Change in Mother–Infant Interactive Behavior: Relations to Change in the Mother, the Infant, and the Social Context

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This study examines relations between change in mother–infant interaction and change in parental and infant traits. Forty-seven mother-infant dyads were observed at 3 months in face-to-face interaction and at 9 months in two play situations, face-to-face social play and exploratory play interaction. Following Belsky's (1984) "determinants of parenting" model, changes in maternal anxiety, infant temperament, and spousal support were assessed. Decreases in maternal trait anxiety and in infant difficult temperament from 3 to 9 months predicted an increase in mother sensitivity in the two play situations. A decrease in infant difficulty and an increase in father involvement were related to a reduction in maternal intrusiveness during social play. Finally, decreases in maternal anxiety and in infant difficulty and an increase in father involvement predicted an increase in infant exploratory play. The data suggest the importance of change in paternal, maternal, and infant traits as additional dimensions to be included in ecological theories of infant development.

Models of the development of mother–infant interaction have focused on stability in early interactive patterns but have provided little explanation for change in such patterns. In particular, stability in the mother's sensitive approach during the first year of life has been emphasized as an important dimension of mother–infant relatedness (Ainsworth, Blehar, Waters, & Wall, 1978; Belsky, Rovine, & Taylor, 1984; Isabella, 1993; Pettit & Bates, 1984; Spangler, Schieche, Ilg, Maier, & Achermann, 1994). However, the low to moderate stability found for maternal sensitivity in most studies and the little or no stability reported for the infant interactive behavior (Bornstein & Tamis-LeMonda, 1990; Heinicke, Diskin, Ramsey-Klee, & Given, 1983) have lead researchers to question whether stability of change is the typical course of early social development (Crockenberg & McClusky, 1986; Emde, 1994; Rutter, 1984).

Ecological models of infant development suggest that behavior patterns develop within, as well as reciprocally shape, a complex hierarchy of environmental forces (Bronfenbrenner, 1977). Of these, the "determinants of parenting" model (Belsky, 1984) emphasizes three sources of influence on the mother's interactive style; maternal personality factors, infant temperamental dispositions, and social-contextual conditions. Numerous studies support the model by showing that optimal maternal, infant, or environmental conditions are associated with more responsive parenting (Crockenberg & Smith, 1982; Heinicke & Guthrie, 1992). Little attention, however, has been paid to the relations between these determinants and change in early dyadic patterns. Moreover, no study has systematically examined the relations between change in maternal, infant, or social variables and corresponding change in mother–infant interactions.
The application of dynamic systems theory to the study of human development (Fogel, 1993; Sameroff, 1983; Thelen, 1990; Thelen & Smith, 1994) provides a theoretical framework for the study of change. Dynamic systems theory proposes that developmental change occurs within hierarchically organized, multi-determined systems; that systems constrain development so that global as opposed to local changes are lawful; and that changes in the individual emerge hand in hand with changes in the surround. Taken together with Belsky’s (1984) ecological model, which defines the “determinants of parenting” as the system wherein mother–infant mutuality evolves, the combined perspective supports the hypothesis that change in mother–infant interactions emerges in relation to change in the mother, the infant, and the social context. This study examines the relations between change in maternal, infant, and contextual determinants and change in interactive patterns. The central question addressed is: Are changes in the conditions that affect social behavior paralleled by changes in the observed behavior? Additionally, we examine to what extent these parallel changes are specific to the immediate social context of the interaction.

A number of researchers suggest that stability and change in early socioemotional development should be studied in relation to three parameters that define the meaning of change: developmental trends or continuities, individual stability, and the context of behavior (Emde, 1984, 1994; Kagan, 1980; Lewis & Starr, 1979). Block (197 1) and Rutter (1984) maintain that developmental change is interpretable only in reference to the central tendency in the group, as indicated by mean-level changes, and the general stability of that measure, as reflected by the magnitude of stability correlation coefficients. Dynamic systems theory would lead to two hypotheses regarding change in early maternal and infant behaviors. First, at points in development when large-scale mean-level changes are observed, implying that new abilities are introduced into the system, variability among individuals is at its peak (Thelen, 1990). Second, changes in psychological or behavioral systems are linked to changes in other related systems. For instance, positive emotional change should be expressed in more adaptive behavior (Fogel & Thelen, 1987; Wolff, 1987).

During the first year, the major transformations in infants’ cognitive, communicative, and motor abilities result in significant mean-level changes in interactive behavior. Infants’ social involvement increases, maternal eliciting behavior decreases, and maternal sensitivity is indexed by behaviors that promote reciprocity, infant initiation, and active exploration (Belsky et al., 1984; Lamb, Morrison, & Malkin, 1987). During this dynamic process, by which infants are introduced into the social world, rank–order changes are to be expected. These changes are likely to correspond to changes in related systems which contribute to the development of interactive patterns, changes in maternal personality, infant temperament, and the nature and availability of social support.

The context of behavior, a neglected topic in the study of social development (Fogel et al., 1992), is another important aspect of behavior change. With growth, the number of contexts available for social interactions increases, resulting in a growing specificity of social behavior as interactive contexts become associated with unique sets of interactive patterns (Sroufe & Jacobvitz, 1989). Moreover, at various stages of development the normative, age-appropriate context for playful interactions is altered. In the first months of life, infants’ immobility limits social interactions to face-to-face contexts. Play is thus constrained by the context into a social interpersonal interactive mode in which patterns of mutual gazing, high pitched co-vocalizations, synchronous affective sharing, and reciprocal imitations are frequent (Cohn & Tronick, 1987; Kaye & Fogel, 1980; Stern, 1985). Following the onset of mobility, play is increasingly directed toward non-social developmental goals—exploration of the environment, manipulation of objects, and gross and fine motor practice—and occurs mainly in non-face-to-face contexts. Because mothers’ inclination toward “social” or “exploratory” interactive approach is a stable dimension during infancy (Bornstein & Tamis-LeMonda, 1990), the goodness-of-fit between the interactive context, the mother’s natural preference, and the age-appropriate goals of play may account for rank-order changes in the interactive atmosphere. In order to include the play context as a study parameter during the transition to mobility, we examined two sets of correlates of change in mother—
infant play between 3 and 9 months. One set of correlates related to two face-to-face situations at the two ages and the other reflected change between face-to-face interaction at 3 months and exploratory play at 9 months. The latter set constitutes two age-appropriate contexts of infant play.

Trait anxiety, defined by the dispositions toward stress reactivity, high emotional arousal, and negative mood, is conceptualized by some personality theorists as part of the higher-order negative emotionality construct (Watson & Clark, 1984; Watson & Tellegen, 1985). From a dynamic systems perspective, trait anxiety is an unstabilizing systemic element. It is among the personality traits most prone to normative instability, the distinction between its “state” and “trait” levels is not entirely clear, and during periods of stress or transitions the instability of the state and trait dimensions are further increased (Cattell & Scheier, 1961; Pervin, 1970). Of those periods of stress or transition, the immediate pre- and post-partum months are considered a phase of significant personal change in which the normative instability of trait anxiety is increased (Heinicke, 1984; Sirignano & Lachman, 1985). This instability is likely to have bearings on the ongoing adaptation between mother and child.

Three interactive dimensions have been associated with maternal anxiety and may be sensitive to changes in trait anxiety during the post-birth period, maternal sensitivity, maternal intrusiveness, and infant exploratory play. Numerous studies report correlations between pre-birth maternal anxiety and later maternal insensitivity at play (Cox, Owen, Lewis, & Henderson, 1989; Field, Sandberg, Vcga-Lahr, Goldstein, & Guy, 1985; Heinicke et al., 1983). Interactions between anxious mothers and their infants have been characterized by diminished maternal responsiveness, continuous intrusion on the child’s natural flow of activity, and restricted infant exploratory play (Biringen, 1990; Nover, Shore, Timberlake, & Greenspan, 1984). Del Carmen, Pedersen, Huffman, and Bryan (1993) found that pre-birth maternal anxiety and 3-month maternal management of infant distress predicted insecure attachment at one year. The authors concluded that the mother’s handling of negative affect, her own or the child’s, is the underlying link to attachment insecurity. If the ability to handle negative affect is prone to normative instability following childbirth, improvement or decrease in maternal distress management may be related to changes in maternal sensitivity and intrusive behavior or have an impact on the development of infant exploration.

Infant difficult temperament is analogous to adult trait anxiety on a number of dimensions pertinent to change. It is similarly conceived of in terms of the higher-order negative emotionality construct (Belsky, Hsieh, & Crnic, 1996) and includes the correlated dispositions of fussiness, irregularity, irritability, and aversive mood (Bates, 1987; Riese, 1987). These tendencies have been associated with the difficult end of the easy-difficult continuum (Peters-Martins & Wachs, 1984; Thomas & Chess, 1970). During the first months of life, negative emotionality is characterized by “lawful discontinuity” rather than stability (Belsky, Fish, & Isabella, 1991). Furthermore, positive change in infant difficulty is related to the degree of maternal sensitivity (Belsky et al., 1991; Washington, Minde, & Goldberg, 1986). Although mothers’ reports of infant difficulty may represent a maternal or an infant characteristic (Bates, 1980), change in perceived difficulty may reflect change in the mother’s mental representations of the child, her attitudes, or her sense of competency and may, in turn, be related to behavior change.

Fathers’ daily involvement in housekeeping responsibilities and childcare is considered the central source of ecological support during the post-birth period (Belsky, 1984; Bronfenbrenner, 1977) and, similar to maternal anxiety and infant difficulty, has been associated with change. For example, high father involvement predicts a lower decrease in marital satisfaction in the transition to parenthood (Belsky, Lang, & Huston, 1986; Levy-Shiff, 1994; Ruble, Hackel, Flaming & Stangor, 1988). In addition, father involvement moderates the effects of infant difficulty on maternal depression (Curtona & Troutman, 1986) and on the mother’s interactive sensitivity (Crnic & Greenberg, 1990). Heinicke and Gutrie (1992) found that positive change in husband-wife relationships over the first four years of the child’s life was related to positive development in parent-child relationships.

Previous research has investigated the relations between the determinants of parenting and
mother or infant behavior. Few studies have examined change in mother (Crockenberg & McClusky, 1986) or infant (Belsky, Fish, & Isabella, 1991) behavior as a function of the characteristics of the other. Moreover, no study to our knowledge has examined change in mother or infant behavior as a function of change in the characteristics of the mother, father, or child. Examining such change is the major purpose of the present investigation.

This study aims to examine change as a predictor during the initial period of mother–child socialization. A major theoretical assumption is that as the determinants of parenting become more favorable, the behavior of both mother and infant become more adaptive. We propose that change in the determinants of parenting between 3 and 9 months will be related to change in mother–infant interaction. Specifically, reductions in maternal anxiety and in infant difficulty and an increase in father involvement will predict behavior change showing an increase in maternal sensitivity, a lowering of maternal intrusiveness, and an increase in infant exploration. Finally, patterns of behavior change are expected to be sensitive to the immediate context of the interaction.

METHOD

Participants

Forty-eight mothers and infants were selected at random from a list of healthy newborns in well-baby clinics in Jerusalem. An equal number of boys and girls and of first-born and second-born infants participated in the study. Out of 60 mothers contacted, 53 agreed to participate, and five dyads were used as a pilot sample. No significant differences in parental education, birthweight, birth order, or Apgar scores, information collected from the well-baby clinic record, were found between those who agreed and those who declined.

Infants were healthy, born at full-term gestation, weighed at least 2,700 g, and received Apgar scores of 8 or above. Infants were between 12 and 15 weeks old (M = 90 days) at the first observation and between 36 and 39 weeks old (M = 264 days) at the second observation. Mothers were between 25 and 36 years (M = 29.6, SD = 1.6 years), had completed on average 14.8 years of education (SD = 0.8 years), and were currently married to the child’s father. All families were considered middle-class by Israeli standards (Harlap, Davis, Grower, & Prywes, 1977). The well-baby clinic records were screened for maternal physical illness, psychopathology, serious pregnancy problems, or perinatal complications. At 9 months, 47 dyads participated (one family moved out of the country).

Procedure

Mothers and infants were invited to a university laboratory at the time of day the infant was expected to be fed and rested. Visits began with an interview, after which mothers completed a battery of self-report instruments. Upon completing the instruments, mother and infant entered a large studio, infant was placed in an infant seat, and the mother sat next to him/her on an adjustable stool. Mothers were instructed to play freely with the child as they would at home. Ten minutes of free play were videotaped through a one-way mirror using a split-screen technique. At 9 months two play interaction situations were videotaped, a face-to-face social situation with the child in an infant seat (without toys) and a non-face-to-face exploratory situation with toys. An exploratory, non-face-to-face situation was not provided at 3 months since children at that age are oriented to face-to-face situations and do not have the motor flexibility to play simultaneously with the mother and toys in non-face-to-face settings. In the exploratory situation, mother and infant played on a carpeted floor with age-appropriate toys (two telephones, two dolls, two puppets, two cars, blocks, and a shape sorter), and mothers were instructed to play with the child using these toys. The order of play situations was counterbalanced.

Measures

**Trait Anxiety Change**. Trait anxiety was measured by the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970) adapted for the Israeli population by Teichman and Melenick (1976). This well-validated instrument (Blumberg, 1980) uses separate scales to measure stable individual differences in anxiety proneness (trait) and current states of anxiety. Because it was hypothesized that the stable dimension of anxiety proneness is related to stability and change in interactive style, the Trait Anxiety score was used in the following analyses.

Mean Trait Anxiety scores (and SD) were 33.46 (6.11) and 32.13 (6.15) at 3 and 9 months, respectively. Anxiety scores were within the normal range for Israeli adults and none exceeded the clinical cutoff. The Trait Anxiety Change score was created by regressing trait anxiety at 3 months onto trait anxiety at 9 months and retaining the residuals (Cronbach & Furby, 1970). This score indicates change in the individual’s susceptibility to anxiety, while holding constant its initial level.

**Infant Difficulty Change**. Infant difficult temperament was measured with the Fussy–Difficult scale of the Infant Characteristics Questionnaire, ICQ (Bates, Freeland, & Lounsbery, 1979). The Fussy–Difficult dimension of the ICQ is the most stable of ICQ factors (Bates, 1987), thus change in difficulty may be examined in relation to its moderate stability in the group (Rutter, 1984). The ICQ Fussy–Difficult dimension measures the negative emotionality component of infant temperament and is theoretically (Hubert, Wachs, Peters-Martin, & Gandour, 1982) and empirically (Goldsmith & Alansky, 1987) related to similar dimensions in other self-report instruments (Riese, 1987; Wornbey & Blajda, 1989). Mean Fussy–Difficult scores (and SD) were 22.5 (6.53) at 3 months and 21.41 (6.81) at 9 months. Difficulty Change scores were computed by regressing difficulty at 3 months on difficulty at 9 months and retaining the residuals.
Father Involvement Change. Father Involvement was measured by means of Ruble and colleagues’ (1988) two-factor instrument administered to the mothers. The two factors assessed father involvement in housekeeping (e.g., dishes, shopping) and in childcare (playing, bathing) and were combined into a single score (Cronbach’s α = .71). Father Involvement change was computed using the same regression procedure.

Coding

Videotapes were scored for 16 maternal, infant, and dyadic play behaviors. Nine measures were adapted from the Rating Scale of Interactional Style-RSIS (Clark & Seifer, 1983) and seven measures were added and scored similarly. The RSIS is a validated scoring system based on a 5-point Likert scale, which has shown sensitivity to age-related changes in interactive behavior as well as to conditions associated with high-risk parenting (Clark & Seifer, 1983). A global coding system was selected to study change in light of Bakeman and Brown’s (1980) argument that constructs such as sensitivity describe a global disposition rather than a sum of discrete frequencies.

Play measures adapted from the RSISI were the maternal measures of Forcing, Overriding, Acknowledging, Imitating, Elaborating, Maternal Gaze, and Maternal Affect, the infant measures of Gaze Aversion, and the dyadic measure of Reciprocity. The seven additional measures included the infant measures of Alertness, Fussiness, Fatigue, Initiation, and Vocalization, the maternal measure of Vocalization, and the dyadic measure of Adaptation-Regulation.

To examine the applicability of a coding system developed for home observations to a laboratory setting, interactions of the five-dyad pilot sample were coded for each play situation. The intercorrelation matrix revealed theoretically meaningful constructs, similar to Belsky et al.’s (1984) composites for home observations. In addition, Spangler et al. (1994) found stability on a global measure of maternal sensitivity between home interactions at 3 months and lab interactions at 6 and 9 months. Colu and Elmore (195) showed convergent validity between global rating and micro-analytic coding in laboratory setting. These findings provide further support to the use of global codes in a laboratory setting.

Two graduate students scored each measure after viewing the entire session. Coders were trained to reliability of 80% within a one-point window. Inter-rater reliability was computed periodically on a random sample of 12 dyads at each age and play context. Reliability percentages using a one-scale point window averaged 92% at 3 months (range = 89%-100%), κ = .83, 93% at 9 months social context (range = 87%-99%), κ = .81, and 94% at the 9 months exploratory context (range = 88%-100%), κ = .84.

Data Reduction

Play measures were summed into three composites: Mother Sensitivity, Infant Involvement, and Mother Intrusiveness. Composites were theoretically derived and demonstrated acceptable internal consistency (Cronbach’s α = .70 and above). Mother Sensitivity include the mother’s specific play patterns (Imitating, Elaborating); general sensitive attitude (Acknowledging of the infant’s social communication, Gaze, warm and appropriate Affect, and Vocalization in the infant register), and the opportunity for mutual exchange (Reciprocity). These interactive dimensions, with minor variations, define the sensitive-responsive construct in most longitudinal studies of mother-infant interaction (Ainsworth et al., 1978; Belsky et al., 1984; Bornstein & Tamis-LeMonda, 1990; Crockenberg & McClusky, 1986, Heinicke et al., 1983; Spangler et al., 1994). Infant Involvement assessed the infant’s active participation in play (Initiation of play bids, Vocalizations, Alert exploration, Continuous gaze) and the level of expressed positive affect (Affect, Fatigue, Fussiness). Mother Intrusiveness included three levels of intrusive behavior; physical intrusiveness (Forcing), nonphysical coercion (Overriding), and inappropriate stimulation (Disregulation). These patterns have been identified as typical of the intrusive style (Egeland & Farber, 1984; Lee & Bates, 1985). Mother Sensitivity and Mother Intrusiveness had very low intercorrelations across observations (r2 = .09-.14).

RESULTS

Analysis of the relations between change in the determinants of parenting and change in mother and infant behavior was carried out in three steps. First, mean-level changes (continuity) and cross-age stability were examined between 3 and 9 months of age on all variables. These data are important for establishing the normative context of change for this sample. Second, Maternal Anxiety Change, Infant Difficulty Change, and Father Involvement Change were examined as predictors of change in Mother Sensitivity, Infant Involvement, and Mother Intrusiveness. Prediction was computed once between the two social face-to-face play situations at 3 and 9 months (continuity in play context) and once between the face-to-face play at 3 months and the exploratory toy interaction at 9 months (continuity in age-appropriateness of the context). Finally, differences between beta coefficients predicting change in the two play contexts were tested.

Mean-Level Changes

Examination of mean-level changes in the determinants of parenting between 3 and 9 months of age showed that Maternal Trait Anxiety was marginally reduced, $F(1, 46) = 4.18, p = .063$, no significant change was found for Infant Difficulty, and Father Involvement increased between 3 and 9 months, $F(1, 46) = 5.21, p < .05$.

Means, standard deviations (SD), and $F$ values of the repeated measure MANOVA (gender and birth order as between-subject factors) of the interactive variables are ported in Table 1.
TABLE 1
Descriptions of Maternal and Infant Interactive Behavior at 3 and 9 Months

<table>
<thead>
<tr>
<th></th>
<th>A: 3 Months</th>
<th>B: 9 Months, Social Play</th>
<th>C: 9 Months, Exploratory Play</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Mother Sensitivity</td>
<td>3.64a</td>
<td>.75</td>
<td>3.10b</td>
</tr>
<tr>
<td>Infant Involvement</td>
<td>2.90a</td>
<td>.60</td>
<td>3.30b</td>
</tr>
<tr>
<td>Mother Intrusiveness</td>
<td>3.47a</td>
<td>.90</td>
<td>2.07b</td>
</tr>
</tbody>
</table>

*Note: Analysis of variance was conducted once between the social situations at 3 and 9 months (AxB) and once between the two social and exploratory play situations at 9 months (BxC). Means with different superscripts were significantly different (Duncan multiple range test, p < .05).***p < .001.

As indicated in Table 1, Mother Sensitivity decreased between 3 and 9 months of age in the social play situation and was further reduced in the exploratory play. Parallel to the maternal decrease, Infant Involvement increased from 3 to 9 months, and increased further in the exploratory play. Mother Intrusiveness decreased significantly between 3 and 9 months. All mothers in the sample reduced their intrusive behavior, mostly by more than one standard deviation, a result that may be attributed to the low risk nature of the sample. Generally, the findings indicate that mothers reduce the level of interactive activity in concordance with the infant’s growing social involvement.

Cross-Age Stability

Cross-age correlations between interactive patterns and the determinants of parenting at 3 and 9 months of age are presented in Table 2.

TABLE 2
Cross-Age Correlations Between Interactive Behavior and the Determinants of Parenting at 3 and 9 Months

<table>
<thead>
<tr>
<th></th>
<th>3 MONTHS</th>
<th>9 MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mother Sensitivity</td>
<td>Infant Involvement</td>
</tr>
<tr>
<td>FACE-TO-FACE PLAY</td>
<td>.46***</td>
<td>.04</td>
</tr>
<tr>
<td>Mother Sensitivity</td>
<td>.32*</td>
<td>-.10</td>
</tr>
<tr>
<td>Infant Involvement</td>
<td>.06</td>
<td>.22</td>
</tr>
<tr>
<td>Maternal Intrusiveness</td>
<td>.41**</td>
<td>.31*</td>
</tr>
<tr>
<td>EXPLORATORY PLAY</td>
<td>.28</td>
<td>-.12</td>
</tr>
<tr>
<td>Mother Sensitivity</td>
<td>-.02</td>
<td>.10</td>
</tr>
<tr>
<td>Infant Involvement</td>
<td>.32*</td>
<td>.12</td>
</tr>
<tr>
<td>Maternal Intrusiveness</td>
<td>-.42**</td>
<td>-.24</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001.
and between Father Involvement at 3 months and Mother Sensitivity and Infant Involvement at 9 months.

Consistency in interactive patterns across the two contexts at 9 months was examined. Significant correlations were found for Mother Sensitivity across context, \( r = .32, p < .05 \), indicating moderate consistency for the mother's sensitive style. Maternal Intrusiveness and Infant Involvement were not significantly correlated across the two contexts.

Prediction of Change

Trait Anxiety Change, Infant Difficulty Change, and Father Involvement Change were examined as predictors of change in Mother Sensitivity, Infant Involvement, and Mother Intrusiveness in a series of hierarchical regression equations. Equations were computed separately for the social (Table 3) and the exploratory (Table 4) play contexts at 9 months. In each regression equation the 3-month corresponding variable was entered first, to partial out variance due to stability. Following this entry, Trait Anxiety Change, Infant Difficulty Change, and Father Involvement Change were entered. The order of entry was in line with Belsky's (1984) model, suggesting that aspects of the mother's personality are the main predictors of early relatedness.

Results reported in Table 3 for the social play situation suggest that decreases in Maternal Trait Anxiety and in Infant Difficulty, regardless of their initial level, predicted an increase in Mother Sensitivity. Decrease in Trait Anxiety and an increase in Father Involvement predicted a decrease in Mother Intrusiveness. Change in Infant Involvement was unrelated to change in the predictors.

Results reported in Table 4 for the exploratory play situation show that decreases in Maternal Trait Anxiety and in Infant Difficulty predicted an increase in Mother Sensitivity. Increase in Infant Involvement was uniquely related to change in all three predictors; a decrease in Maternal Anxiety, a decrease in Infant difficulty, and an increase in Father Involvement. Unlike the social context, change in Mother Intrusiveness was unrelated to change in the predictors.

An alternative, theoretically possible hierarchical model was examined in which Infant Difficulty Change was entered before Anxiety Change in similar regression models. Results indicated that in these models, Infant Difficulty Change did not make a unique contribution to the prediction of interactive change in either

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Mother Sensitivity</th>
<th>Infant Involvement</th>
<th>Mother Intrusiveness</th>
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<tr>
<td>3-Month Parallel Variable</td>
<td>.52***</td>
<td>-.13</td>
<td>.17</td>
</tr>
<tr>
<td>R²</td>
<td>.21***</td>
<td>.02</td>
<td>.01</td>
</tr>
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</table>

CHANGE IN DETERMINANTS OF PARENTING

<table>
<thead>
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<th>Predictor Variables</th>
<th>Mother Sensitivity</th>
<th>Infant Involvement</th>
<th>Mother Intrusiveness</th>
</tr>
</thead>
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<tr>
<td>Trait Anxiety Change</td>
<td>-.34***</td>
<td>-.13</td>
<td>.17</td>
</tr>
<tr>
<td>R² Change</td>
<td>.10*</td>
<td>.01</td>
<td>.15*</td>
</tr>
<tr>
<td>Infant Difficulty Change</td>
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<td>-.15</td>
</tr>
<tr>
<td>R² Change</td>
<td>.06*</td>
<td>.02</td>
<td>.03</td>
</tr>
<tr>
<td>Father Involvement Change</td>
<td>.14</td>
<td>.12</td>
<td>-.39*</td>
</tr>
<tr>
<td>R² Change</td>
<td>.02</td>
<td>.03</td>
<td>.09*</td>
</tr>
<tr>
<td>R² Total</td>
<td>.39***</td>
<td>.08</td>
<td>.28*</td>
</tr>
</tbody>
</table>

Note: The coefficients are standardized betas. dfs are 1,45 for the covariate, 2,44 for Trait Anxiety Change; 3,43 for Infant Difficulty Change, and 4,42 for Father Involvement Change.

*p < .05. **p < .01. ***p < .001.
TABLE 4
Results of Hierarchical Regressions Predicting Change in Exploratory Play

<table>
<thead>
<tr>
<th>Predictor Variables</th>
<th>Mother Sensitivity</th>
<th>Infant Involvement</th>
<th>Mother Intrusiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Month Parallel Variable</td>
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<td>.02</td>
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<tr>
<td>R²</td>
<td>.16**</td>
<td>.01</td>
<td>.00</td>
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<tr>
<td>CHANGE IN THE DETERMINANTS OF PARENTING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trait Anxiety Change</td>
<td>-.32*</td>
<td>-.31*</td>
<td>-.16</td>
</tr>
<tr>
<td>R² Change</td>
<td>.08*</td>
<td>.10*</td>
<td>.03</td>
</tr>
<tr>
<td>Infant Difficulty Change</td>
<td>-.28*</td>
<td>-.28*</td>
<td>-.15</td>
</tr>
<tr>
<td>R² Change</td>
<td>.07*</td>
<td>.07*</td>
<td>.02</td>
</tr>
<tr>
<td>Father Involvement change</td>
<td>.15</td>
<td>.35*</td>
<td>-.14</td>
</tr>
<tr>
<td>R² Change</td>
<td>.03</td>
<td>.10*</td>
<td>.02</td>
</tr>
<tr>
<td>R² Total</td>
<td>.34**</td>
<td>.28*</td>
<td>.07</td>
</tr>
</tbody>
</table>

Note: The coefficients are standardized beta. dfs are 1,45 for the covariate, 2,44 for Trait Anxiety Change, 3,43 for Infant Difficulty Change, and 4,42 for Father Involvement Change.

*p < .05. **p < .01. ***p < .001.

play context. Change in perceived infant difficulty may thus be related to change in behavior only when it occurs in the context of a more global change in the mother’s anxious attitude. Models in which Father Involvement Change was entered as the first predictor were also examined. These models accounted for a smaller percentage of the variance on all criterions.

Testing the Difference Between Beta Coefficients in the Two Play Contexts

To determine the impact of context on the magnitude of beta coefficients in the face-to-face as opposed to the exploratory play context, we used Cohen and Cohen’s (1983, p. 479) method for testing the differences in partial regression coefficients from the same sample. Differences in beta coefficients predicting change in Mother Sensitivity were nonsignificant, indicating that the relations between change in Mother Sensitivity and change in Maternal Anxiety, Infant Difficulty, and Father Involvement were not related to the play context. On the other hand, the beta coefficients relating Trait Anxiety Change and Father Involvement Change to reduction in Mother Intrusiveness were higher in the social context than in the exploratory context (t = 3.71, 3.89 respectively, p < .01). All three beta coefficients of predictors of Infant Involvement Change were significantly higher (p < .05) in the exploratory play context as compared to the social context; Trait Anxiety Change (t = 2.73), Infant Difficulty Change (t = 2.73) and Father Involvement Change (t = 2.65).

DISCUSSION

Results of this study support our hypotheses and add a new dynamic dimension to ecological models of infant development (Belsky, 1984; Bronfenbrenner, 1977). In addition to the reciprocal and longitudinal relationships between mother–infant interaction and the family ecology, suggested by these models and supported by extant research, change in mother and infant behavior are shown here to be related to changes in parental and infant traits. Reduction in maternal trait anxiety, a decrease in infant difficult temperament, and an increase in father involvement predicted positive change in mother–infant interaction between 3 and 9 months. These findings extend the “determinants of parenting” framework (Belsky, 1984) by demonstrating its heuristic validity for the explanation of both stability and change in early parent-child relatedness.

The correspondence between change in maternal anxiety, infant difficulty, and father involvement and change in interactive patterns emerged within a dynamic developmental pro
cess (Block, 1971), a period when large-scale mean-level changes indicate that new abilities are mastered by the interacting partners. The shifts in mean-levels found for maternal sensitivity, infant involvement, and maternal intrusiveness between 3 and 9 months indicate discontinuity in mother-infant interaction patterns during the first year, which possibly sets the stage for rank-order instability (Thelen, 1990). The mean-level reduction in maternal sensitivity and the mean-level increase in infant involvement followed the process of “mutual regulation” (McCune, DiPane, Fireoved, & Fleck, 1994). This process refers to the correspondence between decreases in maternal stimulation and increases in infant activity observed longitudinally across the early stages of social development. Other models (e.g., Gianino & Tronick, 1988) describe similar processes of mutual regulation within the course of a single observation, the mother’s and infant’s mutual adaptation to second-by-second shifts in the partner’s level of interactive engagement. Thus, parallel regulatory processes seem to occur at the longitudinal level of early social development and at the micro-analytic level of a single interaction. An example of such processes in the present study is the infant’s growing social involvement occurring as the mother tends to withdraw from the leading role.

Play behaviors that were stable across time were more likely to show similar patterns of change in relation to the predictors in both play contexts, while play behaviors that were unstable showed dissimilar patterns of change in these contexts. For example, maternal intrusiveness and infant involvement were unstable across time. These behaviors also showed different magnitudes of change in relation to the predictors in the different contexts. On the other hand, the extent of change in maternal sensitivity in relation to change in the predictors was similar in the two contexts. This is indicated in the data by the nonsignificant difference between the beta coefficients assessing change in maternal sensitivity in the two contexts. These findings suggest that maternal sensitivity, conceptualized as a global and stable maternal parameter (Ainsworth et al., 1978), is not only stable across time and consistent across context during the first year but when change does occur it is not specific to one interactive setting. Maternal sensitivity may thus be considered a global maternal parameter with regard to both stability and change.

On the other hand, the special characteristics of the social interactive context may have strengthened the relations between a decrease in trait anxiety, an increase in father involvement, and a decrease in mother intrusiveness. Social play, an open interactive setting which requires continuous monitoring of the partner’s facial expressions and affective states, may lead anxious or less-supported mothers to exercise higher levels of control than the semi-structured exploratory play. As anxiety decreases and support increases, there may be more notable reductions in maternal control attempts in the finely-tuned face-to-face exchange.

Similarly, change in infant involvement in relation to change in maternal anxiety, infant difficulty, and father involvement was observed only during toy exploration. With the transition to mobility infants generally shift to playing in non-face-to-face contexts in which the focus is exploratory. The shift in goals and setting may have provided an opportunity for the change in parental and infant traits to have an impact on change in behavior. Developmental transitions, such as the transition to mobility, are often followed by a reorganization of the person-environment relationships (Emde, Gaensbauer, & Harmon, 1976). When the determinants of parenting become more favorable, the re-integration of behavior, emotional states, and environmental inputs may result in more adaptive behavior in the new social context.

Change in maternal anxiety proved to be the central predictor of change in mother and infant behavior. Models in which infant difficulty change and father involvement change were entered as first predictors accounted for a smaller portion of the variance. These results extend Belsky’s (1984) proposition, that mother personality is the central predictor of mother-child relatedness, to the relations between change in maternal personality dimensions and change in interactive behavior. Zeanah and Andreas (1987) suggest that the mother’s anxiety-proneness defines the “psychological context” into which infants are born, and this context, in turn, serves as the foundation for the development of mother-child relationship. It is possible that the malleability of trait anxiety—
variability in its rate and direction of change—is an additional component of the psychological context. While some mothers may be quick to reorganize following the initial stress of childbirth, others may become increasingly stressed by ongoing childcare, the infant's growing need for independence, or the growing complexity of her behavior.

Reduction in infant difficulty contributed to the prediction of change in mother and infant behavior. The repeatedly raised question, is mother report of infant temperament a maternal or an infant variable (Bates, 1987), is similarly relevant with regard to change. Seifer, Sameroff, Barrett, and Krauschk (1994) found that mothers' reports of infant temperament was unrelated to observers' reports on similar temperamental dimensions and concluded that mothers are poor informants of infant temperament. Their conclusion may add leverage to the interpretation that change in reported difficulty is subjective and is linked to the mother's improved sense of competence in handling a difficult child. Yet alternative explanations cannot be ruled out. Change in anxiety may be followed by an improvement in the mother's management of infant distress, and better distress management may facilitate an objective decrease in the infant fussy-difficult behavior. Finally, if mothers are accurate reporters of infant behavior, a decrease in infant difficulty may indeed be related to an increase in maternal sensitivity. This interpretation is supported in the data by the finding that as infant difficulty decreases, infant involvement increases, indicating a relationship between observed and reported infant behavior.

Increase in father involvement was related to an increase in infant exploration and to a decrease in mother intrusive behavior. Positive associations between father involvement and toddlers' interactive involvement were reported by Belsky, Youngblade, Rovine, and Voling (1991) and the present findings extend their results to the first year of life. Father involvement has been associated with responsive dyadic and triadic interactions during the first year (McHale, Frosch, Greene, Ferry, & Mangelsdorf, 1995), and its impact on improvement in family functioning, mother interactive approach, and infant social competence is yet to be examined in depth. It is possible that high paternal involvement in childcare affords extra opportunities for parent–child interactions and an additional social role model. Thus, involved fathering may have a direct impact on the infant's interactive skills. Additionally, an increase in father involvement may function to reduce the mother's intrusiveness, thereby indirectly promoting the infant's initiatory behavior, exploratory attempts, or expressed autonomy.

The relations between change in behavior and change in the conditions that affect behavior have been little researched. Although Bronfenbrenner's (1986) ecological model underscores the person-process-context link, processes of change in personality in relation to change in context have not been studied. The direction of the associations between change in mother and infant behavior, change in their emotional states, and change in father involvement is not sufficiently clear and merits further research. It is possible that change in the emotional states of one family member affects changes in the emotionality and behavior of other family members and processes of change in psychological and behavioral systems interact in a mutually reinforcing manner. The findings suggest the need to construct models and perform research on the nature and correlates of change. Such research should include building indicators of mother's and infant's propensities for change at points of transition, using these indicators to assess change in developmental outcomes as a function of interventive strategies in healthy and at-risk populations.

FOOTNOTE
1. Clinical cutoffs were defined as scores above the 90th percentile (raw score of 52), which is almost identical to the mean score for a mentally-ill sample (51.9) (Teichman & Melenick, 1976). The highest score in the present sample was 48.

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