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Interparental Relationship Dynamics and Cardiac Vagal Functioning in Infancy

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Abstract

This study examined associations between interparental relationship dynamics and vagus system functioning in infancy. The functioning of the vagus system, part of the parasympathetic nervous system, indexes emotional reactivity and regulation. Interparental avoidance and dyadic adjustment constitute the focus of this study in order to bring attention to relationship dynamics not subsumed under overt conflict. Infants' baseline vagal tone and change in vagal tone in response to a novel toy were assessed at five months in a sample of high-risk mother-infant dyads ($n = 77$). Maternal report of interparental avoidance demonstrated an association with infants' baseline vagal tone, while interparental dyadic adjustment was associated with change in infants' vagal tone from baseline to the novel toy. Infant gender moderated these associations. Maternal sensitivity did not mediate interparental relationship dynamics and infants' vagal functioning. Results are discussed in the context of emotional security theory.

Keywords

interparental relationship; emotional development; emotion regulation; vagal tone; infant

1. Introduction

The development of emotion regulation during infancy has received considerable scientific attention. A more recent focus on parents' relationship dynamics and their possible influences on developing emotion regulatory capabilities has broadened the scope of investigation from a largely exclusive focus on dyadic infant-caregiver interactions. While links between interparental relationship dynamics and adjustment in older children have been established (Davies & Cummings, 1994; Davies, Sturge-Apple, Cicchetti, & Cummings, 2007), evidence of connections between interparental dynamics and infants' adjustment are only beginning to emerge. Moreover, little of this work has been conducted with high risk samples in which greater variability in family dynamics and conflict may hold different implications for infants' developing regulatory psychophysiology.

The extant literature suggests that infants' emerging emotion regulatory capabilities are related to levels of interparental aggression and positive affect (Crockenberg, Leerkes, &

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Lekka, 2007; Moore, 2010; Porter, Wouden-Miller, Silva, & Porter, 2003). Inconsistencies regarding the impact on physiological systems underlying emotion regulation, however, require further investigation. For example, whereas Porter and colleagues (2003) reported a negative correlation between marital conflict and infants' baseline vagal tone (an index of parasympathetic nervous system functioning) Moore (2010) found instead that marital conflict only predicted infants' vagal modulation (an index of parasympathetic nervous system response to environmental stimuli) in response to an interaction with a caregiver. The parasympathetic nervous system constitutes a particularly important target of investigation as highlighted by studies showing that baseline vagal tone and vagal modulation moderate the impact of interparental conflict on adjustment in older children (El-Sheikh, Harger, & Whitson, 2001; El-Shiek & Whitson, 2006; Katz & Gottman, 1995, 1997). The present study seeks to clarify and extend our understanding of how interparental relationship dynamics contribute to individual difference in infants' vagal tone as well as to vagal modulation in response to novel environmental demands. Differences in vagal tone and modulation may precede exposure to conflict, thus operating as buffers or vulnerabilities in the context of future conflict. Alternatively, vagal tone and modulation may develop under the sway of interparental processes beginning in infancy.

1.1 Vagal tone in infancy and environmental influences

The sympathetic and parasympathetic branches of the autonomic nervous system function in a complementary manner to maintain bodily homeostasis, with parasympathetic nervous system activity associated with growth and restorative processes and sympathetic nervous system activity associated with meeting external demands. Vagal tone, or vagus nerve activity, reflects the influence of the parasympathetic nervous system on a number of organs including the heart (Porges, McCabe, & Yonge, 1982). The coordinated activity of efferent and afferent fibers of the vagus nerve, or tenth cranial nerve, causes increases in heart rate during inhalation, and decreases in heart rate during exhalation. Respiratory sinus arrhythmia (RSA), the rhythmic change in heart rate associated with respiration, is therefore used as an index of cardiac vagal tone (commonly referred to as vagal tone), which in turn provides an index of parasympathetic nervous system activity.

One critical indicator of vagal functioning is baseline vagal tone, which provides a measure of the ability to maintain bodily homeostasis during periods with little external challenge or stimulation. Higher baseline vagal tone during infancy is associated with increased capacity for engagement with the environment, as evidenced by increased positive, as well as negative, emotional responding to a range of stimuli (Beauchaine, 2001; Propper & Moore, 2006). During childhood and adulthood, higher baseline vagal tone is a negative correlate of both externalizing and internalizing symptoms (Beauchaine, 2001). Modulation of vagal tone, or change in vagal tone in response to environmental stimuli, provides an index of emotional functioning that is somewhat distinct from baseline vagal tone. Withdrawal of vagal tone in response to challenge demonstrates associations with increased emotion regulation capabilities from infancy (Calkins & Dedmon, 2000; DeGangi, DiPietro, Greenspan, & Porges, 1991) through later childhood (El-Sheikh, et al., 2001). However, application of, or increased, vagal tone in response to novelty predicts sustained attention to, and exploration of novel stimuli during infancy (Bazhenova, Plonskaia, & Porges, 2001; DiPietro, Porges, & Uhly, 1992). Therefore, whether a stimulus challenges or captures attention determines how vagal tone changes in response to environmental stimuli. Atypical patterns of vagal modulation in response to environmental challenges (cognitive, sensory or emotional) have been linked to problems in regulating behavior and emotions (Porges, 1995). For example, Porges and colleagues (1996) reported that infants who evidenced little withdrawal of RSA during administration of the Bayley Scales of Infant Development

(Bayley, 1969), were reported to have higher levels of internalizing and externalizing symptoms at 3 years of age.

Rapid changes in indices of cardiac functioning between four and nine months of age suggest the possibility of a sensitive period for physiological systems that innervate the heart (Bar-Haim, Marshall, & Fox, 2000). In line with research indicating that infants emerging emotion regulatory capabilities are contingent upon sensitive caregiving (Propper & Moore, 2006), parenting behaviors appear to influence infants' baseline vagal tone and vagal modulation. Infants' baseline vagal tone correlates positively with symmetrical co-regulation in infant-mother dyads (Porter, 2003), and patterns of vagal modulation in response to a social stressor differ based on levels of synchronized affect in infant-mother dyads (Moore & Calkins, 2004). Longitudinal work indicates that the normative developmental pattern of increasing vagal tone during the first year of life is altered in infants with depressed mothers (Field, Pickens, Fox, & Nawrocki, 1995). However, family dynamics beyond the dyadic infant-parent relationship have received less attention as a potential influence on infants' developing vagus system.

As mentioned, possible associations between interparental dynamics and baseline vagal tone in infancy are mixed, with some finding a negative correlation between marital conflict and baseline vagal tone in six-month-olds (Porter et al., 2003), and others finding no association (Moore, 2010). Findings regarding vagal modulation are limited; only one study, focused on a dyadic interaction between infant and mother, has examined connections between interparental dynamics and infants' vagal modulation. Moore (2010) examined vagal modulation across the still-face paradigm (Tronick et al., 1978), finding that infants from high conflict families evidenced withdrawal of vagal tone from baseline to each episode, regardless of whether the episode was neutral (play), stressful (still face) or recuperative (reunion) and, to some extent, irrespective of maternal behavior. In comparison, infants from low conflict families evidenced an increase in vagal tone from baseline to the play episode, followed by vagal withdrawal from play to still face, and a subsequent increase in vagal tone from the still face to reunion. These results suggest that for some infants, high familial conflict may have a direct effect on vagal functioning, perhaps independent of infant-caregiver interactions.

Crockenberg and colleagues (2007) examined associations between interparental aggression and infants' emotion regulation by observing infants' behaviors in response to a novel toy. They found that higher levels of withdrawal or escape behaviors were associated with higher levels of interparental aggression. In general, infants' response to novelty appears to have implications for future emotion regulation capacity; higher levels of withdrawal behavior at 6 months of age predict symptoms of anxiety at 2.5 years of age (Crockenberg & Leerkes, 2006). Novel situations during infancy are both common and critical to cognitive and socioemotional development (DiPietro et al., 1992), with individual differences in temperamental fearfulness providing a partial explanation for why some infants might approach and others withdraw from new experiences (Crockenberg et al., 2007). As Crockenberg and colleagues' research suggests, interparental conflict may create unpredictable or overwhelming contexts within which infants develop regulatory behaviors designed to avoid novel albeit potentially useful situations; at present, possible links to infant's developing regulatory physiology have not been explored.

1.2 Conflict avoidance and dyadic adjustment in the interparental relationship

Emotional security theory (EST) posits that children's adjustment depends upon feeling safe and supported not only in the context of the parent-child relationship, but also in the context of the interparental relationship (Cummings & Davies, 2002). According to EST, relationship dynamics that create an environment of instability predict negative outcomes for

children. Observational studies of couple interactions suggest that disengagement from conflict predicts marital dissolution (Gottman & Levenson, 1992). Self-report of avoidance of conflict also significantly predicts the likelihood of marital dissolution (McGonagle, Kessler, & Gotlib, 1993). Although the literature has focused largely on overt interparental conflict, there appear to be distinct pathways from covert (defined by withdrawal behaviors and lack of responding to one another) versus overt conflict to children's internalizing and externalizing problems (Ablow, 2005). Avoidance of conflict or disengagement during conflict may actually be a more potent predictor of child maladjustment than overt conflict (Sturge-Apple, Davies, & Cummings, 2006). Sturge-Apple and colleagues (2006) interpreted their findings with regard to avoidance as indicative of parents' inability to manage negative affect, and of relationship instability.

Infants' capacity to distinguish between various emotional states portrayed by adult actors (Caron, Caron & MacLean, 1988), combined with a tendency to allocate higher levels of attention to angry emotional tone of voice (Grossman, Stirano, & Friederici, 2006), suggests that negative affect in the interparental relationship would likely be detected by infants. Avoidance of conflict likely engenders chronic tension, and negative affect as conflicts remain unresolved (Ablow, 2005). Increased startle response reported for 5-month old infants viewing angry versus happy faces (Balaban, 1995) indicates that infants' level of arousal may be increased in the presence of negative affect, even in the absence of overt vocal expressions of anger. Looking to animal research it appears that chronic stimulation of brain regions involved in processing negative affect leads to dysregulation of biobehavioral emotional systems (Kalynchuk & Meaney, 2003).

Dyadic adjustment constitutes another important predictor of relationship stability, which has received little attention in the literature regarding child outcome. Spanier (1976) conceptualized dyadic adjustment as a measure of the overall health of the interparental relationship including partners' satisfaction, agreement on fundamental issues, cohesion in terms of engaging in shared interests, and expressions of affect. Levels of dyadic adjustment reliably distinguish between separated versus non-separated couples and predict relationship dissolution (Möller & Van Zyl, 1991; Prouty, Markowski, & Barnes, 2000). Dyadic adjustment also maps onto the domain of constructive relationship behaviors, such as problem solving and expressions of affection, which have been shown to have a positive impact on children's behavioral regulation (Goeke-Morey, Cummings, Harold, & Shelton, 2003). Aspects of dyadic adjustment also appear relevant for infants' adjustment as maternal report of positive emotion and behaviors aimed at maintaining a marriage's health have been associated with higher emotion regulatory capacity during infancy (Porter et al., 2003). Infants observing a dynamic range of well regulated emotions (from negative to positive) in the context of the interparental relationship may be more likely to effectively express and regulate their own emotions.

1.3 This Study

This study examined the associations between interparental relationship infants' vagal functioning as indexed by RSA. Baseline RSA was measured to assess infants' capacity to engage with the environment, whereas RSA modulation (change from baseline) was evaluated as an index of emotion response and regulation. We examined RSA modulation in response to a novel toy, which we expected would elicit either fear or attention/curiosity from most infants. This study extends previous work by focusing on parents' covert conflict dynamics and dyadic adjustment, and by examining a physiological index of infants' emotion regulation with known links to critical behavioral outcomes.

We predicted that dynamics indicative of maladjustment in the interparental relationship (higher interparental avoidance and lower dyadic adjustment) would correlate with lower

baseline vagal tone in infants, indicative of lower levels of overall engagement with the environment. Regarding RSA modulation in response to the novel toy, we predicted that interparental relationship dynamics indicative of maladjustment would be associated with a withdrawal of RSA, commensurate with a fear response. However, consistent with decreased emotion regulatory capacity, we also expected that greater interparental difficulties would be associated with a smaller magnitude of RSA response. In contrast, we expected infants from homes characterized by interparental adjustment to show clear RSA increases in response to the novel toy, indicative of engagement and directed attention.

Emotional security theory posits a set of necessary controls, as well as potential moderators or mediators of the impact of negative interparental dynamics on children's development that merit consideration (Cummings & Davies, 2002). Rothbart and Bates (1998) have argued that infants' emotional and behavioral responses to novel situations have strong constitutional underpinnings in the temperamental traits of fear or withdrawal versus approach, including attention and positive engagement. Accordingly, measures of infants' temperamental fear and approach were controlled in the present investigation.

Second, differences in how boys and girls express emotion regulatory difficulties in the context of interparental conflict (Ablow, 2005; Davies & Lindsay, 2004; El-Sheikh & Whitson, 2006), persuaded us to examine potential gender differences in RSA. For example, girls are more likely than boys to express internalizing problems in the context of interparental conflict, though it is not yet clear when such gender differences emerge, nor whether these differences are detectible early in life in infants' psychobiology. Evidence for the effects of interparental dynamics on psychobiology are limited, though there is some evidence that boys exposed to interparental conflict may show autonomic responses more akin to vigilance than fear when exposed to conflict (El-Sheikh, 1994).

Third, the structural features of children's environments, such as parents' current living arrangements, may also determine how distal or proximal interparental conflict is to their infants. Due to the range of living situations in this high risk sample, mothers' marital and living situation with their partners also was tested as a possible moderator. It is possible that being married, or at least cohabiting, increases stability of a relationship (Bouchard, 2006). Alternatively, being married or at least cohabiting may keep an infant exposed to developmental stress in the context of poor relationship adjustment.

Finally, maternal sensitivity was included as a potential mediator of the effects of interparental dynamics on infants' vagal functioning as more proximal parenting constructs have previously been shown to change as a function of marital dynamics (Ablow, 2005), and have demonstrated associations with infants' vagal functioning (Conradt & Ablow, in press).

2. Method

2.1 Participants

Participants were recruited during their third trimester of pregnancy through local hospitals, and public assistance organizations ($N = 105$) to participate in a longitudinal project in a mid-sized city in the Pacific Northwest. Participants were screened using the Screening Scale for Problems in Parenting (SSPP; Avison, Turner, & Noh, 1986) and a 9-item version of the Center for Epidemiological Studies-Depression scale (CES-D; Radloff, 1977). Participants with scores of 11 or above (out of a possible 25) on the SSPP and 12 or above (out of a possible 36) on the CES-D were invited to participate in a prenatal laboratory visit. Participants ($n = 95$) returned to the laboratory again when their infants were 5 months old ($M = 20.99$ weeks, $SD = 2.55$). Of the 10 participants who did not complete the 5-month visit, one mother's baby died, two moved, four could not be reached, two had infants who

became too fussy at the start of the assessment, and one had volunteered for the prenatal assessment alone. There were no differences in participant age, marital status, education, or household income between participants who completed the 5-month assessment and those with missing data.

Of the 95 dyads that participated in the 5-month assessment, 11 infants had missing physiology data due to minor equipment problems or because they became too fussy. Seven mothers did not fill out relationship questionnaires because they did not have a partner. Mothers with missing data did not differ from mothers included in analyses with regard to age, mean income, education level, ethnicity, or marital status. Infants with missing data did not differ from infants included in analyses with regard to age, temperament or interparental dynamics.

Mothers with complete data ($N = 77$) had a mean age of 23.57 years ($SD = 4.47$, range = 18–38). Total household income was below \$20,000 for 47% of the sample, and below \$40,000 for 43%. Approximately 8% of the sample did not finish high school or pass an equivalency test, 29% completed high-school or passed an equivalency test, 43% received a two-year college degree, and 20% received a four-year college degree or beyond. The sample was moderately representative of the surrounding area with regard to ethnicity (83.11% European American, 3.8% African American, 2.61% Mexican American or Hispanic, 3.91% American Indian, and 6.49% identifying with “another group”). The mean age of infants was 20.99 weeks ($SD = 2.55$, range = 16–32), with only four infants above 30 weeks or below 18 weeks.

2.2 Procedures

2.2.1. Questionnaires and baseline—Mothers came into the laboratory during their third trimester of pregnancy, and filled out questionnaires about their relationship with their partner. When infants were 5 months old, they came into the laboratory with their mothers. Following assessment with the Bayley Scales of Infant Development (Bayley, 1969) experimenters attached heart rate and respiration monitoring equipment (described below) to infants. Mothers then dressed their infants in a white cotton sleeper so that the infant could not pull on the electrodes. The dyads completed a baseline episode, which involved watching a 2-minute Baby Einstein video (© 2002, The Baby Einstein, LLC) while the infant sat on the mother’s lap, and then the still-face paradigm (Tronick et al., 1978). Following the still-face paradigm the dyads completed a second baseline, which was identical to the first.

2.2.2. Novel toy task—Following the second baseline, infants were placed in a high chair in front of a table. The mother was seated in a chair approximately 1.5 feet to the right of the infant at a 45 degree angle. Mothers were told that babies might react in a variety of ways, and were asked to remain as uninvolved as possible. A remote control robot was then placed with one foot in a track running along the table. Once the experimenter noticed the infant attending to the toy, the robot moved along the track toward the infant, stopping at 15 cm away. The toy remained in front of the infant (10 s), before moving backward to the start of the track. After a pause (5 s) the entire procedure was repeated two more times. During the last pause in front of the infant the robot made five loud barking noises. After the three trials, the experimenter picked up the robot and brought it within arms’ reach of the infant (10 s). The task lasted for 2 minutes.

The novel toy episode was adapted from the Unpredictable Mechanical Toy in the Laboratory Temperament Assessment Battery Prelocomotor Version 3.1 (Lab-TAB; Goldsmith & Rothbart, 1999), which was designed to illicit fear. However, a study examining the prevalence of infants’ expression of fear in response to the toy indicated that

fear was expressed by less than half of infants (Buss & Goldsmith, 1998). More recent versions of novel toy episodes, including fast moving toys, may more reliably illicit expressions of fear, or distress (Crockenberg, Leerkes, & Lekka, 2007). Crockenberg and colleagues (2007) reported positive associations between infants' observed distress and exposure to marital arguments, as well as negative maternal behavior, suggesting that the novel toy is more likely to elicit fear under conditions of insensitive parenting and exposure to marital discord. We therefore conceptualize the novel toy paradigm used in the current study primarily as a stimulus to illicit fear, however, we acknowledge the possibility that it may also engage attention or interest in some.

2.3. Measures

2.3.1 Interparental Dyadic Adjustment and Conflict Avoidance—During the prenatal visit mothers completed the Dyadic Adjustment Scale (DAS; Spanier, 1976), and a compilation of measures assessing conflict resolution and negativity of conflicts entitled Experiences with Your Partner (Hooley & Teasdale, 1989; McGonagle et al., 1993). The DAS is a 32-item measure, which includes questions about relationship satisfaction and how often partners agree on a variety of topics and engage in activities together. In line with literature critical of using the subscales of the DAS separately (Crane, Busby & Larson, 1991), the overall sum score was used. Scores range from 0 to 151 with higher scores indicating higher levels of adjustment. In this study the internal consistency (Cronbach's alpha) of the DAS was .945.

Only the 3-item avoidance scale was used from the Experiences with Your Partner questionnaire. This scale was derived from 10 items assessing frequency, style, and resolution of conflicts (McGonagle et al., 1993). From these items, McGonagle and colleagues (1993) identified an underlying factor representing avoidance, which includes frequency of either partner giving in, and avoidance of issues for fear of the other partner's reaction. A sample item is as follows: "How much do you avoid talking about certain things with your spouse/partner because of how she/he might react?" The avoidance scale had fairly low internal consistency (Cronbach's alpha = .573) in this study due to the small number of items in the scale.

2.3.2 Infant RSA—Infant heart rate and respiration were recorded during the baseline and novel toy episodes in order to assess RSA as an index of vagal tone. Physiological responses were collected with 21-channel Bioamplifiers (model JCA-09). Oil was removed from the skin with an alcohol wipe before film electrodes were placed on the infant. The experimenter placed electrodes axially on the left-rib and right-rib at the same elevation as the heart. The ground electrode was placed on the middle of the infant's back. Surgical tape was used to attach the electrode lead leaving an extra inch of slack to prevent tugging on the electrode.

During the experimental session, physiological channels were sampled continuously, and artifacts (including those due to motion) were edited manually for each channel. Editing the files involved identifying outlier points by examining adjacent data. Outliers were replaced to be consistent with adjacent interbeat intervals. Outliers that were more than 3 standard deviations above or below the mean were removed and replaced with the mean of the episode.

RSA was computed using respiration and interbeat interval (IBI) data as outlined by Grossman's peak-valley technique (Grossman, 1983; Grossman, Karemaker, & Wieling, 1991). The difference between the minimum IBI during inspiration and the maximum IBI during expiration, in seconds, was used to calculate RSA. The difference was computed twice for each respiration cycle, once for each inspiration and once for each expiration.

Using this method, RSA was computed without being impacted by arrhythmia due to baroreceptor thermoregulation, and tonic shifts in heart rate.

2.3.3. Infant temperament—In order to assess infant temperament, mothers were asked to complete the Infant Behavior Questionnaire-Revised (IBQ-R; Garstein & Rothbart, 2003). The Fear scale, which assesses distress and startle in response to novelty, was chosen because temperamental fear is theoretically related to arousal, which likely impacts vagal tone. As well, the Approach scale, which assesses rapid approach, excitement, and positive anticipation of pleasurable activities, was chosen because orienting and approach behaviors have also been linked to changes in vagal tone (DiPietro et al., 1992). Both scales include sixteen items rated on a scale from 1 (never) to 7 (always). For infants (3–6 months) they demonstrated good internal reliability (.81–.90), and high interrater reliability (r 's = .57–.75) (Garstein & Rothbart, 2003).

2.3.4. Maternal sensitivity—Maternal sensitivity was coded during the reunion episode of the still face paradigm using the Global Ratings of Mother-Infant Interaction (Murray, Fiori-Cowley, Hooper, & Cooper, 1996). Five dimensions of maternal behavior, were coded on a scale from 1–5. *Maternal warmth* was defined as the degree to which the mother expressed affection toward her infant; *acceptance* included the mother's willingness to follow the infant's lead; *responsiveness* included the mother's response to her infant's signals; *demandingness* was defined as the degree to which the mother tried to coerce the infant to behave in a certain way; and *sensitivity* included the ability of the mother to modulate her behavior according to the infants' signals. A subset of tapes (32.6%) was coded by two coders. Intraclass correlations between coders for the five dimensions ranged from .89 to .93. Because the five scales were highly intercorrelated, *mean* $r = .71$ (range = .46 to .91), each woman's score on all five dimensions (with *demandingness* reverse scored) was averaged to create a single measure (Cronbach's $\alpha = .880$).

2.3.5 Power—In all, data were available for 77 infants. With α set to .05, 77 infants provided power of .86 or greater to detect large effect sizes, .60 or greater to detect medium effect sizes, and .20 or greater to detect small effect sizes in either GLM or multivariate regression analyses with up to 8 predictors (Cohen, 1988; Faul, Erdfelder, Lang & Buchner, 2007).

3. Results

3.1. Preliminary Analyses

Table 1 presents descriptive statistics for all variables. The sample included women cohabiting and married to their partner (39.0%), women cohabiting but not married to their partner (45.5%) and women neither married nor cohabiting who still felt that their relationship was serious enough to warrant the label of 'partner' (15.6%). Interparental conflict avoidance did not differ as a function of marital status ($F(2,74) = 1.96, p = .148$). However, dyadic adjustment differed as a function of marital status ($F(2,74) = 5.70, p = .005$), such that married and cohabiting mothers reported higher adjustment than non-cohabiting mothers ($t(40) = 2.852, p = .005$; $t(45) = 2.696, p = .011$ respectively), with no significant difference between married and cohabiting mothers ($t(63) = -.594, p = .882$). Male infants evidenced higher baseline RSA than female infants ($t(75) = -2.16, p = .034$). Neither of the relationship variables showed differences associated with infant gender.

Table 2 contains correlations among the study's variables. Conflict avoidance correlated moderately with dyadic adjustment, supporting our conceptualization of higher avoidance and lower dyadic adjustment as distinct indicators of relationship problems. Maternal

sensitivity correlated positively with dyadic adjustment. However, as it was not correlated with infants' RSA it is unlikely to mediate between interparental dynamics and infants' RSA. It is still possible that maternal sensitivity will share variance with the relationship dynamics in predicting infants' vagal functioning. Baseline RSA correlated positively with novel toy RSA suggesting that higher baseline RSA predicted higher RSA during the novel toy.

3.2. Multivariate modeling with relationship variables and baseline RSA

We tested separate hierarchical regression models to investigate associations between each relationship variable (avoidance and dyadic adjustment) and infants' baseline RSA (Table 3). All predictor variables were centered. With infant baseline RSA serving as criterion, Step 1 of each model comprised infant gender, temperamental fear and approach, maternal sensitivity, marital status, and either relationship variable. Two-way interactions (between gender by marital status, gender by relationship variable, and marital status by relationship variable) were entered on Step 2 followed on Step 3 by a single three-way interaction (between gender, marital status and the relationship variable). To probe significant interactions, simple intercepts and simple slopes were computed to represent the association between a predictor and infants' RSA (Cohen, Cohen, West, & Aiken, 2003) at lower and higher (median split) levels of a given moderator.

3.2.1. Conflict Avoidance—As shown in the top panel of Table 3, only infant gender was a significant unique predictor in our models when step 1 or steps 1 and 2 were entered; male infants had significantly higher baseline levels of RSA. The effect of gender disappeared, however, once all interactions were entered. In contrast, whereas avoidance did not account for unique variance on step 1 with other main effects entered, higher levels of avoidance were associated with lower levels of baseline RSA when interaction terms were included. However, this effect was qualified by the significant two-way interactions involving avoidance (avoidance by gender; avoidance by marital status), which were themselves qualified by a significant 3-way interaction among avoidance, infant gender, and marital status. Additionally, only the 3-step model was significant overall, as shown in Table 3. Follow-up analyses of the three-way interaction (shown in Figure 1a and 1b) revealed that among female infants with married, cohabitating mothers, higher interparental conflict avoidance predicted higher baseline RSA ($B = .009, SE = .002, p < .001$). In contrast, among male infants with married, cohabitating mothers, higher avoidance was associated with lower baseline RSA ($B = -.014, SE = .003, p = .041$). Among unmarried, cohabitating married mothers, there was no significant difference in the effect of low versus high avoidance on the baseline RSA levels for either female infants ($B = .000, SE = .002, p = .81$) or male infants ($B = .000, SE = .003, p = .93$). Among unmarried, non-cohabitating mothers, higher avoidance showed a trend level association with higher baseline RSA ($B = .013, SE = .002, p = .082$) among female infants, but did not differentiate among male infants ($B = .007, SE = .003, p = .121$), though like females, higher avoidance was also associated with higher baseline RSA. In absolute terms, t tests confirmed that female and male infants from married, cohabitating households described as high in avoidance showed significantly higher or lower baseline RSA, respectively, compared to the infants from other households with either high or low avoidance.

3.2.2. Dyadic Adjustment—As shown in the lower panel of Table 3, although infant gender and marital status showed significant main effect associations with baseline RSA, none of the steps in the dyadic adjustment model accounted for a significant amount of variance, nor was the overall model significant. Contrary to prediction, dyadic adjustment was not associated with baseline RSA, either as a main effect or in combination with infant gender or marital status.

3.2.3. Conflict Avoidance and Dyadic Adjustment—We tested a final model in which avoidance and dyadic adjustment were tested simultaneously. As with our earlier models, main effects and covariates were entered on the first step, followed on step 2 by two-way interactions, step 3 by three-way interaction, and step 4 by the four-way interaction between avoidance, dyadic, infant gender, and marital status. As with the avoidance model above, only step 3 added significantly to the prediction of baseline; with just three steps entered (excluding step 4), the overall model was significant. As with the avoidance model reported above, a significant main effect for avoidance and significant two-way interactions between avoidance and infant gender and avoidance and marital status were qualified by a significant three-way interaction of avoidance, infant gender, and marital status. A probe of this interaction yield patterns identical to those reported in Figures 1a and 1b. In sum, avoidance and its interaction with infant gender and marital status, but not dyadic adjustment, was associated with infants' baseline levels of RSA.

3.3. Multivariate modeling with relationship variables and RSA change from baseline to the novel toy task

Next we used hierarchical autoregressive models to investigate the extent to which avoidance and dyadic adjustment predicted change in infant RSA from baseline to novel toy. With infants' mean RSA during the novel toy task serving as criterion, Step 1 of each model comprised infants' baseline RSA, infant gender, temperamental fear and approach, maternal sensitivity, marital status, and either relationship variable. Two-way interactions (gender by marital status, gender by relationship variable, and marital status by relationship variable) were entered on Step 2, followed on Step 3 by the three-way interaction (between gender, marital status and the relationship variable). Again, simple intercepts and simple slopes were computed to probe significant interactions. Prior to running these models, a repeated measures ANOVA confirmed that infants showed a significant increase in mean RSA levels from baseline to novel toy, $F(1, 76) = 4.16, p = .045$, suggesting that overall the novel toy tended to elicit more attention and engagement than fear.

3.3.1. Conflict Avoidance—As shown in the top panel of Table 4, infants' baseline RSA and infants' temperamental approach were significant main effect predictors of RSA during the novel toy; infants with higher baseline RSA had higher RSA levels during the novel toy task, and infants described as higher in temperamental approach showed increased RSA from baseline to novel toy. Contrary to prediction, avoidance, neither alone nor in interaction with infant gender or marital status predicted change in RSA while controlling for individual differences in baseline RSA. Although the overall model was not significant, infants who were described by their mothers as higher in temperamental approach tended to show significant increases in their levels of RSA between baseline and the novel toy task. Additional post hoc analyses testing possible interactions with approach proved non-significant.

3.3.2 Dyadic adjustment—As shown in the lower portion of Table 4, again, only baseline RSA and infants' temperamental approach were significant main effect predictors of RSA during the novel toy. As shown in Table 4, steps 1 and 2 of the model each added significantly to the prediction of RSA change; the three-way interaction (step 3) did not, however. Although dyadic adjustment alone did not contribute significantly to the prediction of RSA change, dyadic adjustment did interact significantly with infant gender (Figure 2). Follow-up analyses revealed that for female infants, dyadic adjustment was not associated with a significant change in RSA at low and high levels of dyadic adjustment, $B = .003, SE = .002, p = .13$, although those whose mothers reported low adjustment showed virtually no change, whereas girls whose mothers reported high adjustment tended to show an increase in RSA from baseline to novel toy. Among male infants, there was a significant effect of

dyadic adjustment on RSA change, $B = -.005$, $SE = .002$, $p = .03$. Specifically, boys whose mothers reported high dyadic adjustment showed a slight decrease in RSA, whereas boys whose mothers reported low dyadic adjustment showed a large increase in RSA from baseline to novel toy.

3.3.3. Conflict Avoidance and Dyadic Adjustment—We tested a final model in which avoidance and dyadic adjustment were tested as simultaneous predictors of change in RSA; steps were identical to the model used to predict baseline RSA, with the exception that baseline RSA was entered on step one as the autoregressive term. The full model was nearly identical to the dyadic adjustment model just described; baseline RSA and temperamental approach predicted increased RSA during the novel toy. Here again, the two-way interaction between dyadic adjustment and infant gender uniquely predicted change in RSA ($\beta = -.93$, $p < .01$), though no other two-, three-, or four-way interactions accounted for significant variance. The final overall model with main effects and two-way interactions was significant, $R^2 = .35$, $F(14, 62) = 2.37$, $p < .01$. The pattern of the interaction was similar to that described for Figure 2. In sum, dyadic adjustment and its interaction with infant gender, but not avoidance, predicted change in RSA.

4. Discussion

The present study sought to extend our understanding of associations between interparental relationship dynamics and infants' cardiac vagal functioning, both at rest and in response to novelty. Conflict avoidance and dyadic adjustment comprised the focus of this study as previous studies have largely investigated overt interparental conflict. A secondary aim was to explore infant gender as a potential moderator, as prior work with older children suggests that gender may moderate the impact of negative interparental dynamics on physiological and behavioral outcomes (Davies & Lindsay, 2004; El-Sheikh et al., 2001). Finally, this study examined associations between interparental dynamics and infants' vagal functioning in a high risk sample. It is possible that interparental dynamics, especially covert aspects of conflict, may be less salient amid other contextual risk factors. Mother's marital status was included as a second potential moderator given that it may determine the proximity of interparental dynamics.

4.1. Infants' baseline vagal tone and interparental relationship dynamics

The results of this study suggest that of our two relationship variables, only maternal report of conflict avoidance was related to baseline RSA, however its effects largely depended on infant gender and mothers' marital status. Looking first at child gender, we found an unexpected but significant gender difference in infants' baseline RSA levels, with males' showing higher baseline RSA. A review of the infant RSA literature does not yield clear evidence of early gender differences. This may simply reflect a general absence of psychophysiology research with high risk infants, for whom important contextual factors might already be exerting differential pressure on the developing neurobiology of boys and girls. That these gender effects in our study were subsumed by interactions involving interparental avoidance as well as mother's marital status provides some support for this contention.

Our clearest and strongest finding regarding baseline RSA concerned those infants whose mothers were married and cohabitating. Among married/cohabitating women who reported that they tended not to avoid problems with their partner, we found no significant differences in the baseline RSA levels of male and female infants. Although ours was a low SES sample, with 90% of the women in our sample reporting household incomes below the national poverty line, these results suggest that interparental dynamics that were low in

avoidance were related similarly to boys and girls baseline RSA. In contrast, when married/cohabitating mothers reported high conflict avoidance, female infants exhibited the highest levels of RSA, and male infants exhibited the lowest levels of baseline RSA. Thus, high conflict avoidance in the context of marriage appears to be problematic for infants as young as 5 months of age. As Ablow (2005) has argued, avoidance of interparental problems may represent a form of covert conflict, which often leaves unspoken and potentially toxic tension in the environment for children to decipher.

Higher baseline vagal tone has typically been seen as indicative of infants' capacity for greater engagement with the environment, be it to express greater positive or negative emotionality (i.e., Beauchaine, 2001). As such, higher interparental avoidance may be associated with female infants engaging more with the environment, potentially as a way to express distress associated with unresolved tension. Alternatively, heightened levels of baseline RSA in the context of covert forms of interparental conflict may suggest that female infants are engaging in higher levels of vigilance given the ambiguous aspects of their environment. Gottman and Katz (1989) suggest that higher levels of baseline vagal tone in the context of negative family processes may seem to represent an adaptive response concurrently, while continued exposure to challenge may exhaust the system. With continued exposure to negative interparental dynamics, young girls might show a pattern of decreasing vagal tone over time, which would be associated with internalizing symptoms often typical of females (Davies & Lindsay, 2004).

The significantly lower baseline RSA exhibited by male infants when their married/cohabitating mothers reported high conflict avoidance was more consistent with our initial expectations and with some earlier work (Porter et al., 2003). During periods of relative quiescence, higher vagal tone supports slower cardiovascular rates and greater internal homeostatic functioning. However, when vagal tone is lower (withdrawn), it is thought to represent environmental demands that require chronic coping and self-regulatory responses (Beauchaine, 2001). For the male infants in our study, high levels of interparental avoidance by married, cohabitating parents may represent such a chronic stressor.

Given that prior studies typically have not found gender differences in infants' vagal tone, we cannot be sure what accounts for this gender difference in our study. Nonetheless, at least two interrelated explanations seem plausible. First, couples may express avoidance dynamics differently around boys and girls. There is some evidence that couples express their problematic dynamics differently in the presence of sons or daughters (Hetherington, Cox, & Cox, 1982). Second, boys and girls may experience their parents' dynamics differently. In general, infants show increase startle in response to pictures of angry versus happy faces (Balaban, 1995), suggesting that they are aroused even in the absence of overt vocal expressions of anger. However, already by four years of age, boys and girls tend to interpret the sources of overt parental conflict differently. Whereas preschool boys reported that their parents still fought a lot, they did not blame themselves for their parents conflict; in contrast, preschool girls reported less conflict, but higher self-blame (Ablow, 2005). Prospective work linking these two age periods may help to determine how and when such gender differences arise.

Although marriage and cohabitation can provide children with relationship stability irrespective of relationship dynamics (Bouchard, 2006), our findings suggest that for some infants, marriage and continued cohabitation in the context of high conflict avoidance may result in chronic exposure to interparental dynamics that are differentially related to boys and girls developing neurobiology. Interestingly, however, among mothers who reported cohabitating with their unmarried partners, boys' and girls' had comparable baseline RSA levels at high and low levels of conflict avoidance. In absolute terms, these infants exhibited

average levels of baseline RSA. Although, relative to the other two marital status groups, these mothers reported average levels of both conflict avoidance and dyadic adjustment with their partners, it would appear that the dynamics of their mother's relationship are possibly less salient to infants. In contrast, the male and female infants of unmarried, noncohabitating mothers showed similar effects at high and low levels of avoidance, though the significance of these effects were marginal given how few women fell into this marital status group (16%). Specifically, at low levels of avoidance, male and female infants of unmarried, noncohabitating mothers evidenced average levels of baseline RSA. However, in the context of high conflict avoidance, both male and female infants showed marginally higher baseline RSA. In all likelihood, both relationship instability as well as a lack of regular contact to their mothers' partner contributes to slightly higher vagal tone. Likewise, we could reasonably conclude that for these infants, higher vagal tone could reflect the need for either greater engagement with or sustained efforts at self-regulation given a less stable or less predictable environment.

4.2 Infants' vagal modulation and interparental relationship dynamics

Overall, infants' demonstrated an increase in RSA from baseline to the novel toy, suggesting that the task elicited attention and engagement more than fear. Maternal report of infants' temperamental tendency to approach and show excitement was associated with a greater increase in vagal tone from baseline to the novel toy, which is in line with the work of DiPietro and colleagues (1992) showing that a greater increase in vagal tone in response to novelty predicted higher levels of sustained attention and exploratory play. Similar to the findings for baseline RSA, child gender moderated the association between interparental dynamics and change in RSA. However, in contrast to baseline RSA, only dyadic adjustment, was associated with change in RSA, and the association was significant only for boys. For boys, higher levels of interparental dyadic adjustment predicted a small decrease in RSA from baseline to the novel toy, which could be interpreted as a sign of more effective emotion regulation (i.e., Calkins & Dedmon, 2000). Girls evidenced a greater (although non-significant) increase in RSA from baseline to the novel toy associated with higher dyadic adjustment, which may indicate higher levels of sustained attention, and a tendency toward exploration (i.e., DiPietro et al., 1992).

Assuming that relationships characterized by low interparental dyadic adjustment share features with relationships characterized by high levels of overt conflict, such as poor emotion regulation, our findings map on partly to the description by Cummings and Davies (2002) of gender differences in physiological reactivity in older children exposed to overt conflict. They suggest that girls may become increasingly sensitive due to exposure to interparental conflict, as indicated by increased heart rate in response to simulated conflict, while boys may become increasingly vigilant, as indicated by decreased heart rate in response to simulated conflict. Similarly, for male infants in this sample lower levels of dyadic adjustment predicted increased vagal tone, typically associated with decreased heart rate, in response to novelty. However, for girls, the non-significant association between lower levels of dyadic adjustment and decreased vagal tone (typically associated with increased heart rate) was extremely small, suggesting that a lack of vagal modulation in response to novelty is a more accurate description of female infants in homes with lower dyadic adjustment. As suggested by DiPietro and colleagues (1992), a lack of physiological modulation in response to stimuli may be seen as a sign of inflexibility or rigidity, which would be maladaptive.

Alternatively, differences in how boys and girls are exposed to interparental dynamics may explain the moderating role of infant gender. Although, dyadic adjustment and avoidance may not manifest in discrete events (unlike overt conflict) that parents attempt to hide from their infants, there may yet be ways in which more subtle, even covert aspects of

interparental dynamics play out differently with boys and girls. Differences in parenting may also explain the moderating role of infant gender. However, consistent with the literature (Maccoby, 1998), maternal sensitivity did not evidence an association with gender. The literature does suggest that parents tend to encourage play with sex-typed toys (Maccoby, 1998). Therefore, the moderating role of infant gender may be related to boys having more prior exposure to similar toys.

4.3. Conflict Avoidance versus Dyadic Adjustment

In this study interparental conflict avoidance demonstrated an association with infants' baseline vagal tone, while evidencing no association with modulation of vagal tone. An interparental relationship characterized by avoidance of conflict, and a lack of conflict resolution likely creates an environment of pervasive tension. It follows that infants' tonic level of vagal tone would be related to chronic tension in the environment. Infants' expressions of emotion are unlikely to alter this fog of tension between parents, even if they illicit a warm parental response. Infants' expressions of distress may also cause increased tension between parents who avoid conflict. In such an environment infants may increase expression of negative emotions in attempts to penetrate the fog of tension (associated with higher vagal tone) or disengage from the environment to escape from the tension (associated with lower vagal tone). In this sample it appears that infant girls demonstrate higher levels of vagal tone, while infant boys demonstrate lower levels of vagal tone in the context of higher interparental avoidance.

It is also possible that processes other than maternal sensitivity (examined in this study) mediate between interparental avoidance and infants' baseline vagal tone. For example, paternal sensitivity may be an important mediator, as father-child relationships appear to suffer more due to negative interparental dynamics than mother-child relationships (Brody, Pellegrini, & Sigel, 1986). Alternatively, it is possible that interparental avoidance engenders intense bouts of overt conflict, which is in turn associated with infants' vagal tone. Although we conducted a series of posthoc analyses that tested for and did not reveal a mediating role for overt conflict in the present study, it may be that better models can identify the ways in which covert and overt dynamics work together to affect young children.

Contrary to interparental avoidance, interparental dyadic adjustment demonstrated an association only with infants' vagal modulation. Vagal modulation in response to the novel toy was interpreted in terms of infants' emotion regulation capacity. A higher level of interparental dyadic adjustment indicates that couples engage in activities together, share values, show affection for each other and are satisfied with their relationship. Higher levels of dyadic adjustment also likely incorporate expression and effective regulation of negative emotions in order to facilitate communication and conflict resolution. Observing a range of emotions that vary appropriately to facilitate communication and engagement may contribute to infants' capacity to regulate their own emotions. The findings in this study are in line with those of Porter and colleagues (2003) that maternal report of positive emotion in the interparental relationship and activities aimed at relationship maintenance demonstrated positive associations with behavioral observation of infants' emotion regulation capacity. However, these aspects of the interparental relationship were not associated with infants' baseline vagal tone.

4.4. Vagal functioning and the interparental relationship in infancy and beyond

According to EST, children's reactions to family processes which do not fall under the domain of consciously recognized feelings or cognitive evaluations, including emotional engagement and regulation, comprise integral parts of their emotional security (Cummings

& Davies, 1996). It follows that infants' reactions to interparental relationship dynamics, though not organized into coherent thoughts or feelings, may contribute to the development of emotional security. Our findings suggest that interparental avoidance and dyadic adjustment are associated with a physiological index of infants' emotional engagement and regulation even after taking maternal sensitivity into account.

In addition to the relevance of infants' vagal functioning for concurrent emotional security, the impact of subsequent interparental dynamics depends on levels of vagal tone and vagal modulation. Our findings suggest that for female infants, higher interparental avoidance is associated with higher baseline vagal tone. Later in development, higher baseline vagal tone serves as a buffer between interparental conflict and negative outcomes (El-Sheikh & Whitson, 2006; Katz & Gottman, 1997). Therefore, our findings suggest that interparental avoidance during infancy may be related to subsequent buffering from the effects of interparental conflict. However, continued exposure to negative family processes may exhaust the system leading to lower vagal tone across time (Gottman & Katz, 1989). Our findings suggest that for infant boys, increased withdrawal of vagal tone is associated with higher interparental dyadic adjustment. In older boys, withdrawal of vagal tone in response to challenge is associated with buffering from externalizing problems associated with interparental conflict (El Sheikh et al., 2001).

4.5. Limitations

Several limitations of this study should be noted. First, interparental relationship dynamics were assessed through maternal self-report. Although we are able to compare our results with the two other studies examining infant vagal functioning and interparental dynamics (Moore, 2010; Porter et al., 2003), which utilized maternal report, we and others will need to incorporate partner self-report and observational data to gain a fuller picture. In addition, maternal report of relationship dynamics occurred during the third trimester of pregnancy. Therefore, associations between relationship dynamics and infants' vagal functioning might be partially explained by the impact of prenatal maternal stress (i.e. DiPietro, Costigan & Gurewitsch, 2003). Similarly, including maternal report of infant temperament as a covariate is problematic as concordance between observation and maternal report differs depending on maternal characteristics, such as maternal depression (Leerkes & Crockenberg, 2003).

The baseline episode represents another limitation of this study in that it followed the recovery of the still face episode suggesting that it may not represent a resting baseline. However, the lack of significant change in RSA across the baseline suggests that it was a rest rather than a recovery period. Finally, including multiple predictors and covariates resulted in low power for our analyses due to the sample size. However, leaving out potential moderating effects, or not controlling for infant temperament, would have limited our ability to interpret findings.

5. Conclusion

This study contributes to the small, but growing body of literature documenting connections between interparental relationship dynamics and infants' biobehavioral development. In addition to interparental aggression and overt conflict (Crockenberg et al., 2007; Moore, 2010), avoidance and dyadic adjustment in the interparental relationship appear to have implications for vagal functioning in infancy. Infant gender appears to be an important consideration, such that for girls, indications of maladjustment in the interparental relationship appear to be associated with higher baseline vagal tone indicative of increased emotional engagement and expression. For boys negative interparental dynamics demonstrate associations with lower baseline vagal tone and increased vagal tone from baseline to the novel toy, suggestive of less emotional reactivity. Finally, interparental

dynamics demonstrated associations with infants' vagal functioning independent of maternal sensitivity, suggesting the possibility of a direct link between interparental dynamics and infants' emotional development.

These findings are particularly important given the evidence for vagus system functioning as a moderator of the impact of negative interparental dynamics in older children. It is possible that during periods of rapid development, such as infancy, interparental dynamics may impact vagus system functioning in a manner that determines whether the system will serve to increase resilience or vulnerability during subsequent exposure to interparental dynamics. An increased understanding of infants' emotional development in the context of distinct family dynamics, as well as moderators, such as infant gender, may allow for family-based interventions targeting aspects of infants' concurrent emotional development and future resilience.

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Figure 1.

(a) Associations between high and low levels of mother reported avoidance, mothers' marital status, and girls' baseline RSA.

(b) Associations between high and low levels of mother reported avoidance, mothers' marital status, and boys' baseline RSA.

Figure 2. Associations between infant gender, high and low levels of interparental adjustment, and the change (difference score) in infant's RSA from baseline to the novel toy task.

Table 1

Descriptive Statistics

	M (%)	SD (n)	Minimum	Maximum
Marital Status				
Not Cohabiting	15.58	12		
Cohabiting but not married	45.45	35		
Married	38.96	30		
Infant Gender				
Female	57.14	44		
Male	42.86	33		
Avoidance	1.41	.506	0	2.67
DAS	116.16	1.89	40.33	151.00
Maternal Sensitivity Coding	2.98	.949	1.20	4.80
Infant Temperament				
IBQ, Fear	2.40	.797	1.12	4.88
IBQ, Approach	5.02	1.07	1.88	7.00
Infant Vagal Tone				
Baseline	0.0121	0.00509	0.00407	0.0227
Novel Toy Task	0.0135	0.00518	0.00574	0.0229

Note. $N=77$. DAS = Dyadic Adjustment Scale. IBQ = Infant Behavior Questionnaire.

Table 2

Correlations among all study variables

	1	2	3	4	5	6	7	8	9
1. Marital Status									
2. Gender	-.073								
3. Avoidance	-.126	-.059							
4. DAS	.235*	-.033	-.273*						
5. Maternal Sensitivity	.024	.041	-.085	.242*					
6. Age Weeks	.109	.027	-.151	.11	.101				
7. IBQ Fear	-.080	-.151	-.147	.021	.006	.260*			
8. IBQ Approach	-.18	.12	.14	-.02	-.09	.15	.12		
9. Baseline RSA	-.086	.240*	.046	-.123	-.046	-.019	-.052	-.06	
10. Novel Toy RSA	.127	.019	-.125	-.144	-.110	.082	-.085	.20	.308**

Note. DAS= Dyadic Adjustment Scale. IBQ = Infant Behavior Questionnaire. RSA = Respiratory Sinus Arrhythmia.

* p<.05;

** p<.01;

*** p<.001;

+ trend. Spearman's rho was used for any correlation involving a nonparametric variable (Gender and Marital Status).

Table 3

Interparental Relationship Dynamics Predicting Baseline RSA

Predictors	$\beta_{\text{Step 1}}$	$\beta_{\text{Step 2}}$	$\beta_{\text{Step 3}}$	R^2	F
Avoidance					
1. Infant Gender	.26*	.91*	.62		
IBQ Fear	-.00	-.01	-.02		
IBQ Approach	-.10	-.11	-.09		
Marital Status	-.02	.58	.37		
Maternal Sensitivity	-.05	-.05	-.11		
Avoidance	.06	.30	-2.88*		
	$\Delta R^2 = .07$			.07	.93
2. Marital Status x Gender		-.88	-.55		
Avoidance x Gender		-.34	3.10***		
Avoidance x Marital Status		.11	3.44***		
	$\Delta R^2 = .04$			.12	1.04
3. Avoidance x Gender x Marital Status			-3.59***		
	$\Delta R^2 = .13^{***}$			.24	2.01*
Dyadic Adjustment					
1. Infant Gender	.25*	*.97	.92		
IBQ Fear	-.01	-.03	-.02		
IBQ Approach	-.09	-.05	-.05		
Marital Status	.01	.75*	.71		
Maternal Sensitivity	-.03	-.01	-.02		
DAS	-.13	-.43	.86		
	$\Delta R^2 = .08$			.08	1.03
2. Marital Status x Gender		-1.06	-.97		
DAS x Gender		.52	-.82		

Predictors	$\beta_{\text{step 1}}$	$\beta_{\text{step 2}}$	$\beta_{\text{step 3}}$	R^2	F
DAS x Marital Status		-.24	-1.15		
		$\Delta R^2 = .07$		.15	1.32
3. DAS x Gender x Marital Status			1.49		
			$\Delta R^2 = .04$	.19	1.53

Note: IBQ = Infant Behavior Questionnaire. DAS= Dyadic Adjustment Scale.

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

Table 4

Interparental Relationship Dynamics Predicting Change in Infant RSA

Predictors	$\beta_{\text{step 1}}$	$\beta_{\text{step 2}}$	$\beta_{\text{step 3}}$	R^2	F
Avoidance					
1. Baseline RSA	.35**	.38***	.37**		
Infant Gender	-.09	-.38	-.40		
IBQ Fear	-.12	-.12	-.12		
IBQ Approach	.29*	.28*	.29*		
Marital Status	.16	-.11	-.12		
Maternal Sensitivity	-.11	-.09	-.10		
Avoidance	-.18	-.46	-.77		
	$\Delta R^2 = .23^{**}$			.23	2.89**
2. Marital Status x Gender		.39	.41		
Avoidance x Gender		.39	.72		
Avoidance x Marital Status		-.10	.22		
		$\Delta R^2 = .02$		.25	2.17*
3. Avoidance x Gender x Marital Status			-.35		
			$\Delta R^2 = .00$	.25	1.96*
Dyadic Adjustment					
1. Baseline RSA	.32**	.37**	.39***		
Infant Gender	-.07	-.41	-.38		
IBQ Fear	-.09	-.05	-.06		
IBQ Approach	.27*	.21	.21		
Marital Status	.13	-.13	-.12		
Maternal Sensitivity	-.06	-.05	-.05		
DAS	-.16	.69	.26		
	$\Delta R^2 = .21^{**}$			.21	2.74**
2. Marital Status x Gender		.46	.44		

Predictors	$\beta_{\text{step 1}}$	$\beta_{\text{step 2}}$	$\beta_{\text{step 3}}$	R^2	F
DAS x Gender		-.88**	-.25		
DAS x Marital Status		.03	.71		
		$\Delta R^2 = .07^*$		.28	2.63***
3. DAS x Gender x Marital Status			-.71		
			$\Delta R^2 = .01$	.29	2.45**

Note: IBQ = Infant Behavior Questionnaire. DAS= Dyadic Adjustment Scale.

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