categories. A parent code was determined if the parent used a certain level of play and was given whether the parent or the child initiated play at that level. A didactic play code was added and addressed episodes in which the parent demonstrated, explained, or provided modeling for the child. If more than one code was observed during the 10-s epoch, the code occurring longer was selected. The parent codes were also aggregated into no play, social play (parent engages child socially without using the toys), didactic play, and symbolic play (simple + complex). Reliability was computed for 15 mother–child and 15 father–child interactions, and the reliability kappa averaged .87 (.76–.94).

Affective component: Reciprocity and intrusiveness. Following the coding for symbolic play, play sessions were coded again for reciprocity and parental intrusiveness by a separate team of coders. For each 10-s epoch, the coder marked reciprocity and intrusiveness using a binary scheme (0 and 1). Reciprocity implied that the two partners were engaged in a warm, positively affected, give-and-take exchange that was synchronous and mutual. Intrusiveness indicated that the parent was leading the interaction, disregarded the child's initiations, and interacted in an overbearing

manner. Reliability for reciprocity and intrusiveness was computed on 15 mother–child and 15 father–child interactions, and the reliability kappa averaged .85 (.77–.93).

Temporal Structure of Parent–Child Play: Co-Occurrences and Sequential Relations

Similar to the analysis of parent–infant synchrony, two types of time-based relationships were examined between the parent’s and the child’s level of symbolization and between the parent’s reciprocity and intrusiveness and the child’s symbolic acts.

Co-occurrences. Conditional probabilities assessed co-occurrences in the parent’s and child’s play—the proportion of time parent and child were in a specific combination of behaviors, for instance, the parent in social play while the child is in symbolic play.

Sequential relations. Lag sequential variables considered a two-step sequence in which one variable occurred immediately after another, for instance, parent symbolic play followed by child symbolic play or parent reciprocity followed by child complex symbolic play. Differences related to parent gender, child gender, and their interactions were examined.

Results

Results are reported in three sections. In the first, data pertaining to the infancy measures are detailed. In the second, information on mother–child and father–child symbolic play is presented. The final section presents hierarchical regressions predicting toddlers’ symbolic complexity from parent’s and child’s relational behaviors at the toddler and infant stage.

Parent–Infant Synchrony

Affect Matching

Data on the infant’s level of arousal and the parent–infant affect matching appear in Table 1.

As seen, differences between infant–mother and infant–father interactions emerged for the level of arousal. Infants showed higher negative and positive arousal with father and more neutral

arousal with mother, indicating that father–child interactions were more arousing, regardless of affective valance. Infants also showed more social orientation with mother. No Parent Gender \times Child Gender effects were found for these variables.

The background emotion or vitality contour of the infant’s affect with mother and father showed a markedly different shape. The average number of positive peaks was 1.56 ($SD = 1.02$) during interactions with mother and 4.52 ($SD = 3.47$) during interactions with father, $F(1, 199) = 7.23, p < .01$. The mean duration of each positive peak lasted, on average, 2.14 s ($SD = 1.74$) with father as compared with 3.98 s ($SD = 2.26$) with mother, $F(1, 199) = 6.75, p < .01$. Similarly, the mean duration of an episode of neutral arousal, in which parent and child are attending to each other or to a joint object, was shorter in father–infant interactions ($M = 3.45, SD = 2.34$) compared with mother–infant interactions ($M = 4.76, SD = 3.12$), $F(1, 199) = 4.64, p < .05$. Infants also reached positive peaks more quickly with their fathers. The latency to the first positive emotionality was shorter with father ($M = 32.43$ s, $SD = 23.66$) than with mother ($M = 65.12$ s, $SD = 44.12$), $F(1, 199) = 4.33, p < .05$.

Data on affect matching between parent and child presented in Table 1 indicate that fathers matched the infant’s negative and positive arousal more than mothers, whereas mothers showed higher affective matching of the infant’s neutral states. Moments of shared social gaze were also more frequent between infant and mother. No effects for child gender were found.

Sequential Relations: Framing the Positive Peaks

Moments of high positive arousal mark the most salient and intense feature of the parent–infant interaction, and thus sequential analyses were used to examine the phase out of the four potential infant phases (protest, avert, object attend, and social attend) and the three potential mother phases (avert, object attend, and social attend) that was most likely to precede or follow the positive peak, that is, to frame moments of intense emotions. During infant–mother interactions, positive peaks were most often preceded by infant social attend, $\chi^2(4, N = 43) = 10.35, p < .01$, and by mother social attend, $\chi^2(3, N = 43) = 13.42, p < .01$; that is, positive peaks were preceded by shared gaze between mother and

Table 1
Infant Arousal and Affect Matching in Interactions With Mother and Father

Infant and dyadic affect	Infant–mother		Infant–father		Univariate $F(1, 199)$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Infant arousal					
Negative arousal	21.22	11.32	23.17	15.76	4.16*
Neutral arousal	68.64	31.16	54.26	27.74	4.73*
Positive arousal (positive peaks)	9.86	4.13	15.49	5.37	6.05**
Social orientation	32.22	17.63	21.45	12.85	5.65**
Affect matching					
Negative arousal	4.42	2.12	5.96	3.53	<i>ns</i>
Neutral arousal	42.23	28.73	28.88	21.11	4.86*
Positive arousal	7.31	4.67	10.76	5.43	3.84*
Shared social gaze	25.47	11.54	13.76	10.28	6.13**

Note. Numbers represent percentages of the entire interactions spent in each state.
* $p < .05$. ** $p < .01$.

child. Infant social attend and mother social attend were also the phases most likely to follow the high positive arousal, $\chi^2(4, N = 43) = 5.42, p < .01$, and $\chi^2(3, N = 43) = 7.65, p < .01$, respectively, indicating that moments of intense positive emotionality were framed by mutual gaze between mother and child. During infant–father interactions, no particular phase occurred significantly more often before or after the positive peaks. These findings highlight the very different contours infants experience with mother and father—gradual and well-prepared peaks with mother versus less predictable peaks during play with father.

Synchronous Coherence

An analysis of variance (ANOVA) with parent gender and child gender was computed for the degree of synchrony (coherence) variable. No differences were found for coherence between infant–mother ($M = .17$) and infant–father ($M = .18$) interactions and no main effects for child gender. These findings, showing similar levels of synchrony with mother and father, are especially important in light of the different vitality contours infants experience with the two parents. Thus, although fathers and infants reach positive peaks more frequently and peaks are not preceded by a specific phase, fathers are nonetheless able to read and respond to second-by-second shifts in infants' affective behavior, as indicated by the similar degree of coherence.

Individual Stability in Measures of Affective Coordination

The proportions of positive and neutral arousal in the two interactions were interrelated ($r_s = .34$ and $.31$, respectively, $p_s < .01$). The number of positive peaks during interactions with mother and father were also correlated ($r = .23, p < .05$), as was the mean duration of the positive peaks ($r = .20, p < .05$). Similarly, the child's social orientation was individually stable ($r = .25, p < .05$), and coherence showed interparental stability ($r = .24, p < .05$). The magnitudes of these correlations were similar for boys and girls. These findings suggest that although infants coconstruct

different vitality contours with mother and father, intraindividual stability is observed for measures of the affective coordination.

Toddler Symbolic Play

A multivariate analysis of variance (MANOVA) computed for the five child play levels (no play, functional play, social play, simple symbolic play, and complex symbolic play) with parent gender and child gender as the between-subjects factors yielded an overall main effect for parent gender, Wilks's $F(5, 164) = 2.74, p < .05$. Univariate tests (see Table 2) showed that no differences in the two symbolic play levels, simple and complex, were found between mother and father. Differences emerged for the presymbolic play levels; children engaged in more functional play with father and more social play with mother. No correlations were found between any of the toddler variables and the child's age in months.

A similar MANOVA was computed for the four parent play levels (no play, didactic play, social play, and symbolic play) and yielded a significant overall main effect for parent gender, Wilks's $F(4, 165) = 2.66, p < .05$. Univariate tests (see Table 2) showed that mothers engaged in more social play, whereas fathers exhibited more didactic play.

A MANOVA computed for the affective component of the interaction, reciprocity and intrusiveness, showed a similar overall effect for parent gender, Wilks's $F(2, 167) = 3.28, p < .01$. Univariate tests (see Table 2) showed that father–child interactions were characterized by higher intrusiveness, whereas mother–child interactions were more reciprocal.

Four ANOVAs examined the affective shape of toddlers' symbolic play, and the findings point to patterns similar to those observed in infancy. The ANOVAs for the latency to simple and complex symbolic levels showed a main effect for parent gender, indicating that children reached episodes of both complex and simple symbolic play more quickly during interactions with father. The latency to the first episode of simple symbolic play was 44.38

Table 2
Parent and Toddler Symbolic Play

	Child–mother		Child–father		Univariate $F(1, 164)$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Child play levels					
No play	.04	.03	.06	.06	<i>ns</i>
Functional play	.29	.22	.37	.25	3.84*
Social play	.12	.11	.04	.03	5.22**
Simple symbolic play	.30	.24	.28	.21	<i>ns</i>
Complex symbolic play	.22	.17	.21	.16	<i>ns</i>
Parent play levels					
No play	.04	.03	.05	.03	<i>ns</i>
Didactic play	.15	.12	.24	.15	3.87*
Social play	.17	.14	.06	.02	7.03**
Symbolic play	.63	.32	.59	.30	<i>ns</i>
Affective component					
Parent–child reciprocity	.35	.22	.24	.15	3.93*
Parent intrusiveness	.08	.04	.14	.06	3.77*

Note. Numbers represent proportions of the entire interactions spent in each play level.
* $p < .05$. ** $p < .01$.

s ($SD = 49.43$) with mother as compared with 33.53 s ($SD = 29.31$) with father, $F(1, 158) = 3.81, p < .05$. Similarly, children showed shorter latencies to reaching complex symbolic play with father ($M = 90.35$ s, $SD = 83.30$) as compared with mother ($M = 143.24$ s, $SD = 983.22$), $F(1, 149) = 3.97, p < .05$. The number of complex symbolic episodes was higher with father ($M = 4.22$, $SD = 2.31$) than with mother ($M = 2.67$, $SD = 1.18$), $F(1, 158) = 3.79, p < .05$. In parallel, each episode of complex symbolic play was shorter with father ($M = 44.24$ s, $SD = 25.98$) as compared with mother ($M = 78.14$ s, $SD = 43.27$), $F(1, 158) = 4.13, p < .05$.

An interaction effect of parent gender and child gender was found in the ANOVA assessing the latency to complex symbolic play, $F(1, 149) = 4.18, p < .05$. Post hoc comparisons with Scheffé tests indicated that father–son dyads took the shortest time to reach the first episode of complex symbolic play, with a latency of 36.40 s ($SD = 31.76$), as compared with father–daughter interactions ($M = 77.28$ s, $SD = 543.11$), mother–son interactions ($M = 94.64$ s, $SD = 219.23$), and mother–daughter interactions ($M = 178.44$ s, $SD = 1,076.33$), $F(1, 149) = 4.76, p < .05$.

The MANOVAs for child play levels also yielded an overall main effect for child gender, Wilks's $F(5, 164) = 2.64, p < .05$, and univariate tests showed that boys engaged in more functional play ($M = .44$) than girls ($M = .30$), $F(1, 164) = 4.12, p < .05$. Similarly, an overall main effect for child gender was found in the MANOVA assessing the parents' play levels, Wilks's $F(4, 165) = 2.52, p < .05$. Parents used more didactic play toward boys ($M = .25$) than toward girls ($M = .16$), $F(1, 165) = 3.97, p < .05$. An overall main effect for child gender was also found for the affective component, Wilks's $F(2, 167) = 2.73, p < .05$. Higher levels of reciprocity were observed during mothers' and fathers' interactions with girls ($M = .33$) compared with boys ($M = .23$), $F(1, 167) = 4.38, p < .05$.

Co-Occurrences

The co-occurrence of parent social play and child complex symbolic play was more prevalent in mother–child interaction ($M = .09$) than in father–child interaction ($M = .01$), $F(1, 105) = 3.96, p < .05$, and an interaction of parent gender and child gender showed that this combination was most prevalent in the interactions of mothers and daughters ($M = .12$) than in any other group, $F(1, 105) = 3.62, p < .05$. Post hoc comparison with Scheffé test indicated that the co-occurrence of parent social play and child complex symbolic play was higher in mother–daughter interactions compared with mother–son interactions ($M = .06$), father–daughter interactions ($M = .02$), and father–son interactions ($M = .01$).

Similar findings emerged for the combination of parent reciprocity and child complex symbolic play. This combination occurred more often during play with mother ($M = .07$) than with father ($M = .04$), $F(1, 162) = 3.85, p < .05$, and more often during play with girls ($M = .07$) than with boys ($M = .03$), $F(1, 162) = 3.85, p < .05$, and appeared most frequently in the interactions of mothers and daughters ($M = .11$) as compared with all other groups ($M = .03$), $F(1, 160) = 3.69, p < .05$.

It thus appears that the social and affective components in the parent's interactive style have closer associations with the child's symbolic expression during interactions with mothers. In addition,

the co-occurrence of parent symbolic play and the child's complex symbolic play was significantly higher during interactions with mother ($M = .08$) than with father ($M = .04$), $F(1, 171) = 4.08, p < .05$, suggesting that although no differences emerged in the amount of complex symbolic play in the two sessions, the matching between the parent's and the child's complex symbolization is more frequent with mother.

Sequential Patterns

Sequences in parent–toddler play were examined separately for mother and father, and lag sequential analyses assessed whether there are sequences of behavior that are more frequent and occur beyond chance level. Four sequential analyses were computed in light of previous research—child behavior following parent intrusiveness, child behavior following parent reciprocity, child behavior following parent social play, and child behavior following parent symbolic play—and each analysis was computed separately for mother and father. An additional sequential analysis examined which parental behavior was more likely to follow the child's functional play to further understand how parents assist children in moving from functional manipulation to symbolic expression.

Results showed that during mother–child play, intrusive maternal actions were most frequently followed by child functional play, $\chi^2(5, N = 86) = 26.34, p < .01$. In fact, the sequence of mother intrusiveness–child functional play occurred seven times more often than any other combination, and no sequences of mother intrusiveness–child complex symbolic play were found. Similarly, reciprocal maternal behavior was typically followed by child symbolic acts, both simple and complex, $\chi^2(5, N = 86) = 18.77, p < .01$. However, during father–child interactions, the sequences of parent intrusive/child functional and parent reciprocal/child symbolic play did not appear more frequently, and the child's symbolic acts were sequentially unrelated to the father's intrusive or reciprocal behavior. The same pattern emerged for the social model of parental behavior. Mother's social play was typically followed by the child's social or simple symbolic episodes, $\chi^2(5, N = 86) = 12.54, p < .01$, but no such links were found for fathers.

For father–child play, sequential associations were found between father's and child's symbolic play. Father's symbolic play was often followed by the child's complex symbolic play, $\chi^2(5, N = 86) = 12.54, p < .01$. On the other hand, mother symbolic play was followed by social, simple symbolic, or complex symbolic play. Child's functional play with father was often followed by father's no play, $\chi^2(5, N = 86) = 5.54, p < .05$, and functional play with mother was followed by mother's social play, $\chi^2(5, N = 86) = 8.22, p < .01$.

In general, the findings suggest that the social and emotional elements in the behavior of parent and child play a significantly greater role in supporting the child's symbolic skills during interactions with mother. Mothers seem to use the social play and the reciprocal mode of behavior to move children from functional nonsymbolic manipulations to more elaborated, creative, and symbolic expressions. During father–child play, symbolic sequences were not so tightly coupled with the relational and affective features of play, and the only significant link was found between the father's symbolization and the child's complex symbolic play.

Individual Stability in Measures of Toddlers' Play

The child's simple and complex symbolic play were individually stable across the two interaction ($r_s = .28$ and $.33$, respectively, $p_s < .01$), pointing to consistency in children's symbolic competencies. None of the other child play levels was stable. Mother's and father's symbolic play was also interrelated ($r = .25$, $p < .05$), perhaps suggesting that a more competent child elicits more symbolic play from both parents.

Predicting Toddlers' Symbolic Competence With Mother and Father

Two hierarchical regression equations were computed predicting the child's complex symbolic play with mother and father from variables at the toddler and infant stage. Complex symbolic play is the age-appropriate indicator of the child's symbolic competencies and was thus selected as a predictor variable. Because different predictors were expected to contribute to symbolic complexity with mother and father, different models were charted for each parent. Predictors were entered in six blocks. The first three blocks included the toddler variables (the parent's symbolic play, reciprocity, and intrusiveness) to partial out variance related to the immediate interaction. The next three variables included the infancy factors (parent–infant synchronous coherence, the child's social orientation, and the numbers of positive peaks in the infant's play) to examine whether the parent–infant coordination predicts complex symbolic play above and beyond the toddler factors. Results of the two regressions are presented in Table 3.

As seen in Table 3, the parents' symbolic play at the toddler age and the degree of synchrony (coherence) in infancy were each uniquely predictive of toddlers' symbolic complexity with mother and father. In mother–child interactions, reciprocity at the toddler stage added unique variance; in the father–child interaction, the number of peaks in the infant's affective contour with father was independently predictive of symbolic complexity in toddlers. The findings demonstrate that parent–infant synchrony predicted symbolic complexity above and beyond variables related to the immediate interaction, suggesting that early affective matching is uniquely related to the development of symbolic competencies.

Discussion

Background emotions are thought to provide the backdrop against which emotions are experienced, chart the timeline for the

ongoing sense of self, and integrate information from subcortical systems that register changes in internal milieu in response to external or internal events and their mapping into higher order structures (Damasio, 1999, 2003). Background emotions, therefore, underlie every emotional experience, in particular, processes that depend on the ongoing integration of internal and external inputs. Symbol formation and creative imagination, especially at the toddler stage when children can use symbols only with the assistance of the adult's moment-by-moment scaffolding (Melstein-Damast et al., 1996; Vygotsky, 1978), integrate cognitive processes and emotional experiences and likely contain a background emotion component to which children are sensitized in early infancy. The present findings chart one pathway in the development of background emotions—from parent–infant affect coordination to sequences of symbolic play in toddlers—in the context of children's relationship with mother and father. The results indicate that the infant's affect synchrony with both parents is related to the complexity of the toddler's symbolic play with that parent above and beyond the parent's concurrent support, suggesting that early affect coordination may contribute to the development of creativity, play, and symbol use.

The shape of infant arousal at play, the background emotion temporal line, showed a markedly different pattern with mother and father, and those were persistent across the first years of life. In infancy, moments of high positive arousal with father were more frequent, were shorter in duration, occurred more quickly, and could have been reached from any previous state. Fathers also showed higher affective matching of the infant's positive arousal, accentuating episodes of intense emotionality through shared affect. The affective contour with mother was more gradual and contained more neutral states. There was typically only one positive emotional peak of longer duration that occurred later in the interaction and was preceded and followed by shared gaze in neutral arousal, as if mother and child were copreparing the intense moment. The quick-paced, highly arousing nature of father–infant play has been described in previous research (Lamb, 1997; Parke, 1996; Yogman, 1981), and the present findings validate and specify these global assessments using a micro-level time-based analysis of discrete affective behaviors. Interestingly, the degree of father–infant synchrony (coherence) was comparable to the mother's, suggesting that although interactions with fathers may appear more random, fathers and infants engage in a tightly fitting, well-matched interactive dance to the same extent as mothers.

Table 3
Regression Models Predicting Toddlers' Complex Symbolic Play With Mother and Father

Criterion	Symbolic play with mother			Symbolic play with father		
	β	ΔR^2	ΔF	β	ΔR^2	ΔF
Toddler stage						
Parent symbolic play	.27*	.11	5.82**	.25*	.08	4.03*
Parent–child reciprocity	.21*	.07	4.04*	.14	.03	2.33
Parent intrusiveness	-.15	.02	2.03	.05	.00	.43
Infancy						
Parent–infant synchrony	.25*	.06	4.31*	.23*	.07	4.09*
Social orientation	.16	.03	3.28	.06	.00	0.22
Positive emotional peaks	.07	.01	1.13	.22*	.05	3.89*
	R^2 total = .30; $F(6, 78) = 4.06, p < .01$			R^2 total = .23; $F(6, 78) = 3.42, p < .05$		

* $p < .05$. ** $p < .01$.

Studies with animals and humans have suggested that emotion regulation capacities are acquired in the context of the parent–infant mutual regulatory exchange (Gianino & Tronick, 1986; Hofer, 1995). It is possible that the quick-paced yet fitted interaction with father facilitates specific forms of emotion regulation in infants, perhaps those related to the management of novelty, unpredictability, and quick shifts in arousal. Research on the effects of father absence on children’s difficulties in regulating emotions in social and learning contexts (Cabrera et al., 2000) is consistent with this assumption. Similarly, attachment theorists have suggested that whereas the role of the infant’s bond with the mother is to promote safety, attachment with father functions to increase exploration and curiosity (Grossman & Grossman, 2005). The present microanalysis lends support to these perspectives by showing that during father–child play partners are less focused on each other and moments of intense affect appear quickly, frequently, and without preparation, an affective line that may direct infants to explore the environment and contribute to their capacity to engage in rapidly changing intense experiences while maintaining a sense of secure base (Bowlby, 1988), internalized through the synchronous interactions with the father. Thus, the specific temporal match infants cocreate with mother and father may be one aspect of the global parental sensitivity considered by several theories of social-emotional development as the cornerstone of the child’s emotional growth.

The parent-specific contours of infancy were preserved at the toddler stage, and episodes of complex symbolic play with father were of shorter durations, higher frequencies, and quicker latencies. Complex symbolic episodes mark the most intense moments of the child’s play as creative output is at its peak and children become engrossed in organizing a detailed imaginary story. At those moments, children are highly excited and charged with positive arousal, energy, and imagination. The similarity in the vitality contour with mother and father across age may suggest that background emotions first appear at the preverbal stage in relationship-specific contexts. As infants make the transition from preverbal relatedness to verbal representations, a symbolic layer is added to the previously established mutuality in ways that preserve the specific rhythms of the parent–child coordination and thus echo the child’s earliest nonverbal experiences. According to Winnicott (1971), the capacity for play—the child’s ability to engage in creative–symbolic activity in ways that integrate internal and external reality—draws on the infant’s earliest attunement with the mother, which provides the basis for the individual’s creative, deeply personal experiences throughout life, including art, culture, and spirituality. Similarly, all major psychoanalytic theorists

(Erikson, 1977; A. Freud, 1965; S. Freud, 1920/1955; Klein, 1986) place the child’s play at the cornerstone of mental health, symbol formation, and well-being. The present results, which show both prediction from parent–infant synchrony to the level of symbolic complexity and continuity from the infant’s affective contour to the temporal organization of creative symbols in the toddler’s play, may provide one explanation for the centrality of background emotions for emotional development and for the creative capacity to use symbols.

The present findings are the first to show sequential relations between the father’s and child’s symbolic expression at play. Similar to the findings for synchrony, fathers appear to support the

child’s creative output to the same extent as mothers while providing moment-by-moment scaffolding. As such, the data show that the infant’s first two meaningful relationships incorporate all three forms of affective coordination—co-occurrences, sequential relations, and synchrony—into the interaction and may suggest that such coordination is an important aspect of interpersonal intimacy across the life span, with each relationship offering affect matching and synchrony in a unique and special way. As seen, the affective components of the interaction played a more central role in toddlers’ interactions with mother. Reciprocal maternal acts were followed by an increase in symbolization; intrusiveness was followed by a decrease in symbolic play and the child’s resort to functional activity; and mothers used the social play mode more than fathers. Reciprocity also emerged as an independent predictor of the child’s symbolic complexity with mother, pointing to the special role of mutual, socially oriented reciprocity for infant development via the relationship with mother. For fathers, the frequency of positive peaks in infancy predicted toddlers’ symbolic expression above and beyond the father’s concurrent scaffolding and the father–infant synchrony, highlighting the organization of intense positive arousal as a potential contributor from the father–child relationship to emotional development.

In contrast to negative emotions, which can be expressed and regulated by the infant in alone states from the first day of life, positive affect in infancy occurs only in dyadic contexts (Rothbart, 1989). To experience and express positive emotions, infants require the participation of an attuned adult who can both construct and coregulate the positive affect in a moment-by-moment process. The origin of positive emotions, therefore, is inherently dyadic and draws on patterns that evolve in time, hence their close links to background emotions and to temporal sequences that can be synchronized with those of another human being. The study of positive affect in general and the regulation of positive emotions in particular have received substantially less attention than research on negative affect. In fact, most studies on emotion regulation in the first years of life consider the regulation of negative emotions—anger, frustration, distress, and negative arousal—and focus on patterns of self-regulation rather than coregulation (Calkins & Fox, 2002). An important exception in this context is the work of Fogel and colleagues (Lavelli & Fogel, 2005; Messinger, Fogel, & Dickson, 1997), which addressed micro-level assessment of infant smiles and positive communication and their development in the first weeks of life. The recent focus on the importance of positive emotions to adults’ well-being (Seligman, Parks, & Steen, 2004) highlights the need to move from a focus on negative emotions to a much deeper understanding of the role of positive emotions in human life. The study of background emotions as they emerge during the infant’s earliest interactions with the parent may provide a window to address the developmental context of positive emotions, to emphasize their dyadic origin, and to underscore the centrality of the temporal component in research on emotions in general, and positive emotions in particular.

A central limitation of the present study is the lack of physiological measures that can begin to unravel the neurological underpinnings of the experience, perception, and expression of background emotions. Much further research is required to understand the nature of background emotions, but moreover to develop a language of affect that can give room for the experience of time in the study of emotions. Similarly, parent–infant interactions in

non-Western cultures provide opportunities for affect matching and synchrony in ways that are unique and support social-emotional growth according to their cultural customs, meaning systems, and caregiving practices (Feldman, Masalha, & Alony, 2006), but little research has followed such pathways. Background emotions provide the backdrop against which perceptions, actions, interpersonal encounters, and mental products are formulated. Future research should tease out these temporal patterns and examine their biological and emotional meaning, their role in early development, and their contribution to the consolidation of the self and the development of interpersonal intimacy across the life span.

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