

The impact of maternal characteristics and sensitivity on the concordance between maternal reports and laboratory observations of infant negative emotionality

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Abstract:

The moderating role of maternal characteristics and maternal sensitivity on the concordance between maternal reports and laboratory observations of negative emotionality was examined. Participants were 90 primiparous mothers and their infants. Mothers completed questionnaires about remembered care from their own parents and their depressive symptoms prenatally, infant temperament (distress to novelty and distress to limitations), and depressive symptoms postnatally. Mothers and infants participated in a laboratory assessment of infant temperament (distress to novelty and limitations) and maternal sensitivity at 6 months postpartum. Several factors that moderate the degree of concordance between maternal reports and behavioral observations were identified, as predicted. Novelty concordance was higher when mothers reported having their emotional needs met in childhood and low prenatal depressive symptoms. Limitations concordance was higher when mothers were less sensitive during the observational tasks. Methodological and theoretical implications are discussed.

Keywords: infant temperament | infant distress to novelty | maternal sensitivity | maternal characteristics

Article:

Infant temperament is viewed as an important contributor to family interactions and has been linked to the development of behavior problems in childhood (see Rothbart & Bates, 1998). Interest in infant temperament has resulted in the development of a number of temperament measures. Often, maternal reports of temperament are preferred because they are quick, easy to administer, inexpensive, and take advantage of mothers' extensive opportunities to observe their

infants. However, there is debate about the accuracy of maternal reports because they agree only modestly with trained observers' ratings (Seifer, Sameroff, Barrett, & Krafchuk, 1994).

Often, poor agreement is attributed to maternal bias because maternal characteristics correlate consistently with maternal reports of temperament (e.g., Sameroff, Seifer, & Elias, 1982). A less studied explanation is that uncontrolled differences in maternal behavior during observations moderate infant behavior and explain some of the discrepancies (Rothbart & Goldsmith, 1985). In this study, we examine each of these possibilities in relation to infant negative reactivity, the dimension of temperament considered most often in relation to child and family functioning. Our goal is to identify the characteristics of mothers and of observational settings that increase congruence between maternal ratings and independent observations of temperament (i.e., concurrent validity), as well as the conditions under which each type of temperament assessment is suspect. Specifically, we test (a) the effect of mothers' remembered parental care during childhood, depressive symptoms, and child gender; and (b) the effect of maternal involvement in the assessment and her sensitivity on the congruence between mother-rated and observed negative reactivity.

Six months is an appropriate age to examine these questions because colic has ended, making it easier to distinguish negative emotionality from physiological immaturity (Barr, 2000), and discrete emotions are apparent by this time. Anger has been identified reliably in infants as young as 2 months (Lewis, Allessandri, & Sullivan, 1990), and behavioral observations at 4 months have predicted subsequent behavioral inhibition at multiple points (Kagan, 1997).

MATERNAL CHARACTERISTICS AND MATERNAL REPORTS OF TEMPERAMENT

In a high-risk sample, maternal characteristics were more predictive of maternal reports of temperament than was observed infant behavior (Sameroff et al., 1982), whereas in a normative sample, father and observer ratings explained more variance in maternal reports of temperament than did maternal characteristics (Bates & Bayles, 1984). This discrepancy may be the result of moderating effects by which mothers who are at risk by virtue of personal and contextual characteristics are influenced by subjective factors when rating temperament more than mothers who are at low risk. Consistent with this view, Gill and Link (2000) reported that concordance between maternal reports of distress to limitations and observed frustration was higher when mothers were primiparous, had daughters, and reported less stress and hostility. In this study, we examine moderating factors that may influence concordance by altering mothers' perceptions and appraisals of infant distress.

Bowlby (1973) postulated that mothers whose emotional needs were not met in childhood have internal working models that make it difficult for them to accurately perceive infant affect because they focus on their own goals, making it unlikely they can appraise and identify others' emotions accurately. Consistent with this view, mothers who were not securely attached or reported that their emotional needs were not met in childhood were more likely to mislabel infant emotions (Adam, Tanaka, Broderson, & Gunnar, 1998; Blokland & Goldberg, 1998; Leerkes & Crockenberg, 2002b). Thus, we propose that mothers whose emotional needs were not met by their parents are less accurate reporters of temperament because these early experiences hamper their ability to accurately label infant emotions and rate their intensity.

Depressed mothers likely misperceive infant temperament because they miss infant signals due to their preoccupation with their own negative feelings, or they might ignore infant distress if it arouses feelings of anxiety and hopelessness. Additionally, they might misinterpret infant signals because of the pattern of attributions that characterize depression (e.g., they perceive distress as rejection). That depressed mothers rate their infants as more difficult and have more difficulty distinguishing between cries than less depressed women is consistent with this view (Donovan, Leavitt, & Walsh, 1998; Mebert, 1991; Schuetze & Zeskind, 2001).

Although gender is a child characteristic, gender biases held by the mother are a maternal characteristic. With the exception of the study by Gill and Link (2000), in which frustration concordance was higher for girls than boys, researchers have not examined the impact of child gender on concordance. However, both Diener and Bradshaw (2002) and Polak, Henderson, and Fox (2002) reported that mothers rated sons higher on frustration than daughters, but there were no gender differences in observed anger. These data are consistent with the possibility that child gender influences mothers' perceptions of temperament, prompting them to overrate anger in their sons. No such effects have been reported for distress to novelty. Thus, we explore the possibility that gender moderates distress to limitations concordance, and that mothers interact differently with their infants based on gender, thereby impacting limitations concordance.

CONTEXT AND CONCORDANCE BETWEEN MATERNAL REPORTS AND TRAINED OBSERVATIONS OF TEMPERAMENT

Concordance between mothers' and trained observers' reports of temperament vary substantially across studies (see Rothbart & Bates, 1998). Concordance appears to be strongest when well-established parental report measures are used, mothers and observers rate infant behavior in similar situations, and comparisons are made between the same dimensions of temperament. We address these issues by using the Infant Behavior Questionnaire (IBQ; Rothbart, 1981), a well-established temperament measure; observing temperament in laboratory situations that are conceptually similar to the IBQ (i.e., exposure to novel toys and situations that limit infant movement and engagement); and comparing related dimensions of infant behavior (i.e., reported and observed distress to novelty, and reported and observed distress to limitations). Further, the extent to which mothers engage with their infants in various observational contexts and the impact their involvement has on observed infant behavior and concordance is unclear. To address this, we test concordance in situations that vary by the degree of maternal involvement.

Mother Involvement and Sensitivity in the Observational Context

Mothers modulate infant reactivity in the short term through their behavioral interventions. Several researchers have found that maternal facial expressions, vocalizations, and touch impact infants' responses in emotionally arousing situations (Hornik, Risenhoover, & Gunnar, 1987; Klinnert, 1984; Mumme, Fernald, & Herrera, 1996; Palaez-Nogueras, Field, Hossain, & Pickens, 1996). Thus, concordance between maternal reports and laboratory assessments of temperament might be greater when mothers are not involved in the observational context because their own behavior will not modulate their infants' responses. That concordance was higher when maternal reports were compared to temperament assessed in a laboratory situation in which mothers were

uninvolved than assessed during a caregiving interaction ($r = .38$ vs. $.24$) is consistent with this view (Pauli-Port, Mertesacker, Bade, Bauer, & Beckmann, 2000).

The sensitivity of involvement may further moderate concordance between maternal reports and observations of temperament in two ways. First, mothers who are highly sensitive in the observational context (e.g., provide support through facial expression, vocalizations, and touch) are more likely to successfully prevent or reduce infant distress in the observational context (as reviewed earlier). Second, infants of highly sensitive mothers may have better regulatory strategies at their disposal, allowing them to self-regulate negative emotions (Braungart-Rieker, Garwood, Powers, & Notaro, 1998; van den Boom, 1994). Alternatively, concordance could be higher for sensitive mothers to the extent their sensitivity reflects greater skill at perceiving and identifying discrete infant emotions, which enhances the accuracy of their reports of temperament. In sum, we hypothesize:

1. Reported and observed distress to novelty and reported and observed distress to limitations correlate positively, and they correlate more strongly when mothers are uninvolved relative to involved in the observation task.
2. Childhood history with parents, depression, and child gender moderate the associations between maternal reports and observed temperament. Specifically, distress to novelty and to limitations concordance are weaker for mothers who experienced little parental care in childhood or are depressed, and limitations concordance is weaker for mothers of sons.
3. Maternal sensitivity moderates the association between maternal reports and observed temperament. Concordance is weaker when mothers are highly sensitive because their behavior and infants' related regulatory strategies prevent or minimize infant distress.

METHOD

Participants

Ninety primiparous mothers participated. Data on this sample have been reported elsewhere (Crockenberg & Leerkes, 2003; Leerkes & Crockenberg, 2002a). Mothers' mean age was 29 years (range = 20--41), mean education was 15 years (range 11-20), and mean family income was \$60,000 (range = \$8,000-\$200,000). The majority (93%) were White and married or living with their partner (99%). Infants were full-term and healthy; 56% were boys.

Procedure

Mothers were recruited at birthing classes during their seventh or eighth month prepartum. At this time, they completed a demographic questionnaire by phone and were sent a packet of questionnaires, including consent forms and measures of childhood history and depressive symptoms. At 5 months postpartum, mothers rated temperament by telephone¹ and completed

¹ The IBQ was administered by phone to ensure that mothers completed it prior to attending the laboratory observation, which might have affected their ratings. The original instructions were read, the rating scale explained, and mothers were asked to indicate which number the interviewer should circle.

the measure of depressive symptoms by mail. At 6 months, mothers and infants were videotaped during the assessment of infant temperament and maternal sensitivity.

Measures

Parental Bonding Instrument (PBI)

The Care subscale of this self-report measure (Parker, Tupling, & Brown, 1979) assessed the acceptance and warmth mothers received from their own parents during childhood. Twelve specific parental behaviors (e.g., "made me feel I wasn't wanted," reverse-coded; "appeared to understand what I needed or wanted") were rated to indicate how much each statement describes the parent on a 4-point scale ranging from 1 (*very unlike*) to 4 (*very like*). The PBI Care scale has good test-retest reliability over a 3-week period (.76) and good split-half reliability (.88). In subsequent studies, PBI scores correlated with parents' self-reports (Parker, 1981). Responses about mothers and fathers were averaged separately to derive scores of remembered maternal care and remembered paternal care, Cronbach's $\alpha = .92$ and $.94$, respectively.

The Center for Epidemiologic Studies-Depression Scale (CES-D)

Depressive symptoms were assessed using this 20-item checklist of moods, feelings, and cognitions associated with depression (e.g., "I felt depressed," "I felt that people dislike me") designed for use with community samples (Radloff, 1977). Respondents indicate how often they felt a particular way during the previous week on a 4-point scale ranging from 0 (*rarely/never*) to 3 (*most of the time/always*). The CES-D demonstrates convergent validity with the Research Diagnostic Criteria, a standardized psychiatric interview, and with the Beck Depression Inventory (Spitzer, Endicott, & Robins, 1978). Items from the CES-D were averaged to derive measures of depressive symptoms for use in data analyses. Mothers completed the CES-D prenatally and at 5 months postpartum, Cronbach's $\alpha = .88$ and $.90$, respectively.

IBQ

Three IBQ subscales (Rothbart, 1981) were administered to assess mothers' perceptions of their infant's temperament: Distress to Limitations (20 items), Distress and Latency to Approach Sudden or Novel Stimuli (17 items), and Soothability (11 items). Only the two distress scales, reflecting negative emotionality, were used in this study. Mothers indicate on a 7-point scale ranging from 1 (*never*) to 7 (*always*) how frequently their infants responded to specific events in a particular fashion during the previous week (e.g., "when introduced to a stranger, clung to the parent or approached the stranger at once"). Subscales have good internal reliability (.75-.81) and interrater reliability (.54-.66) for 6-month-old infants (Rothbart, 1981), good concurrent validity with home observations of infant temperament at 6 months (mean $r = .40$; Rothbart & Goldsmith, 1985) and with the negative emotionality and approach-sociability subscales of the Revised Infant Temperament Questionnaire and the Infant Characteristics Questionnaire ($r_s = .61-.73$; Goldsmith, Rieser-Danner, & Briggs, 1991). Items from each subscale were averaged to obtain measures of distress to novelty and distress to limitations, Cronbach's $\alpha = .68$ and $.78$, respectively.

Six-Month Behavioral Observation

Mother and infant behavior were videotaped during a laboratory assessment of infant temperament similar to those used by others (Goldsmith & Rothbart, 1996). During a 5-min warm-up period, mothers were instructed to make themselves and their infants comfortable, to use any of the toys in the room, and to complete a brief form. Then, the experimenter asked the mother to place her infant in an infant seat. Mothers sat 3 ft (0.9 m) from the infant, situated so that with some effort infants could see them. Two novel toys were introduced first, followed by a 5-min break, and then two limiting tasks.

Novelty Tasks

During the novelty tasks, the infant seat was tucked into a table with a plexiglass barrier that prevented the toys from touching the infant. While the fire truck approached the infant from the opposite side of the table, a voice and emergency sirens sounded and lights flashed. When it reached the barrier, it stopped, but the lights and sirens continued. This lasted 25 sec and was repeated three times. After the third approach, the sirens, voices, and flashing lights continued for 35 sec. Then, the experimenter placed the silent fire truck within the infant's reach for 1 min.

Prior to the bumble ball task, another barrier was added, 2 ft (0.6 m) away from the plexiglass barrier, to ensure that the bumble ball would bounce in close proximity to the infant. The experimenter placed the bumble ball on the table between the two barriers and turned it on. It bounced unpredictably for 30 sec, then remained still while emitting a shrieking giggle for 15 sec. This sequence was repeated three times. Then the experimenter turned off the ball and placed it within the infant's reach on the table for 1 min. These novelty tasks include unpredictable motion and loud noises consistent with IBQ distress to novelty items referring to being exposed to a loud noise and being startled.

Break

The novelty tasks were followed by a 5-min break to reduce carryover to the limitations context. The experimenter walked around the building with the mother and infant, while an assistant altered the appearance of the room by removing the barrier and covering the table with a cloth. Mother and infant then returned to the room and their seats.

Limitations Tasks

During the toy retraction, the infant seat was tucked into the table and the experimenter sat to the infant's left. She showed the infant two attractive toys (a teething ring with multicolored plastic keys and a brightly colored plastic face with a mirror on the back). When the infant displayed interest in one toy, the experimenter placed that toy on the table directly in front of the infant for 15 sec and placed the unselected toy out of view. After 15 sec, she placed the toy just beyond the infant's reach. This sequence was repeated 12 times. The experimenter did not interact with the infant during this task.

During the arm restraint task, the infant seat was pushed away from the table and the experimenter knelt in front of the seat. She gently held the infant's forearms immobile for 3 min. Her head was bowed, and she did not interact with the infant. These tasks have components of confinement and goal interference similar to IBQ distress to limitations items.

Mothers were instructed to remain neutral during the first task in each emotion context so we could observe the infant's independent response to the activity. During the second task, mothers were instructed to interact with their infants in any way they liked, but not to intervene directly in the activity (e.g., touch the novel toy) or remove their child from the seat unless they wished to end the activity.² This resulted in two mother uninvolved tasks and two mother involved tasks (one novelty, one limitations each). Order of presentation of the novelty and limitations tasks were counterbalanced to control for task effects on infant reactivity and maternal sensitivity. Mothers soothed their infants between each task to reduce carryover.

Coding Infant Reactivity and Maternal Sensitivity

Infant reactivity was rated from videotapes during all four tasks, and maternal behavior was coded during the mother-involved tasks. Event-based continuous coding was done using computer software. Trained undergraduates coded in pairs given the multiple tasks involved (i.e., watching the videotape, operating the VCR, and entering codes). Pairs alternated to prevent bias. Coders were blind to other data with one exception. One coded both reactivity and maternal behavior 4 months apart. The authors independently coded videotapes at the beginning and midway through coding to assess reliability and to prevent coder drift. A 1-sec window for agreement was used.

Infant reactivity was rated on a 7-point scale, adapted from Braungart-Rieker and Stifter (1996), with scores ranging from 1 (*high positive affect*) to 7 (*high negative affect*), based on the infant's facial expressions, body tension, and vocalizations. Kappa for each level of affect ranged from .68 to .98 ($M = .83$). This system yielded several measures of observed infant reactivity: peak intensity of negative affect, latency to first negative, mean affect, and ratio of time negative to positive or neutral during each of the tasks. Factor analyses were run on the behavioral measures, separately for each of the four tasks. Factor loadings ranged from .73 to .95 (absolute value) for each task. Thus, they were standardized and then averaged within task to create measures of observed distress to novelty mother uninvolved, observed distress to novelty mother involved, observed distress to limitations mother uninvolved, and observed distress to limitations mother involved (Cronbach's $\alpha = .92, .72, .91, \text{ and } .82$, respectively). None of these scores varied by task (e.g., scores for mother uninvolved distress to novelty were similar for the bumble ball and the fire truck). Observed temperament data were incomplete for some infants,³ and, as missing values were not replaced, sample size varied across analyses.

Maternal Behavior and Sensitivity

² Three mothers stopped an activity prior to its completion.

³ Certain data from 6 infants (3 from novelty involved task, 2 from limitations involved task, and 1 from limitations uninvolved task) were not included due to significant changes in the protocol after their data were collected. Two infants fell asleep prior to the limitations involved task. One infant was inconsolable after the two novelty tasks and, therefore, did not participate in either limitations task.

Twelve codes were created based on existing schemes (Farran, Kasari, Comfort, & Jay, 1986; van den Boom, 1994) and after reviewing several videotapes from this study to determine their appropriateness. Each maternal behavior was assigned a sensitivity rating (1 = *insensitive*, 2 = *moderately sensitive*, 3 = *sensitive*) a priori, which could vary by infant state (i.e., positive, neutral, or negative):

- *Negative*: Mother directs facial or vocal negative affect toward infant (1).
- *Intrusive*: Mother forces her agenda on infant (1).
- *Mismatched affect*: Mother's affect is incongruent with infant's (1).
- *Distracted from infant*: Mother is uninvolved or minimally involved with infant (1 if infant is positive or negative, 2 if infant is neutral).
- *Persistent ineffective*: Mother continues to respond in same ineffective manner when alternative responses are available (2).
- *Monitor*: Mother watches infant or monitors situation (2 if infant is positive or neutral, 1 if infant is negative).
- *Task focused*: Mother focuses infant's attention on the arousing task (3 if infant is positive or neutral, 1 if infant is negative).
- *Calming contact*: Mother soothes infant physically, vocally, or both (3).
- *Supportive*: Mother soothingly supports infant's interest in the task when the infant is distressed or on the verge of distress (3).
- *Non-task-focused engagement*: Mother plays with or attempts to distract the infant without utilizing the arousing task (3).
- *Empathy*: Mother empathizes with or mirrors infant's positive or negative affect (3).
- *Uncodable*: The infant or mother cannot be seen.

Table 1. Simple Correlations

Variables	1	2	3	4	5	6	7	8	9	10	11	12
Reported temperament												
1. IBQ distress to novelty	—											
2. IBQ distress to limitations	.13	—										
Observed temperament												
3. Uninvolved novelty distress	.07	.15	—									
4. Involved novelty distress	.03	-.03	.67**	—								
5. Uninvolved limitations distress	.03	-.11	.22*	.16	—							
6. Involved limitations distress	.13	-.08	.16	.25*	.24*	—						
Maternal characteristics												
7. Remembered maternal care	-.10	-.15	.11	.00	.08	.09	—					
8. Remembered paternal care	.05	-.06	-.07	-.03	-.12	.01	.46**	—				
9. Prenatal depression	.07	.15	.03	.00	-.03	.07	-.25*	-.34**	—			
10. Postnatal depression	.01	.13	-.06	-.14	.10	.04	-.38**	-.53**	.60**	—		
Maternal sensitivity												
11. Novelty sensitivity	-.11	.01	.09	.13	.01	.03	-.03	.15	-.06	-.17	—	
12. Limitations sensitivity	-.11	.10	-.08	-.08	-.24*	-.25*	.09	.24*	-.16	-.27*	.36**	—

Note. Samples range from 85 to 90. IBQ = Infant Behavior Questionnaire.

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

Kappas ranged from .65 to .85 ($M = .75$). Mothers' average level of sensitivity during each task was computed, resulting in two variables: novelty sensitivity and limitations sensitivity. These scores correlate positively ($r_s .48-.67$) with global sensitivity ratings used previously in this

sample (Crockenberg & Leerkes, 2003; Leerkes & Crockenberg, 2002a), negatively with postpartum depression, as shown in Table 1, and positively with independent measures of mothers' emotional competencies (Leerkes, Crockenberg, & Burrous, 2003), supporting their validity. Descriptive statistics for all variables appear in Table 2.

Table 2. Descriptive Statistics

<i>Variables</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Range</i>
Maternal reported temperament				
IBQ distress to novelty	90	2.13	0.57	1.20–3.90
IBQ distress to limitations	90	3.00	0.70	1.32–5.45
Observed temperament				
Uninvolved distress to novelty	90	0.00	0.64	–1.01–1.68
Involved distress to novelty	87	0.00	0.65	–1.05–1.65
Uninvolved distress to limitations	88	0.00	0.63	–1.10–1.46
Involved distress to limitations	85	0.00	0.58	–1.14–1.66
Maternal characteristics				
Remembered maternal care	90	3.33	0.61	1.75–4.00
Remembered paternal care	87	3.11	0.75	1.33–4.00
Prenatal depression	90	1.47	0.35	1.00–2.95
Postnatal depression	90	1.37	0.34	1.00–2.65
Maternal sensitivity				
Novelty sensitivity	87	2.47	0.30	1.57–3.00
Limitations sensitivity	85	2.50	0.41	1.00–3.00

Note. IBQ = Infant Behavior Questionnaire.

RESULTS

Data analysis proceeded in several steps. First, potential covariates were identified by examining correlations between demographic variables and temperament variables and by testing mean differences in temperament based on child gender. Then, simple correlations were calculated between the primary variables to identify collinearity and as a preliminary test of hypotheses prior to controlling covariates. Finally, hierarchical multiple regression was used to test proposed main and moderating effects controlling for covariates. Interaction effects were tested and interpreted using procedures outlined by Aiken and West (1991).

There were no significant correlations between potential demographic covariates (maternal age, education, and family income) and temperament variables. There was a gender difference in maternal reports of infant distress to limitations; mothers rated sons ($M = 2.14$, $SD = 0.52$) significantly higher than daughters ($M = 2.09$, $SD = 0.65$), $t(88) = 2.26$, $p < .05$. Thus, we included child gender as a covariate in the limits context, and in the novelty context for consistency. Additionally, observed distress to novelty correlated with observed distress to limitations (see Table 1), suggesting carryover of distress from the novelty to the limitations tasks. Therefore, observed distress to novelty averaged across the involved and uninvolved tasks was included as a covariate in regressions predicting observed distress to limitations. Further, interactions between observed distress to novelty and IBQ distress to limitations were examined to test the possibility that it is high novelty distress that carries over to the limitations context.

Correlations Between Maternal Reports and Observed Temperament

Simple correlations between maternal reports and laboratory observations are reported in Table 1. There were no simple associations between observed and reported distress to novelty, nor between observed and reported distress to limitations. Associations between observed and reported temperament did not vary as a function of maternal involvement.

Hierarchical Multiple Regression: Identifying Factors That Alter Concordance

Given the relatedness of some maternal characteristics (i.e., maternal and paternal care, prenatal and postnatal depression), interaction effects involving related maternal characteristics were prescreened for inclusion in the full hierarchical regressions to reduce collinearity and to maintain an appropriate subject to predictor ratio. Eight preliminary regressions were calculated. IBQ distress to novelty, maternal and paternal care, and their interactive terms with IBQ distress to novelty were regressed on observed distress to novelty during the involved and uninvolved episodes. IBQ distress to novelty, prenatal and postnatal depression, and their interactive terms with IBQ distress to novelty were regressed on observed distress to novelty from both episodes. The same approach was taken when regressing observed distress to limitations on its predictors.

Interactions involving maternal care, prenatal depression, and postnatal depression met criteria for inclusion in the regressions predicting observed distress to novelty (β s ranged from $-.46$ to $.22$), but paternal care did not ($\beta = -.02$ and $-.11$). None of the maternal characteristic interactions with IBQ distress to limitations met criteria for inclusion in the regressions predicting observed distress to limitations (β s ranged from $.00$ -. 14 , absolute value) and were considered no further. Although this procedure capitalizes on chance, three aspects of the analyses mitigate this concern: (a) only conceptually based, hypothesized interactions were prescreened; (b) the number of identified interactions with maternal characteristics exceeded the number expected by chance (5 of 16 were significant); and (c) most prescreened interactions remained significant in the final regression models.

Distress to Novelty

Hierarchical regressions predicting observed distress to novelty during mother involved and uninvolved episodes are presented in Table 3. Child gender and task (fire truck or bumble ball) were entered in Step 1 as covariates. Next, the maternal characteristics (maternal care, prenatal depression, postnatal depression) were entered, followed by maternal sensitivity during the novelty task, and then IBQ distress to novelty to determine if controlling for maternal characteristics improved the degree of association between observed and reported distress to novelty. Then, the identified interaction terms involving maternal characteristics were entered one at a time beginning with the prenatal characteristics. The interaction between maternal sensitivity and distress to novelty was entered last to determine if maternal sensitivity moderates concordance after accounting for variance associated with maternal characteristics.

Hypotheses 1. Contrary to prediction, IBQ distress to novelty was not associated with observed distress to novelty after entry of the covariates, maternal characteristics, and maternal sensitivity,

and associations between observed and reported distress to novelty did not vary as a function of maternal involvement in the task ($\beta = .01$ and $.07$, both *ns*).

Table 3. Hierarchical Multiple Regression Predicting Observed Distress to Novelty

Predictors	Observed Distress to Novelty					
	Mother Uninvolved			Mother Involved		
	<i>B</i>	β	ΔR^2	<i>B</i>	β	ΔR^2
1. Child gender	-.08	-.06		-.13	-.10	
Novelty task	.12	.09	.01	.16	.12	.02
2. Remembered maternal care	.15	.14		-.05	-.05	
Prenatal depression	.22	.12		.24	.13	
Postnatal depression	-.18	-.09	.03	-.47	-.25 ⁺	.04
3. Maternal sensitivity–novelty task	.10	.05	.00	.11	.05	.00
4. IBQ distress to novelty	.08	.07	.01	.00	.01	.00
5. Maternal Care × IBQ Distress to Novelty	.48	.26 [*]	.06	.41	.22 ⁺	.04
6. Prenatal Depression × IBQ Distress to Novelty	-.65	-.23 [*]	.04	-.88	-.31 ^{**}	.08
7. Postnatal Depression × IBQ Distress to Novelty	1.75	.53 ^{**}	.08	.90	.28	.02
8. Maternal Sensitivity × IBQ Distress to Novelty	-.53	-.12	.01	-.39	-.09	.01
Total			.24 [*]			.21 [*]

Note. $N = 88$ for observed fear–mother uninvolved and 85 for observed fear–mother involved; *B* is unstandardized and β is standardized beta at entry. IBQ = Infant Behavior Questionnaire.

⁺ $p < .10$. ^{*} $p < .05$. ^{**} $p < .01$.

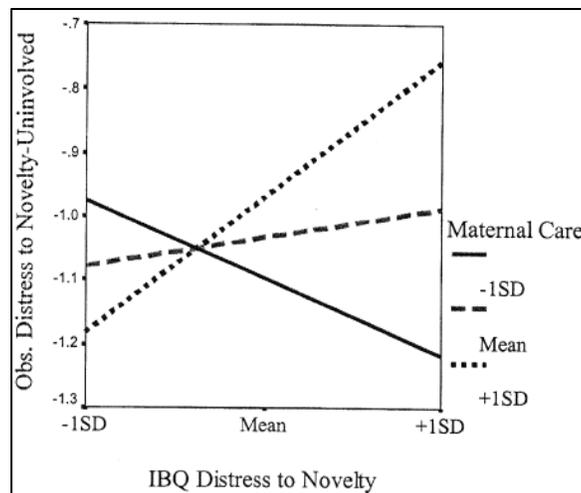


Figure 1. The moderating effect of remembered maternal care on concordance between maternal reports of distress to novelty and observed distress to novelty during the mother uninvolved task.

Hypothesis 2. Consistent with prediction, maternal care moderated the association between observed and reported distress to novelty in both the mother involved and uninvolved tasks. As

illustrated in Figure 1, maternal reports of distress to novelty correlated positively with observed novelty distress during the mother unininvolved task (i.e., they were congruent) when mothers recalled their own mothers as caring, but not when they recalled them as uncaring.

Also consistent with prediction, prenatal depression moderated the concordance between maternal reports and observed distress to novelty during both the unininvolved and involved tasks. As illustrated in Figure 2, reported and observed distress to novelty were congruent when prenatal depression was low, but incongruent when prenatal depression was high.

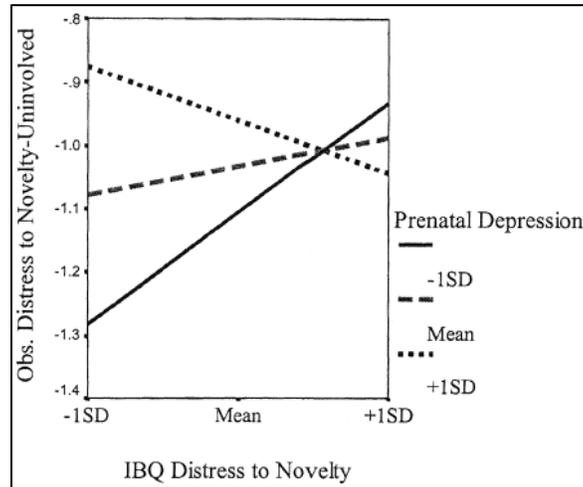


Figure 2. The moderating effect of prenatal depression on concordance between maternal reports of distress to novelty and observed distress to novelty during the mother unininvolved task.

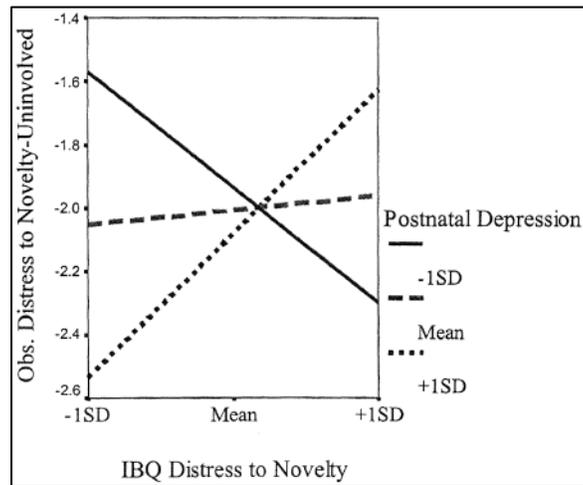


Figure 3. The moderating effect of postnatal depression on concordance between maternal reports of distress to novelty and observed distress to novelty during the mother unininvolved task.

Additionally, postnatal depression moderated congruence between maternal reports and observed distress to novelty during the mother unininvolved task after variation accounted for by the prenatal depression interaction was removed. As illustrated in Figure 3, novelty concordance was higher when postnatal depression was high than low, suggesting that depression assessed at

different times affects concordance differently, for reasons we discuss later. Each interaction remained significant in the final block.

Hypothesis 3. Contrary to prediction, maternal sensitivity did not moderate the association between reported and observed distress to novelty.

Distress to Limitations

The regressions predicting observed distress to limitations are displayed in Table 4. First, child gender, task (arm restraint or toy retraction), and observed distress to novelty were entered as covariates. Maternal sensitivity during the limitations task was entered next, followed by IBQ distress to limitations. Then, the interaction term for observed distress to novelty by distress to limitations was entered to test the possibility that carryover of high novelty distress reduced concordance. Finally, each two-way term that composed the three-way interaction among gender, IBQ distress to limitations, and sensitivity were entered one at a time, followed by the three-way term to test the hypothesis that gender affects concordance by altering mothers' perceptions of and reactions to infant anger.

Table 4. Hierarchical Multiple Regression Predicting Observed Distress to Limitations

<i>Predictors</i>	<i>Observed Distress to Limitations</i>					
	<i>Mother Uninvolved</i>			<i>Mother Involved</i>		
	<i>B</i>	β	ΔR^2	<i>B</i>	β	ΔR^2
1. Child gender	.10	.08		.01	.01	
Limitations task	-.13	-.10		-.11	-.09	
Observed distress to novelty	.23	.21*	.06	.24	.23*	.06
2. Maternal sensitivity–limitations task	-.32	-.21*	.04	-.33	-.23*	.05
3. IBQ distress to limitations	-.06	-.07	.00	-.05	-.06	.00
4. Observed Novelty Distress \times IBQ Distress to Limitations	.00	.00	.00	.32	.20 ⁺	.04
5. Gender \times IBQ Distress to Limitations	-.08	-.13	.01	.28	.51	.02
6. Gender \times Maternal Sensitivity–Limitations Task	-.25	-.26	.00	-.48	-.51	.02
7. Maternal Sensitivity \times IBQ Distress to Limitations	-.26	-.11	.00	-.61	-.27*	.05
8. Gender \times Sensitivity \times IBQ Distress to Limitations	-1.13	-.75 ⁺	.05	-.18	-.13	.00
Total			.16			.24*

Note. $N = 84$ for observed anger–mother uninvolved and 84 for observed anger–mother involved; B is unstandardized and β is standardized beta at entry. IBQ = Infant Behavior Questionnaire.

⁺ $p < .10$. * $p < .05$.

Hypothesis 1. Contrary to prediction, reported and observed distress to limitations were not correlated during the mother uninvolved or the mother involved limitations task after controlling

for the covariates, and limitations concordance did not vary as a function of maternal involvement ($\beta = -.06$ and $-.07$, both *ns*).

Hypothesis 2. As noted earlier, childhood history and depression did not moderate concordance for observed limitations in the prescreening and were not included in the final regressions, nor did child gender moderate concordance, contrary to prediction.

Carryover Effects From Novelty

Observed novelty distress did not moderate the association between maternal reports and observed distress to limitations during the uninvolved task; however, there was a trend during the mother involved task.⁴ Maternal reports of distress to limitations were more congruent with observed distress to limitations when observed novelty distress was high versus low. Thus, carryover effects, although weak, enhanced congruence.

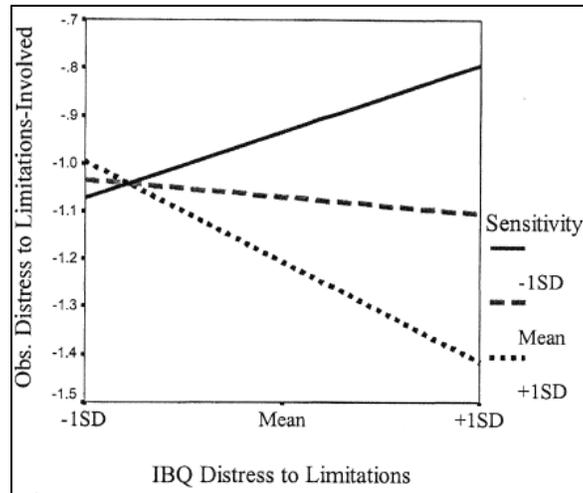


Figure 4. The moderating effect of maternal sensitivity during the limitations task on concordance between maternal reports of distress to limitations and observed distress to limitations during the mother involved task.

Hypothesis 3. Consistent with prediction, maternal sensitivity moderated the association between observed and reported distress to limitations during the mother involved task. As illustrated in Figure 4, congruence between maternal reports and observed distress to limitations was higher when mothers were less sensitive than when they were more sensitive, presumably because their behavioral interventions modulated infant distress. Although this interaction was not significant for the mother uninvolved task, there was a trend for a three-way interaction among gender, IBQ distress to limitations, and sensitivity. To interpret the three-way interaction (see footnote 4), hierarchical regressions tested the two-way interaction between maternal sensitivity and distress to limitations for boys and girls separately. Maternal sensitivity moderated the association between reported and observed distress to limitations for girls ($\beta = -.47$, $p < .05$), but not for boys ($\beta = .12$, *ns*). Similar to the effect shown in Figure 4, congruence between reported and observed

⁴ Interactions that were significant at the $p < .10$ level were interpreted because of evidence that the ability to detect interaction effects is hampered in nonexperimental designs (McClelland & Judd, 1993).

distress to limitations was weaker for girls when mothers were more sensitive. When carryover was not controlled, the three-way interaction predicted observed distress to limitations in the uninvolved task significantly ($\beta = -.90, p < .05$).

DISCUSSION

Maternal Characteristics and Concordance

That mothers whose emotional needs were not met in childhood tended to rate their infants' distress to novelty differently than was apparent in the observation is consistent with the attachment theory view (Bowlby, 1973) that early experiences of rejection predispose mothers to react negatively to their infants' distress, prompting them to misinterpret infant signals. That women with insecure working models had more negative feelings and perceptions toward distressed infants and overrated infant distress in other studies lends credence to this view (Adam et al., 1998; Blokland & Goldberg, 1998). Interestingly, this effect was apparent only for infant distress to novelty, related to fear, the emotion thought to activate mothers' attachment-related caregiving systems, further supporting this interpretation.

Maternal prenatal depressive symptoms moderated the degree of concordance between maternal reports and the laboratory assessment of distress to novelty as well. Highly depressed mothers were less concordant, consistent with the view that depressed mothers fail to notice infant signals (Donovan et al., 1998; Schuetze & Zeskind, 2001). Although this interaction involves prenatal depression, that it remains significant after variation from the interaction with postnatal depression is removed suggests that the subgroup of mothers who remained depressed over time likely accounts for the effect. That is, mothers who were depressed at the onset of parenting and who remain so postpartum are biased in reporting infant distress to novelty. In contrast, mothers who become depressed after the birth of their infants might do so in part because their infants are in fact more reactive to novelty. Evidence that infant distress to novelty in conjunction with childhood history predicts postpartum depressive symptoms after prenatal depression is controlled statistically lends credence to this interpretation (Crockenberg & Leerkes, 2003; Murray, Stanley, Hooper, & King, 1996).

In sum, prenatal maternal characteristics bias how some mothers rate distress to novelty. Importantly, as Bates and Bayles (1984) noted, once a source of bias is identified, we can design studies in which biasing factors are controlled statistically. These maternal characteristics did not alter concordance for limitations. Perhaps different maternal characteristics, such as parenting stress and hostility, as reported by Gill and Link (2000), contribute to biased perceptions of distress to limitations because mothers who are stressed and hostile are inclined to perceive distress as hostility directed at themselves and overrate infant anger for that reason.

Maternal Sensitivity and Concordance

Highly sensitive mothers tended to rate their infants higher on distress to limitations than was displayed during the observations. Perhaps high maternal sensitivity reduced distress during the observation, consistent with findings that sensitive maternal behavior predicts less infant distress during arousing activities (Hornik et al., 1987; Klinnert, 1984). The interaction between distress

to limitations and sensitivity might indicate also that infants of sensitive mothers have learned better regulatory strategies to reduce their own arousal. That this effect was present only for girls during the mother uninvolved limitations task is consistent with recent findings that male infants have greater difficulty regulating negative affect than female infants (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002; Stifter & Spinrad, 2002; Weinberg, Tronick, Cohn, & Olson, 1999). Consistent with this view, mothers in this sample rated daughters as more soothable than sons.⁵

That sensitive mothers overrated infant distress to limitations might be the result of a lag between the development of infant regulation skills and mothers' incorporation of them into their perceptions of temperament, a lag particularly likely to occur during periods of rapid development of regulatory skills in the first year of life. As regulatory strategies become more stable and predictable by the end of the infant's first year (Cicchetti, Ganiban, & Barnett, 1991), this lag might diminish.

Any effect of a lag on concordance might be magnified in this study by the 2-week period of time between maternal reports and the laboratory observations.

That maternal sensitivity did not alter concordance in the novelty tasks could be a function of task demands on maternal and infant behavior. Mothers were asked not to intervene directly in the task (e.g., move infant away from or turn off the aversive stimulus), and the remaining strategies, distraction and soothing, might have been insufficient to reduce infant arousal in the face of such intense stimuli. Further, because the infants cannot flee, it would be adaptive for them to closely monitor the situation, a strategy unlikely to reduce negative arousal. Thus, mother and infant regulatory behaviors might reduce arousal more effectively in limitations tasks than in novelty tasks, consistent with Buss and Goldsmith's (1998) findings that infants' regulatory attempts were more successful in reducing anger than fear distress.

Limitations and Directions for Future Research

The interpretation of these data rests on the assumption that observational assessments serve as the gold standard for infant temperament, a notion that is questionable given the limited sample of infant behavior they provide and potential threats to validity (see Rothbart & Bates, 1998). For example, associations between observed distress to novelty and to limitations in this study may reflect carryover from one task to another. Alternatively, distress in the two laboratory contexts might reflect a general tendency to distress, rather than distinct temperamental dimensions, an issue of particular concern in infants as young as 6 months. To address these limitations, multiple observational measures of temperament, preferably conducted at multiple points in time, are needed to ensure that observed behavior accurately reflects stable infant characteristics and not situational demands or carryover. Also, temperament should be assessed later in the first year in view of rapidly developing regulatory capacities that likely contribute to change in observed distress over time. Replication would increase our confidence also that the identified moderating factors are not due to Type I error given the number of potential moderating variables examined in this study.

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⁵ Mothers tended to rate daughters ($M = 5.45$, $SD = .77$) as more soothable than sons ($M = 5.17$, $SD = .73$), $t(88) = 1.70$, $p < .10$.

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