INFANT BEHAVIOR AND DEVELOPMENT 20 (2), 1997, pp. 247–258 ISSN 0163-6383


# Maternal Verbal Sensitivity and Child Language Comprehension

LISA BAUMWELL
CATHERINE S. TAMIS-LEMONDA
*New York University*
MARC H. BORNSTEIN
*National Institute of Child Health and Human Development*

This longitudinal investigation examined covariation among specific maternal behaviors and their differential prediction of children's language comprehension across the transition to beginning speech. Forty mother–infant dyads were videotaped during free play in their homes when children were 9 and 13 months old. At each age, six maternal behaviors and children's language comprehension were assessed. Two factors of maternal interaction, labeled verbal sensitivity and verbal intrusiveness, were extracted at the two ages; the two factors were stable across this 4-month period. Nine-month maternal sensitivity, but not intrusiveness, uniquely predicted 13-month child language comprehension and did so over and above children's 9-month language comprehension, which was itself stable between the two ages. Maternal verbal sensitivity was especially influential in promoting comprehension among children who were initially lower in language comprehension, a finding that has implications for the design of intervention strategies. These findings confirm models of environmental specificity which state that certain aspects of parenting, in contrast with others, affect particular outcomes in the child; in this regard, we contrast the importance of maternal verbal sensitivity for children's language development with other kinds of maternal interaction.

maternal sensitivity maternal intrusiveness child language comprehension

Early socialization plays a central role in the development of language in young children (see Nelson, 1973; Shatz, 1982; Snow, 1977). Parental behaviors that are sensitive and responsive to the signals of their children promote cognitive–linguistic advances, whereas those that interrupt, prohibit, or miss their children's initiatives appear unrelated or inversely related to these abilities in children (e.g., Tomasello & Farrar, 1986; Tomasello & Todd, 1983). Accordingly, one goal of the present study was to investigate covariation among different maternal behaviors thought to facilitate or constrain child language development. Using a multidimensional framework, we examined six mutually exclusive maternal verbal behaviors characteristic of mother–child interactions. Scores for the maternal behaviors at 9 and 13 months were subjected to principal components analyses and varimax rotation in order to extract distinct factors of maternal verbal interactions. A second goal was to examine whether these factors would differentially predict children's emerging language comprehension and how that prediction would depend on children's initial language abilities.

Direct all correspondence to: Dr. Lisa Baumwell, New York University, Greene Street, 2nd floor, New York, NY 10003

## Maternal Behaviors

Parenting incorporates a range of different behaviors embedded in an interpersonal exchange system (e.g., Ainsworth, Blehar, Waters, & Wall, 1978; Bornstein, 1989, 1995; Martin, 1989). In general, for mothers' behaviors to maximally benefit their children's cognition, and language acquisition specifically, they should be sensitive to children's signals by matching or initiating behaviors appropriate to the child's developmental level and current state (e.g., Bohlin, Hagekull, Germer, Andersson, & Lindberg, 1989; Bornstein & Tamis-LeMonda, 1989; Skinner, 1986). As such, one central dimension of parenting is responsiveness—the prompt, contingent, and appropriate responding by mothers to children's exploratory and communicative overtures (e.g., Ainsworth et al., 1978; Bornstein, 1989; Watson, 1985). The experience of contingency has been proposed as a mechanism whereby children develop expectations about the impact of their own behaviors and a sense of control over the environment. Moreover, verbally responsive mothers monitor

their child's visual attention and activity and then respond contingently, thereby maximizing the matching of words/phrases with targets of the child's current focus (Dunham & Dunham, 1995).

Empirical evidence shows that maternal responsiveness relates concurrently to toddler speech and vocabulary progress in the second year (Olson, Bates, & Bayles, 1984; Olson, Bayles, & Bates, 1986). Responsiveness in infancy has been shown to predict receptive vocabulary size, responsiveness to mothers' utterances, and higher scores on the Bayley Scales of Infant Development (MDI) at 24 months (Beckwith & Cohen, 1989), representational competence at 13 months, nonverbal discrimination-learning, and Wechsler Preschool and Primary Scale of Intelligence scores at 4 years (Bornstein & Tamis-LeMonda, 1989). Verbal responsiveness to toddlers relates to 3- and 4-year Stanford-Binet scores (Bakeman, Adamson, Brown, & Eldridge, 1989) and 12-year Wechsler Intelligence Scale for Children scores (WISC) in preterm children (Beckwith & Cohen, 1989). Contingent maternal verbal responsiveness to the vocalizations of 1-year-old toddlers even predicts communicative development in adopted toddlers, thereby pinpointing the predictive validity of responsiveness (Hardy-Brown, Plomin, & DeFries, 1981; Plomin & DeFries, 1985).

Another aspect of parenting found to be associated with growing linguistic competence is joint attention. Adults promote early vocabulary acquisition in their children when they sustain joint visual focus to objects under the child's visual scrutiny (Bruner, 1978; Tomasello & Farrar, 1986; Tomasello, Mannle, & Kruger, 1986). Indeed, Tomasello and Todd (1983) showed that mothers who maintained high levels of joint attentional focus during unstructured play sessions with their toddlers had children with higher vocabularies overall and greater nominal vocabularies specifically. Similarly, Dunham and Dunham (1995) found that when experimenters labeled an object attended to by 18-month-olds, the children were more likely to learn the label than children who were provided the label when focused on a different object. Other investigators have documented relations between joint attention and Bayley MDI scores (e.g., Roggman, Carroll, Lee, & Pippin, 1991).

A third parenting behavior found to predict early child language is attention focusing when children are off-task or unfocused. For example, Bornstein and Tamis-LeMonda (1990) and Tamis-LeMonda and Bornstein (1989) showed that mothers who organized their unfocused 2- and 5-month-old infants to attend to objects and events in the environment had babies who more frequently engaged in object exploration, possessed larger receptive vocabularies, and engaged in more symbolic play in the second year. Vibbert and Bornstein (1989) likewise demonstrated that mothers who engaged in more didactic focusing had young toddlers with higher overall vocabularies at 13 months.

To date, investigators have not examined whether or how these maternal behaviors covary. That is, responsive mothers might also maintain joint topic focus when their children actively attend (e.g., by elaborating on the features of a toy that a child is examining) and focus children when they are unengaged or distracted (e.g., by demonstrating how a toy works in order to solicit a child's interest). The extraction of maternal factors from these behaviors and analyzing their differential prediction to child language comprehension will yield a more comprehensive portrayal of parenting effectiveness.

In contrast to maternal behaviors that are sensitive to children's focus are maternal behaviors that interrupt, prohibit, or miss their children's initiatives. Specifically, intrusive behaviors (i.e., those that interrupt, control, or redirect children's activities) have been found to be either unrelated to language or to affect language outcomes adversely (e.g., Della Corte, Benedict, & Klein, 1983; Snow, 1989). For example, Tomasello and Todd (1983) reported no relation between 12-month maternal control (referred to as "directives" by the authors) and overall child vocabulary size during joint attention episodes. Tomasello and Farrar (1986) demonstrated that mothers who initiated interactions by directing their toddlers' attention to something new (rather than following the child's focus of attention) had toddlers with smaller productive vocabulary sizes at 21 months. Maternal control has also been associated with fewer child language initiations and a

restriction of the range and amount of children's communications (Duchan, 1989).

Other studies have shown that prohibitive behaviors on the part of parents hinder language development in children. For example, parental "avoidance of restriction and punishment" of young toddlers, as measured by the Home has consistently predicted children's language growth (e.g., Elardo, Bradley, & Caldwell, 1977). Also, Nelson (1973) found that mothers who rejected their 18-month-olds' speech as meaningful had two-year-olds with smaller vocabularies as compared to toddlers with more accepting mothers. In addition to controlling and restrictive maternal behaviors, maternal uninvolvement may adversely affect language development in children. Recent examinations of at-risk mother–child dyads (e.g., depressed mothers, adolescent mothers) have suggested that uninvolvement, reflected in for example missing children's cues, may be associated with poorer linguistic outcomes of children (e.g., Burge & Hammen, 1991; Furstenberg, Brooks-Gunn, & Chase-Landsdale, 1989). It is reasonable to conjecture that such relations would generalize to other groups as well.

### Children's Language Comprehension at 9 and 13 Months

We examined mother–child relations during the emergence of language comprehension, referred to as the "First" and "Second Moments" in language development (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). At approximately 9 months, increased receptiveness to the communicative intent of others, intentionality of communications, and the notable "ritualization" of signals are apparent. This suggests that the child recognizes conventional aspects of communication, a realization that is important to further gains in understanding as well as producing mature language. At 13 months, children appear to attain nominal insight, the idea that things have names (Volterra, Bates, Benigni, Bretherton, & Camaioni, 1979).

To date, the majority of studies that explore mothers' contributions to their children's language development have neglected the 9- to 13-month period, even though this period signals a time of heightened sensitivity to linguistic stimulation (Snow, 1987). A traditional theoretical and methodological emphasis on children's language production may help to explain this selection. Admittedly, language production is readily observable. Nevertheless, recent evidence suggests a possible dissociation between language comprehension and language production, with language comprehension reflecting a greater semantic-conceptual sophistication than language production at early ages (Bates, Bretherton, & Snyder, 1988; Fenson et al., 1991; Rose, Feldman, Wallace, & Cohen, 1991; Tamis-LeMonda & Bornstein, 1990, 1994; Vibbert & Bornstein, 1989). In view of these findings, the examination of the differential predictive influence of maternal interactions at the onset of language comprehension seems essential to understanding child language development and key to the improved implementation of mother–child interventions.

To these ends, we examined mother–child interactions during collaborative play at 9 and 13 months and assessed maternal responsiveness, joint topic focus, focusing of toddler attention, prohibitions, focus shifts, and misses. These maternal behaviors were examined in relation to one another as well as in relation to children's growing language comprehension. We expected to (1) extract meaningful factors of maternal behavior, (2) show cross-age stability in those factors and in child language comprehension, and (3) demonstrate differential prediction of maternal verbal factors at 9 months to children's language comprehension at 13 months. We also explored the possibility that the interaction between 9-month language comprehension and 9-month maternal factors would explain additional variance in the growing language comprehension of children over and above the separate contributions of early infant language and mothers' behaviors. Few studies of socialization effects have examined how maternal behavior interacts with the developmental status of the child to influence language performance.

## METHOD

### Participants

Forty mother–child dyads (17 sons and 23 daughters) participated in this study. Dyads were recruited from private pediatric and obstetric groups in a large metropolitan area. Only firstborn, term infants ($M$ weight = 3.5 kg, $SD$ = .5 kg; $M$ length = 51.9 cm, $SD$ = 2.6 cm) who were free of any known neurological and sensory abnormalities participated in the study. All children came from intact white families in which

both mother and father were native English speakers. Mothers ($M$ age = 33.2 years, $SD$ = 3.4) and fathers ($M$ age = 35.7 years, $SD$ = 4.8) had completed an average of 5.6 ($SD$ = 2.1) and 5.3 ($SD$ = 1.7) years of schooling past high school, respectively, and they provided relatively homogeneous, middle- to upper-middle-class households ($M$ = 58.7, $SD$ = 6.3, on the Hollingshead Four Factor Index of Social Status, 1975; Gottfried, 1985).

Demographic variables were not related to any 9- or 13-month infant or maternal variables and thus were not considered in further analyses. Two of the 40 mother–daughter dyads were excluded from analyses because both were outliers on language variables and on bivariate scatterplots of relations between child language and maternal sensitivity. Magnitudes of the Studentized Deleted Residual, Leverage, and Cook's D for residuals confirmed that each of the outliers was influential in making nonsignificant correlations significant and/or significant correlations nonsignificant (Judd & McClelland, 1989).

## Design and Procedure

Dyads were seen in their homes when children were between the ages of 9 and 10 months ($M$ = 9.5, $SD$ = .3) and then again when the children were between the ages of 13 and 14 months ($M$ = 13.7, $SD$ = .4). They were visited at the convenience of the mother and at a time when the child was sated and alert. The same procedures were followed at the two visits. After a period of acclimation, the mother was asked to play with her child using a standard set of toys for 10 min. The toys included cups, plates, spoons, teapot and cover, doll, baby blanket, baby bottle, bus with people, sponge, telephone, blocks, and nesting cups. Mothers were instructed to disregard the experimenter as much as possible.

## Measures

*Assessment of maternal and child behaviors.* Five mutually exclusive maternal verbal behaviors aimed at target child behaviors were coded: (1) maternal responsiveness, (2) joint topic focus, (3) focus, (4) prohibition/restriction, and (5) focus shift. Additionally, miss was coded whenever mother failed to respond verbally to a target child behavior. Maternal comments regarding children's emotional state or children's involvement with objects other than the standard toy set were excluded from consideration. Criteria for delineating among comments involved both content and timing; if comments indicated different maternal categories or different sentences, or if 2 s elapsed between comments, two behaviors were coded (see also Bornstein et al., 1992).

*Responsiveness* was defined as a positive and meaningful change in mother's verbal behavior subsequent to and dependent on a child exhibiting a vocal or exploratory act (Bornstein et al., 1992). As an example, if a child looked at the brush and mother said "brush," mother was credited with responsiveness. In order for a maternal verbal activity to be credited as responsive, mother had to change her ongoing behavior within 5 s of a change in a child visual or vocal activity (see also, Bornstein et al., 1992). *Joint topic focus* was coded whenever a child maintained attention to the same toy (did not change activity), and mother continued to elaborate verbally on the toy or the child's activity with the toy. For example, if a child looked at the brush and mother said "Brush. It is green," mother's description of the brush would be coded as joint topic focus. *Focus* was coded whenever mother attempted to verbally focus an unfocused child on the toys (e.g., orienting her child with "Look at the brush"). *Prohibition/Restriction* was coded whenever mother negated or discouraged her child's behavior (e.g., saying "no" or "not like that"). *Focus shift* was coded whenever a child was focused on a toy for at least 2 s, and mother attempted verbally to direct her child's attention toward a different toy. For example, if a child looked at a brush and mother said "look at the cup," mother was credited with a focus shift. *Miss* was coded whenever mother failed to respond verbally to a new child activity within a 5-s period or before her child shifted focus (e.g., a child looked at the brush and mother didn't respond within a 5-s period).

Because all the maternal behaviors except *focus* depended on a child's attention to the toys, the summed frequencies for all behaviors except for *focus* were divided by the summed frequency of child acts. Eight child acts were included: vocalizes, looks at toy, looks and touches toy, looks at mother, bids to mother, plays, vocalizes with activity, and watches mother with toy. Because *focus* depended on a child's lack of attention to toys, the summed frequency of maternal *focus* was divided by the summed frequency of episodes of when a child was unfocused. The proportion scores for *joint topic focus*, *prohibition/restriction*, *focus shift*, and *focus* could potentially exceed unity because mothers could repeat replies to a child act or a single occurrence of unfocus.

Three trained coders, unaware of children's language data, coded 80 videotapes (40 each at 9 and 13 months). Four random reliability checks at each age were used to ensure reliability. Cohen's Kappas were acceptable to very good for each class of codes: $M$ k = .77 for child behaviors and $M$ k = .73 for maternal behaviors.

*Child language assessments.* Children's language comprehension was assessed through extensive maternal interviews conducted shortly after the 9- and 13-month home visits. Experimenters, unaware of maternal behavior data, probed mothers regarding their infants' understanding of new words or phrases using a code system adapted from the Language and Gesture Inventory (Bates et al., 1988) and the MacArthur Communicative Developmental Inventories (Fenson et al., 1991).

Parental report provides an invaluable source of information about the child's day-to-day progress in the early stages of language development (Thal & Bates, 1990). It provides a valid representation of emerging language skills (Bates et al., 1988; Reznick, 1990), and it is also cost-effective for a rapid general evaluation of child language (Fenson et al., 1991). Parental report scores of child language relate concurrently to laboratory measures of language, median $r$ = .61 (Fenson et al., 1994). Predictively, parental report portends subsequent child language (Tomasello & Mervis, 1994) including observations of vocabulary and grammar (Fenson et al., 1991), mean length of longest utterances (MLLU), and semantic diversity (Tamis-LeMonda & Bornstein, 1994). Bates et al. (1988) found that parental reports of 10-month and 13-month language comprehension strongly predicted 28-month Peabody Picture Vocabulary Test scores.

In this study, the experimenter read specific lexical items taken from general word categories (e.g., food, toys, activities) and asked the mother whether her child understood each item as well as related items that might not appear on

the inventory. If the child understood the word, the experimenter probed to ascertain what the child's response to the word was and any specific gestural, vocal, temporal, and/or spatial cues that facilitated the child's understanding. The number of "context-flexible" words, words that were understood independent of cues, were tabulated to index the child's language comprehension scores from interviews conducted after the child's 9- and 13-month visits. We elected to use the restricted/flexible comprehension distinction because flexible comprehension of words goes beyond a purely performative understanding of words (see Snyder, Bates, & Bretherton, 1981; Tamis-LeMonda & Bornstein, 1989, 1990, 1994).

## RESULTS

### Descriptive Statistics

Descriptive statistics for child language comprehension, child behaviors, and maternal behaviors at 9 and 13 months are presented in Table 1. As expected, there was a significant difference in the number of words/phases understood by children between 9 months and 13 months, $t(37) = -12.55$, $p < .001$; similarly, there was a difference between the number of behaviors exhibited by children between the two ages, $t(37) = -8.45$, $p < .001$. Mothers' focusing of child increased whereas prohibition/restrictions and misses decreased between 9 and 13 months, $ts(37) = -3.28$, 2.85, and 2.17, $ps < .05$, respectively.

Scores for the six maternal behaviors at 9 and 13 months were subjected to principal components analyses and varimax rotation. As shown in Table 2, two distinct factors emerged from maternal verbal behaviors at each age after varimax rotation. Factor 1 was labeled *verbal sensitivity* and Factor 2 was labeled *verbal intrusiveness*. At 9 months, the first factor received positive loadings from *responsiveness, joint topic focus*, and *focus* and received a negative loading from *miss*. Factor 1 accounted for 56% of the variance in the summary score. At 9 months, the second factor received positive loadings from *prohibition/restriction, focus shift*, and *joint topic focus*, and accounted for 19% of the variance in the summary score.

The *sensitivity* factor at 13 months received positive loadings from *responsiveness, joint topic focus*, and *focus* and a negative loading from *miss*. Factor 1 accounted for 50% of the variance in the summary score. Factor 2 at 13 months received positive loadings from *prohibition/restriction* and *focus shift*. Factor 2 accounted for 25% of the variance in the summary score.

Zero-order correlations were calculated in order to examine the 9- to 13-month stability of maternal verbal sensitivity and intrusiveness. Between 9 and 13 months, verbal sensitivity was stable, $r(36) = .62$, $p < .001$, as was intrusiveness, $r(36) = .55$, $p < .001$. Because stability in maternal behaviors could be mediated by stability in children's own language comprehension, we asked whether maternal behaviors remained stable over and above the contributions of child. Results from hierarchical multiple regression analyses indicated that 9 month maternal verbal sensitivity uniquely accounted for 38% of the variance in 13-month sensitivity over and above the contributions of children's 9- and 13-month language comprehension. Nine-month maternal verbal intrusiveness uniquely accounted for 20% of the variance in 13-month intrusiveness over and above the contributions of children's 9- and 13-month language comprehension. Also, 9-month verbal sensitivity did not predict 13-month intrusiveness and 9-month verbal intrusiveness did not predict 13-month sensitivity, $rs(36) = .04$, and .25, *ns*, respectively.

### Concurrent Relations

Mothers' verbal sensitivity to their 9-month-olds marginally predicted 9-month language comprehension, $r(36) = .29$, $p < .10$. Mothers' sensitivity to their 13-month-olds did not predict their children's 13-month language comprehension, $r(36) = .18$, *ns*. Concurrent relations between maternal intrusiveness and language comprehension at 9 and 13 months were not significant, $rs(36) = .19$ and $-.05$, *ns*, respectively.

### Predictive Relations

Hierarchical multiple regression analyses were conducted to evaluate the unique, joint, and interactive predictive contributions of 9-month child language comprehension, 9-month maternal verbal sensitivity, and 9-month maternal verbal intrusiveness to 13-month child language comprehension. One goal in these analyses was to ascertain whether the extracted factors *uniquely* predict child outcome, that is, after controlling for children's own earlier capabilities (e.g., see Bornstein & Tamis-LeMonda, 1990, 1994). In these analyses, maternal sensitivity uniquely predicted child comprehension, whereas intrusiveness did not, $R^2$ change = .01, *ns*.

**TABLE 1**
**Descriptive Statistics for Child Language Comprehension, Child Behaviors, and Maternal Behaviors at 9 and 13 Months**

| | *M* | *SD* | *Range* |
|---|---|---|---|
| 9 Months | | | |
| Child | | | |
| Comprehension | 11.0 | 7.7 | 1–34 |
| Behaviors | 75.63 | 17.12 | 33–103 |
| Maternal | | | |
| Responsiveness | 0.65 | 0.14 | 0.31–0.87 |
| Joint Topic Focus | 0.55 | 0.26 | 0.08–1.31 |
| Focus | 0.72 | 0.44 | 0.11–1.80 |
| Prohibition/Restriction | 0.03 | 0.05 | 0.00–0.21 |
| Focus Shift | 0.06 | 0.07 | 0.00–0.25 |
| Miss | 0.29 | 0.16 | 0.05–0.65 |
| 13 Months | | | |
| Child | | | |
| Comprehension | 86.2 | 39.8 | 2–185 |
| Behaviors | 101.37 | 19.02 | 56–142 |
| Maternal | | | |
| Responsiveness | 0.68 | 0.12 | 0.28–0.90 |
| Joint Topic Focus | 0.55 | 0.23 | 0.13–1.15 |
| Focus | 1.17 | 0.80 | 0.33–4.10 |
| Prohibition/Restriction | 0.02 | 0.03 | 0.00–0.14 |
| Focus Shift | 0.06 | 0.07 | 0.00–0.30 |
| Miss | 0.25 | 0.14 | 0.04–0.74 |

*Note*: Maternal behaviors were computed by dividing the summed frequencies of maternal behaviors by the summed frequency of child acts; maternal focus was divided by the summed frequency of episodes during which children were unfocused.

**TABLE 2**
**Maternal Verbal Behaviors and Factor Loadings at 9 and 13 Months**

| Maternal Behavior | Verbal Sensitivity | Verbal Intrusiveness |
|---|---|---|
| 9 Months | | |
| Responsiveness | .96 | -.04 |
| Joint Topic Focus | .66 | .55 |
| Focus | .75 | .30 |
| Miss | -.95 | -.20 |
| Prohibition/Restriction | .07 | .80 |
| Focus Shift | .18 | .76 |
| 13 Months | | |
| Responsiveness | .88 | -.25 |
| Joint Topic Focus | .88 | .18 |
| Focus | .69 | .27 |
| Miss | -.94 | -.07 |
| Prohibition/Restriction | .02 | .83 |
| Focus Shift | .11 | .85 |

Table 3 presents data obtained from the significant regressions for child language comprehension and maternal verbal sensitivity at 9 months. The first regression equation tests the unique stability of children's language comprehension across age. To do this, 9- and 13-month maternal sensitivity were partialed by entering them into the regression equation first and then entering 9-month language comprehension. Controlling for maternal sensitivity at the two ages, 9-month language comprehension uniquely accounted for a significant 10% of the variance in 13-month language comprehension.

The second regression equation in Table 3 evaluates the unique contribution of 9-month maternal verbal sensitivity to 13-month language comprehension. In this equation, 9-month language comprehension and 13-month maternal sensitivity were entered first and 9-month maternal sensitivity was entered last. Controlling for 9-month language comprehension and 13-month maternal sensitivity, maternal sensitivity to 9-month-olds uniquely accounted for a significant 15% of the variance in 13-month language comprehension. As shown in both models, together 9-month comprehension and 9- and 13-month maternal sensitivity accounted for 37% of the variance in children's 13-month language comprehension.

Last, we sought to assess the moderating effect of 9-month language comprehension on the association between 9-month maternal verbal sensitivity and 13-month language comprehension. To do this, 9-month language comprehension and 13-month sensitivity were first regressed on 13-month toddler comprehension followed by the 9-month interaction (9-month comprehension × 9-month sensitivity). The moderating effect of 9-month language comprehension on the relation between 9-month maternal sensitivity and 13-month child comprehension accounted for a significant 8% of variance in 13-month language comprehension over and above the contributions of the main effects. Together, 9-month child language comprehension, 9-month maternal sensitivity, 13-month maternal sensitivity, and the interaction variable accounted for 45% of the total variance in the language comprehension of 13-month-olds. Importantly, *B* values for the main effects of 9-month language comprehension and 9-month maternal sensitivity remained significant after considering the interaction between these variables, *B*s = 2.24, and 38.97, *p*s < .01 and .001, respectively.

**TABLE 3**
**Hierarchical Predictive Regressions from 9-Month Child Language Comprehension and Maternal Sensitivity to Toddler Comprehension at 13 Months**

| Criterion/Predictors (Step) | Cumulative $R^2$ | $R^2$ Change | *F* Change | Model *F* |
|---|---|---|---|---|
| Toddler Comprehension at 13 Months | | | | |
| 1. 9-Month Maternal Sensitivity | 0.25 | — | 11.86** | 11.86** |
| 2. 13-Month Maternal Sensitivity | 0.28 | 0.03 | 1.33 | 6.65** |
| 3. 9-Month Child Comprehension | 0.37 | 0.10 | 5.33* | 6.76** |
| Toddler Comprehension at 13 Months | | | | |
| 1. 9-Month Child Comprehension | 0.21 | — | 9.45** | 9.45** |
| 2. 13-Month Maternal Sensitivity | 0.22 | 0.02 | 0.73 | 5.05* |
| 3. 9-Month Maternal Sensitivity | 0.37 | 0.15 | 8.11** | 6.76** |
| Toddler Comprehension at 13 Months | | | | |
| 1. 9-Month Child Comprehension | 0.21 | — | 9.45** | 9.45** |
| 2. 13-Month Maternal Sensitivity | 0.22 | 0.02 | 0.73 | 5.05* |
| 3. 9-Month Maternal Sensitivity | 0.37 | 0.15 | 8.11** | 6.76** |
| 4. 9-Month Comprehension x Sensitivity | 0.45 | 0.08 | 4.86* | 6.86*** |

*Note:* *$p < .05$. **$p < .01$. ***$p < .001$.
Two-tailed probability values.

To elucidate the Language Comprehension × Verbal Sensitivity interaction, the sample was divided into low, medium, and high 9-month language groups (see Vibbert & Bornstein, 1989). The slopes of the three language groups were calculated by substituting the mean of 9-month language comprehension (medium group) and values 1 *SD* above and below the mean (high and low groups, respectively) for the interaction variable in the regression equation (Cohen & Cohen, 1983). This permitted assessment of the effect of 9-month maternal sensitivity on children differing in 9-month language comprehension. Maternal sensitivity related to language comprehension in all three subgroups, as indicated by systematic positive correlations. Nonetheless, the magnitude of relations between maternal verbal sensitivity and child language comprehension varied as a function of child language status. Maternal verbal sensitivity strongly predicted 13-month language comprehension for children who were initially lower in language comprehension, $r(11) = .71$, $p < .006$; the relation between maternal sensitivity and 13-month language comprehension was marginally significant for the medium group, $r(10) = .52$, $p < .08$; and it did not reach significance for the highest group, $r(11) = .35$, *ns*. Differences between the correlations for the lowest and highest groups indicated a large effect size, $q = .52$ (Cohen, 1977). Additionally, the change in 13-month language comprehension as a function of maternal sensitivity was greater for the lowest language group (slope = .34) as compared to the medium (slope = .23) and highest language groups (slope = .12).

## DISCUSSION

We examined the different predictive validity of two factors of maternal behavior to child language comprehension. Mothers scoring higher in verbal sensitivity were responsive to their children's behaviors, maintained joint topic focus with their children, focused their children when they were unfocused, and did not miss their children's signals. In contrast, mothers scoring higher in verbal intrusiveness shifted the focus of their children and were prohibitive or restrictive toward their children's behavior. Individual differences in maternal factors and child language comprehension were stable between 9 and 13 months and maternal factors were differentially predictive of child language comprehension.

Indeed, 9-month language comprehension uniquely predicted 13-month language comprehension over and above mothers' contributions to language. Although other studies have found stability in early language (e.g., Bates et al., 1988), few have controlled for the contribution of maternal behavior (but see Tamis-LeMonda & Bornstein, 1994). The language comprehension scores in this study should not be regarded as pure estimates of child ability, unaffected by maternal influences. By 9 months, prior maternal interactions have certainly influenced language competency, and our data are based on maternal report. Nonetheless, the finding of stability in language comprehension lends credence to the proposition that individual differences in symbolic ability are evident in infancy and continue through early childhood.

Nine-month maternal verbal sensitivity predicted 13-month child language comprehension over and above stability in child language comprehension. This finding accords with other studies that have found predictive associations between maternal responsiveness and child language performance (e.g., Bornstein & Tamis-LeMonda, 1989; Olson et al., 1986). It also evokes a social-interactional view of language in that maternal interactions help to explain language variation in children (Snow, 1977, 1989); language comprehension is facilitated by a language acquisition support system, a sensitive partner, in conjunction with a language acquisition device (Bruner, 1983).

Concurrent relations between maternal verbal sensitivity and language comprehension were marginal or not significant, suggesting that mothers are more strongly affecting their children's later development. The lack of correspondence between early maternal behaviors and language abilities may imply a "sleeper" effect of some types of maternal stimulation on some types of child performance (Beckwith & Cohen, 1989). Similarly, other investigators did not uncover concurrent relations between maternal-infant interactions and cognitive achievements until children were 18 to 24 months (Olson et al., 1984; Tomasello & Farrar, 1986; Tomasello & Todd, 1983). In this study, 9-month maternal verbal sensitivity uniquely influenced 13-month child compre-

hension and was not mediated by stability in maternal sensitivity, implying that children may be especially receptive to this form of maternal verbal behavior during the period between 9 and 13 months. This is not to suggest that 13-month maternal sensitivity, as we measured it, is unimportant for child language. Instead, in a recent pilot study, we found that mothers' verbal responsiveness to 13-month-olds uniquely predicted the timing of the vocabulary spurt and combinatorial speech months later (Tamis-LeMonda, Bornstein, Kahana-Kalman, Baumwell, & Cyphers, in progress). This finding suggests that specific maternal behaviors at specific ages affect certain language outcomes, but not others.

In contrast to positive findings from maternal verbal sensitivity, some researchers have found negative child outcomes associated with behaviors reflecting maternal control (e.g., Ainsworth et al., 1978; Frodi, Bridges, & Grolnick, 1985; Grolnick, Frodi, & Bridges, 1984; Tomasello & Farrar, 1986). In this study, maternal verbal intrusiveness did not predict 13-month language comprehension. When children are 9 months old, maternal intrusive verbal behavior is not as influential as sensitive verbal behavior. Similarly, Bates, Thal, Fenson, Whitesell, and Oakes (1989) demonstrated that adult linguistic support (or incongruity) is not equally effective at every stage of child lexical development. Accordingly, that maternal intrusiveness did not relate to language comprehension in our study underscores the premise that different maternal behaviors differentially influence child abilities during particular developmental periods. It is also possible that the nonsignificant correlation between intrusiveness and child language comprehension was due to the relatively low frequency of behaviors comprising the intrusiveness factor.

Few studies have investigated whether aspects of the caregiving environment interact with the developmental status of the child to influence subsequent cognitive development. We found that children's initial language status moderated the influence of maternal sensitivity; that is, the influence of early maternal sensitivity on children's subsequent language comprehension was stronger for children who were initially lower in language comprehension. It appears that mothers' verbal sensitivity provided less verbally advanced children with sufficient stimulation to bolster language comprehension at 13 months.

Because of the relatively small sample size, the interaction between language comprehension and maternal sensitivity should be regarded as exploratory of conditional relations. Nonetheless, Ho (1990), using a sample of 349 12-month-olds, found that interactions between early maternal responsiveness and children's scores on tests of mental performance accounted for as much as 20% of cognitive performance a year later and as much as 11% three years later. As in our study, he found that children who were initially lower in mental status gained most from maternal sensitivity. Therefore, in addition to focusing on main effects, our results indicate that investigators will benefit from examining interactions between maternal behaviors and child characteristics on child cognitive outcomes.

It is important to recognize that the results of this study may be applicable only to children in this age group, evaluated under the circumstances specified, and in the population investigated. The families in this study came from the upper range of the socioeconomic scale. For the foregoing reasons, generalizations of these findings to other ages, situations, and populations should be made with caution.

In general, many studies of environmental influences have adhered to a model of global action, in which good stimulation uniformly enhances all aspects of development at all ages for all children (see discussions by Maccoby & Martin, 1983; Wachs, 1984). Rather, our analyses suggest that investigators should identify the features of the environment that are most salient in facilitating specific aspects of development for specific individuals at specific ages (Bornstein & Tamis-LeMonda, 1990; Olson et al., 1986; Tamis-LeMonda & Bornstein, 1987; Wachs, 1992). Our findings, that child language comprehension and maternal verbal sensitivity uniquely, jointly, and conditionally contribute to early language acquisition, have implications for understanding learning and developing intervention strategies for certain children at this pivotal age in language development.

AUTHORS' NOTES

This research was conducted in partial fulfillment of the Doctoral requirements for L.B. at New York University's Department of Applied Psychology. C.T.L. was supported by research grants HD20559 and HD20807. M.H.B. was supported by research grants HD20559 and HD20807 and by a Research Career Development Award HD00521 from the National Institute of Child Health and Human Development. The generous guidance of Cynthia Deutsch and William Schiff is gratefully acknowledged. Valuable assistance was provided by A. Damast, L. Cyphers, J. McClure, R. Kahana-Kalman, J. Daws, and O. M. Haynes.

REFERENCES

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

Bakeman, R., Adamson, L.B., Brown, J.V., & Eldridge, M.E. (1989). Can early interaction predict? How and how much? In M.H. Bornstein & N.A. Krasnegor (Eds.), *Stability and continuity in mental development: Behavioral and biological perspectives.* Hillsdale, NY: Erlbaum.

Bates, E., Benigni, L., Bretherton, I., Camaioni, L., & Volterra, V. (1979). *The emergence of symbols: Cognition and communication in infancy.* New York: Academic.

Bates, E., Bretherton, I., & Snyder, L. (1988). *From first words to grammar: Individual differences and dissociable mechanisms.* Cambridge: Cambridge University Press.

Bates, E., Thal, D., Fenson, L., Whitesell, K., & Oakes, L. (1989). Integrating language and gesture in infancy. *Developmental Psychology, 25,* 1004–1019.

Beckwith, L., & Cohen, S.E. (1989). Maternal responsiveness with preterm infants and later competency. In M.H. Bornstein (Ed.), *Maternal responsiveness: Characteristics and consequences: New directions for child development.* San Francisco: Jossey-Bass.

Bohlin, G., Hagekull, B., Germer, M. Andersson, K., & Lindberg, L. (1989). Avoidance and resistant reunion behaviors as predicted by maternal interactive behavior and infant temperament. *Infant Behavior and Development, 12,* 105–117.

Bornstein, M.H. (Ed.). (1989). *Maternal responsiveness: Characteristics and consequences: New directions for child development.* San Francisco: Jossey-Bass.

Bornstein, M.H. (Ed.). (1995). *Handbook of parenting.* Mahwah, NJ: Erlbaum.

Bornstein, M.H., & Tamis-LeMonda, C.S. (1989). Maternal responsiveness and cognitive development in children. In M.H. Bornstein (Ed.), *Maternal responsiveness: Characteristics and consequences: New directions for child development.* San Francisco: Jossey-Bass.

Bornstein, M.H., & Tamis-LeMonda, C.S. (1990). Activities and interactions of mothers and their firstborn infants in the first six months of life: Stability, continuity, covariation, correspondence, and prediction. *Child Development, 61,* 1206–1217.

Bornstein, M.H., & Tamis-LeMonda, C.S. (1994). Antecedents of information-processing skills in infants: Habituation, novelty responsiveness, and cross-modal transfer. *Infant Behavior and Development, 17,* 369–378.

Bornstein, M.H., Tamis-LeMonda, C.S., Tal, J., Ludemann, P., Toda, S. Rahn, C. W., Pêcheux, M., Azuma, H., & Vardi, D. (1992). Maternal responsiveness to infants in three societies: America, France, and Japan. *Child Development, 63,* 808–821.

Bruner, J. (1978). From communication to language: A psychological perspective. In I. Markova (Ed.), *The social context of language.* New York: Wiley.

Bruner, J.S. (1983). *Child's talk.* New York: Norton.

Burge, D., & Hammen, C. (1991). Maternal communication: Predictors of outcome at follow-up in a sample of children at high and low risk for depression. *Journal of Abnormal Psychology, 100,* 174–180.

Cohen, J. (1977). *Statistical power analysis for the behavioral sciences.* New York: Academic.

Cohen, P., & Cohen, J. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Della Corte, M., Benedict, H., & Klein, D. (1983). The relationship of pragmatic dimensions of mothers' speech to the referential-expressive distinction. *Journal of Child Language, 10,* 35–43.

Duchan, J. (1989). Evaluating adults' talk to children: Assessing adult attunement. *Seminars in Speech and Language, 10,* 17–27.

Dunham, P.J., & Dunham, F. (1995). Optimal social structures and adaptive infant development. In C. Moore & P. J. Dunham (Eds.), *Joint attention: Its origins and role in development.* Hillsdale, NJ: Erlbaum.

Elardo, R., Bradley, R.H., & Caldwell, B.M.A. (1977). A longitudinal study of the relation of infants' home environments to language devel-

opment at age three. *Child Development, 48,* 595–603.

Fenson, L., Dale, P.S., Reznick, J.S., Bates, E., Thal, D.J., & Pethick, S.J. (1994). Variability in early communicative development. *Monographs of the Society for Research in Child Development,*Chicago: University of Chicago Press.

Fenson, L., Dale, P.S., Reznick, J.S., Thal, D., Bates, E., Harting, J.P., Pethick, S., & Reilly, J. S. (1991). *Technical Manual for the MacArthur Communicative Developmental Inventories.* San Diego State University.

Frodi, A., Bridges, L., & Grolnick, W. (1985). Correlates of mastery-related behavior: A short-term longitudinal study of infants in their second year. *Child Development, 56,* 1291–1298.

Furstenberg, F.F. Jr., Brooks-Gunn, J., & Chase-Landsdale, L. (1989). Teenage pregnancy and child bearing. *American Psychologist, 44,* 313–320.

Gottfried, A.W. (1985). Measures of socioeconomic status in child development research: Data and recommendations. *Merrill-Palmer Quarterly, 31,* 85–92.

Grolnick, W., Frodi, A., & Bridges, L. (1984). Maternal control style and the mastery motivation of one-year-olds. *Infant Mental Health Journal, 5,* 72–82.

Hardy-Brown, K., Plomin, R., & Defries, J.C. (1981). Genetic and environmental influences on communicative development in the first year. *Developmental Psychology, 17,* 704–717.

Ho, H.Z. (1990, May). *Interaction of early caregiving environment and infant developmental status in predicting subsequent cognitive performance.* Paper presented at the meeting of the International Society of Infant Studies, Montreal, Canada.

Hollingshead, A.B. (1975). *The four-factor index of social status.* Unpublished manuscript, Yale University. New Haven.

Judd, C.M., & McClelland, G.H. (1989). *Data analysis: A model comparison approach.* New York: Harcourt, Brace, & Jovanovich.

Maccoby, E.E., & Martin, J.A. (1983). Socialization in the context of the family: Parent–child interaction. In E.M. Hetherington (Ed.), P.H. Mussen (Series Ed.), *Handbook of child psychology: Vol. 1. Socialization, personality and social development.* New York: Wiley.

Martin, J.A. (1989). Personal and interpersonal components of responsiveness. In M.H. Bornstein (Ed.), *Maternal responsiveness: Characteristics and consequences: New Directions for child development.* San Francisco: Jossey-Bass.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development,* 38(1–2).

Olson, S.L., Bates, J.E., & Bayles, K. (1984). Mother–infant interaction and the development of individual differences in children's cognitive competence. *Developmental Psychology, 20,* 166–179.

Olson, S.L., Bayles, K., & Bates, J.E. (1986). Mother–child interaction and children's speech progress: A longitudinal study of the first two years. *Merrill-Palmer Quarterly, 32,* 1–20.

Plomin, R., & DeFries, J. C. (1985). *Origins of individual differences in infancy: The Colorado Adoption Project.* New York: Academic.

Reznick, S.J. (1990). Visual preference as a test of infant word comprehension. *Applied Psycholinguistics, 11,* 145–160. .

Roggman, L.A., Carroll, K.A., Lee, J., & Pippin, E.A. (1991, April). *Mother–toddler coordinated attention in relation to security of attachment and cognitive skill.* Paper presented at the meeting of the Society for Research in Child Development, Seattle, WA.

Rose, S.A., Feldman, J.F., Wallace, I.F., & Cohen, P. (1991). Language: A partial link between infant attention and later intelligence. *Developmental Psychology, 27,* 798–805.

Shatz, M. (1982). On mechanisms of language acquisition: Can features of the communicative environment account for development? In L. Gleitman & E. Warner (Eds.), *Language acquisition: The state of the art.* Cambridge: Cambridge University Press.

Skinner, E.A. (1986). The origins of young children's perceived control: Mother contingent and sensitive behavior. *International Journal of Behavioral Development, 9,* 359–382.

Snow, C.E. (1977). Mothers' speech research: From input to interaction. In C. E. Snow & C. A. Ferguson (Eds.), *Talking to children: Language input to acquisition.* Cambridge: Cambridge University Press.

Snow, C.E. (1987). Relevance of the notion of a critical period to language acquisition. In M.H. Bornstein (Ed.), *Sensitive periods in development: Interdisciplinary perspectives.* Hillsdale, NJ: Erlbaum.

Snow, C.E. (1989). Understanding social interaction and language acquisition: Sentences are not enough. In M.H. Bornstein & J.S. Bruner (Eds.), *Interaction in human development.* Hillsdale, NJ: Erlbaum.

Snyder, L., Bates, E., & Bretherton, I. (1981). Content and context in early lexical development. *Journal of Child Language, 8,* 565–582.

Tamis-LeMonda, C.S., & Bornstein, M.H. (1987). Is there a "sensitive period" in human mental development? In M. H. Bornstein (Ed.), *Sensitive periods in development: Interdisciplinary perspectives*. Hillsdale, NJ: Erlbaum.

Tamis-LeMonda, C.S., & Bornstein, M.H. (1989). Habituation and maternal encouragement of attention in infancy as predictors of toddler language, play, and representational competence. *Child Development, 60,* 738–751.

Tamis-LeMonda, C.S., & Bornstein, M.H. (1990). Language, play, and attention at one year. *Infant Behavior and Development, 13,* 85–98.

Tamis-LeMonda, C.S., & Bornstein, M.H. (1994). Specificity in mother–toddler language-play relations across the second year. *Developmental Psychology, 30,* 283–292.

Thal, D., & Bates, E. (1990). Continuity and variation in early language development. In J. Columbo & J. Fagen (Eds.), *Individual differences in infancy: Reliability, stability, prediction*. Hillsdale, NJ: Erlbaum.

Tomasello, M., & Farrar, M.J. (1986). Joint attention and early language. *Child Development, 57,* 1454–1463.

Tomasello, M., Mannle, S., & Kruger, , A. (1986). The linguistic environment of one to two year old twins. *Developmental Psychology, 22,* 169–176.

Tomasello, M., & Mervis, C.B. (1994). The instrument is great, but measuring comprehension is still a problem. Commentary of *Variability in early communicative development. Monographs of the Society for Research in Child Development, 59* (5, Serial No. 242).

Tomasello, M., & Todd, J. (1983). Joint attention and lexical acquisition style. *First Language, 4,* 197–212.

Vibbert, M., & Bornstein, M.H. (1989). Specific associations between domains of mother–child interaction and toddler referential language and pretense play. *Infant Behavior and Development, 12,* 163–184.

Volterra, V., Bates, E., Benigni, L., Bretherton, I., & Camaioni, L. (1979). First words in language and action: A qualitative look. In E. Bates, L. Benigni, I. Bretherton, L. Camaioni, & V. Volterra (Eds.), *The emergence of symbols: Cognition and communication in infancy*. New York: Academic.

Wachs, T.D. (1984). Proximal experience and early cognitive-intellectual development: The social environment. In A. W. Gottfried (Ed.), *Home environment and early cognitive development*. New York: Academic.

Wachs, T.D. (1992). *The nature of nurture*. California: Sage.

Watson, J.S. (1985). Contingency perception in early social development. In T. Field & N. Fox (Eds.), *Social perception in infants*. Norwood, NJ: Ablex.

19 February 1996; Revised 1 October 1996 ■