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Mothers' Attributions of Communication to Prelinguistic Behavior of Developmentally Delayed and Mentally Retarded Infants

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Some investigators have suggested that mothers of severely handicapped infants do not attribute communication to their infants' behavior as frequently as do other mothers because such infants exhibit developmentally younger and more ambiguous behavior. This premise was tested, and several factors that may influence the frequency with which mothers attribute communication to their babies' behavior were examined. Sixteen mother–handicapped infant pairs participated. Results did not support the simple notion that mothers of severely handicapped babies attribute less communication than do mothers of mildly handicapped infants. Results suggest that the mothers' attributions of communication may be influenced by a number of factors besides the actual behavior emitted by the infants, factors that may allow the mothers to interact effectively with an even severely handicapped baby.

Harding (1984) convincingly argued that it is the mothers' attribution about the meaning of their babies' behavior, not just the occurrence of the behavior, that affects which kinds of behavior mothers respond to. She suggested that mothers generally respond to their infants' behavior when they perceive that their babies need something or show interest/disinterest in some stimuli. By influencing how frequently and in what manner

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mothers respond to their babies' behavior, such maternal attributions of meaning may indirectly facilitate not only synchronous mother–child interaction, but also infant communication development (Harding, 1984). Differential maternal responsivity to increasingly more conventional and clear infant signals facilitates infant contingency awareness (Riksen-Walraven, 1978) and is associated with infant development of goal-oriented behavior and conventional communicative behavior (Harding, 1984).

Many mothers of developmentally delayed infants are less responsive to their infants than are mothers of normally developing infants who were developmentally matched (e.g., Brooks-Gunn & Lewis, 1984). This finding is troublesome given the possible facilitative effect of maternal responsivity on infant development. As a possible explanation for the mothers' relatively low rate of responsivity, some investigators have suggested that handicapped infants provide their mothers with fewer opportunities to attribute meaning and therefore fewer opportunities to respond (Dunst, 1983; Goldberg, 1977). It is unclear, however, whether mothers of such infants attribute meaning to infant cues less frequently or whether they adapt by attributing to different, perhaps more subtle infant cues.

In the present study we investigated two models designed to predict how the low frequency of clean communicative cues by developmentally delayed infants affects mothers' attributions of communication to their infants' prelinguistic behavior. Both models predict that severely handicapped infants will exhibit fewer behaviors that researchers define as communicative (see Dunst, 1983, for review).

The first model predicts that mothers of severely handicapped infants will perceive their babies' behavior as meaningful less frequently than will mothers of mildly handicapped babies because the severely handicapped babies actually are less frequently responsive and initiating (Dunst, 1983; Goldberg, 1977). The first model predicts that mothers of babies who exhibit more of the behaviors that researchers consider communicative will see their babies as communicating more frequently than do mothers of babies who display relatively few instances of these types of behavior. We refer to this first model as the "infant driven model."

Not all mothers, however, interpret the same behaviors as communicative. In fact, mothers in some cultures do not attribute communicative intent to any prelinguistic behaviors (Schieffelin, 1979). Further, a study including mostly middle-class American mothers indicated that even mothers of babies in the same developmental period differed greatly in the extent to which they indicated that their babies' behaviors were communicative (Feagans & Robinson, 1985). Regardless of the source of these differences, we posited that mothers may vary in their tendency to attribute meaning to infant behavior and that this tendency influences how readily they attribute communication to their own babies' behavior.

The second model predicts that, in addition to the relative frequency of objectively defined infant cues, the mothers' general tendency to attribute communication also affects their attributions to their own infants' behavior. In keeping with the notion of maternal compensation, we posited that mothers of severely handicapped infants will have greater general tendencies to attribute meaning than will mothers of mildly handicapped infants. We expected this relation because we conceptualized the general tendency to attribute as a learned characteristic that is partly influenced by the mothers' past interactions with their infants. As a specific test of this adaptation model, we expected that the mothers' general tendencies to attribute and the infants' degree of handicap would relate to the types of behavior the mothers interpreted as meaningful in their own infant. This last set of relations is crucial to determining whether the mothers' general tendency to attribute communication was really related to what they considered communicative in their own babies. This "adaptation model" therefore, does not predict a relation between degree of infant handicap and the frequency of maternal attributions of meaning to their own babies' behavior.

This study was designed to test these two explanatory models in a sample of infants with handicaps and their mothers. The results suggest how degree of infant handicap influences mothers' attributions of prelinguistic communication.

Method

Subjects

Sixteen mother–handicapped infant pairs participated. The infants were mostly white (n = 15), approximately 11 months old (mean = 11.6 months, standard deviation [*SD*] = .78), and mostly first or second born (8 and 6, respectively). There were more males than females (10 and 6, respectively), but no sex effects were found on any

variable of interest. Informal assessments indicated that all infants had hearing and vision within normal limits. The type and severity of the handicaps were severe physical and mental handicap (n = 5); moderate physical handicap, but mild mental handicap (n = 4); mild physical handicap, but moderate cognitive handicap (n = 1); mild overall delay (n = 5); and developmentally at risk (n = 1). The severity of cognitive handicaps varied greatly (mean Bayley Scales of Infant Development [Bayley, 1969] Mental Development Index = 65.5, SD = 28.9).

The mothers' average age was 31.6 years (SD = 5.01). All mothers had at least some college education, and all but one family made over $15,000 annually.

Procedure

Free-Play Session. A 20-minute free-play mother–infant interaction session was videotaped in a small carpeted playroom equipped with developmentally appropriate toys. The camera placement and zoom lens ensured an excellent view of infant and mother facial expressions.

Assessment of Infant Motor Handicap

A trained examiner assessed the infant's neuromotor status using the Movement Assessment of Infants (hereafter called "Movement Assessment," Chandler, Andrews, & Swanson, 1980), which assessed four areas: muscle tone, autonomic reactions, primitive reflexes, and volitional movement. A total risk score was derived from the sum of these subscale scores, with higher scores indicative of more severe motor handicaps.

The Movement Assessment was selected because it measured areas of functioning that previous researchers had found to affect the clarity and frequency of communicative signals (e.g., muscle tone [Gallagher, Jens, & O'Donnell, 1983]), and, unlike the extrapolated form of the Bayley Mental Development Index (Naglieri, 1981), this test allowed continuous measurement of the severity of handicap represented in the present sample (mean score = 32.5, SD = 15.87). (Although the Movement Assessment directly measures neuromotor status, cognitive [Mental Development Index] and neuromotor [Movement Assessment] status covaried strongly in the handicapped sample, $r = -.80, p < .001$). In contrast, a normally developing sample of 16 infants matched on chronological age had an average of 8 Movement Assessment risk points (SD = 5 points) (Yoder, 1985).

The generalizability coefficient (Cronbach, Gleser, Nanda, & Rajaratnam, 1972) to estimate interobserver reliability of the Movement Assessment was estimated at .98 (n = 10, Kasari, 1985) and the test–retest reliability has been estimated at .72 (Harris & Swanson, 1984).

Mother's Attributions to Her Infant

Immediately following the free-play session, the mother viewed her own videotaped free-play session and was instructed to push a button on a data-collection device (OS3 by Observation Systems) to identify when her child communicated during the first 10 minutes of the videotaped free-play. Mothers were not instructed about the definition of *communication* or what unit of analysis to use to segment the session because we wanted the mothers to base their attributions on their own definitions of *communication.* They were only instructed to press the button when they felt their child was trying to communicate with them. The number of times the mother pushed the button was the measure of the number of maternal attributions of communication to her infant. Test–retest agreement on the occurrence of mother-identified cues averaged 81% (67% to 93%).

Maternal Attributions to an Unknown Infant

To measure the mothers' general tendency to attribute communication, we showed them a videotape of a common set of infant behaviors displayed by an unknown infant. All mothers viewed and rated 20 videotaped scenes depicting an unfamiliar adult and baby interacting. The 20 scenes depicted infant behaviors that varied systematically in their communicative clarity (Harding, 1984; Lawrence, 1984).

The mothers were asked to rate the certainty with which they could say that the infant behavior depicted in each scene was communicative. The 6-point scale ranged from 1 (I'm sure the baby's behavior is not communicative) to 6 (I'm sure the baby's behavior is communicative). A composite score across all 20 scenes was used as the index of general maternal tendency to attribute communication. The generalizability coefficient to estimate test–retest reliability of the composite score across a 2-week period was .83 (n = 8).

Investigator-Defined Communicative Infant Cues

Two trained observers coded all 16 free-play sessions for instances of infant behavior that fit our definition of prelinguistic, intentional, and unintentional communication. The operational definitions of intentional and unintentional communication as well as examples of the types of behaviors that were considered communicative are as follows. *Unintentional cues:* sustained shift of attention to new toy (e.g., baby was playing with rattle, but now stops and begins playing with blocks for at least 3 seconds); sustained shift in manner of play with toy (e.g., baby was mouthing stack rings, but now stops and starts shaking the stacking pole for at least 3 seconds); sudden shift in emotional state (e.g., baby suddenly begins to cry); strained or frustrated directed action (e.g., baby maintains a stretched reach for a toy that is out of reach); nonfuss or noncry vocalization (e.g., baby says "ah" while separating connecting beads). *Intentional cues:* conventional gesture (e.g., baby points to object); word approximation (e.g., baby says "baba" while playing with doll); coordinated attention to object and mother (e.g., baby gives object to mother, baby looks from object to mother while vocalizing).

Only 3 subjects had two or fewer instances of cues that coders judged to be intentional communication. The generalizability coefficient to estimate interobserver reliability before consensus was .78 (n = 16). Consensus coding was used to settle disagreements on the occurrence of an infant cue; therefore, actual reliability of the scores was greater than .78. The score was the consensus of the total number of cues, regardless of type of cue.

Description of Communicative Infant Cues Signaled by Mothers During Free-Play Session

Trained coders located and described the infant behaviors that occurred on the videotaped free-play session, beginning from the time of occurrence of each button press (maternal attributes of communication to own child) and ending at the immediately following shift in the infant's attention. Shifts in infant attention provided a natural breaking point to guide segmenting infant behavior clusters and allowed us to avoid an arbitrary temporal segmenting criterion. (The use of a segmenting criteria based on infant attention shifts [i.e., thematic] resulted in varying lengths of behavior clusters. Length of cluster, however, was not related to degree of handicap, r = .45. In addition, a second coding using a fixed 5-second segmenting criteria provided nearly identical results to those using the thematic criteria.) Infant behaviors were coded as the solitary or combined occurrence of (a) attention to mother, (b) attention to toy, and (c) vocalization, thus creating many possible categories of behavior.

The nine categories that showed sufficient variance to be of use in describing individual differences in the types of behaviors that mothers interpreted as communicative are as follows: Communicative behavior clusters showing (a) at least attention to toy; (b) at least attention to mother; (c) at least vocalization; (d) attention to toy and vocalization; (e) attention to toy and mother; (f) attention to mother and vocalization; (g) attention to mother, not toy; (h) attention to mother, no vocalization; and (i) attention to toy only.

These scores took the form of the number of communicative behavior clusters exhibiting the target behavior(s) divided by the total number of communicative behavior clusters. Generalizability coefficients to estimate the interobserver reliability of these category scores averaged .87 and ranged from .59 to .97 (all but one category was above .86).

Results

Simple correlations were used to test bivariate relations. Multiple regressions were used to test relations when statistically controlling for a third, intercorrelated variable was necessary. Spearman correlations were computed for nonnormally distributed variables. The data fit all statistical assumptions within acceptable limits unless otherwise stated. One handicapped infant cried too much to assess his neuromotor status, leaving a sample of 15 subjects for analyses involving this variable. Other analyses were based on 16 subjects.

The hypotheses predicted by the infant driven and/or adaptation models were tested first. Post hoc analyses were required to analyze certain relations within unexpected subgroups.

Confirmatory Analyses

As expected under both models, trained coders observed fewer cues by severely delayed infants than by mildly delayed infants, $r = -.51, p$

$< .05$, 1-tailed. Although violations in the assumptions of the test require cautious interpretation, the number of experimenter-defined infant cues was not related to the number of maternal attributions to her own child, $r = .10$. Further, the number of maternal attributions to her own child was not related to degree of infant handicap, $r = .18$.

The following complex pattern of results indicates more than just a simple relation between the number of "objectively" defined infant cues and those interpreted by the mothers. Even though all mothers rated the same 20 play scenes, mothers of severely handicapped infants tended to attribute communication more frequently and with more certainty to an unknown infant than did mothers of less handicapped infants, $r = .59, p < .05$. Again, violations in the assumptions of the statistical test require cautious interpretation, but the relation between the mothers' general tendency to attribute to an unknown infant and the number of attributions the mothers made to their own infants just missed significance, $r = .40, p = .065$, 1-tailed.

Mothers tended to interpret different types of behaviors in their own infants depending on the degree of their infants' handicap and the mothers' general tendency to attribute communication. In order to control for individual differences in the measure of the types of behaviors mothers called "communicative," the number of maternal attributions to her child was statistically controlled in these analyses when related to the dependent variable. Mothers with liberal general tendencies to attribute communication tended to interpret communicative behavior clusters for their own infants that showed attention to mother, partial $r = .41, p < .01$, and, more specifically, attention to mother and toy, partial $r = .28, p < .05$, than did more conservative attributers. In addition, mothers of severely handicapped infants interpreted communicative behavior clusters with more instances of attention to mother, partial $r = .45, p < .01$, and, more specifically, more attention to mother with vocalizations, $r = .54, p < .05$, and less instances of attention to toys only, $r = -.52, p < .05$, than did mothers of less handicapped infants.

Post Hoc Analyses

As mentioned earlier, two of the proposed analyses were not appropriate due to subgrouping. The scatterplot representing the relation between maternal attributions to their own children and coder-identified cues revealed two subgroups (Figure 1): (a) those scoring above 30 maternal attributions ($n = 4$) and (b) those scoring below 30 maternal attributions to their own children's cues ($n = 12$).

Separate correlations by subgroup indicated that the number of code-identified cues and the number of maternal attributions to their own children were strongly positively related in the large subgroup, $r = .86, p < .001$. This was not true in the small subgroup, $r = .12$, although the relationship must be interpreted with caution because of the small number of subjects in this subgroup.

Two important infant variables failed to differentiate the subgroups. Even though the average degree of handicap represented in the small subgroup was slightly more severe (mean = 39.75, $SD = 17.08$) than that in the large subgroup (mean = 30, $SD = 15.40$), this difference was not significant. (The unequal group t tests were tested using Satterthwaite's solution to unequal sample sizes, which tests the significance of the pooled variance t score using adjusted degrees of freedom [Howell, 1982].) In addition, the average number of coder-identified cues in the small subgroup was less (mean = 18.5, $SD = 7.42$) than that in the large subgroup (mean = 23.6, $SD = 5.4$), but this difference was not significant either.

In addition to the number of maternal attributions to their own children, however, two other mother variables did differentiate the subgroups. The mothers in the smaller subgroup (mean = 106.25, $SD = 5.79$) had a general tendency to attribute (to unknown infant) more freely than did mothers in the large subgroup (mean = 97.41, $SD = 8.46$; unequal group $t(29) = 2.33, p < .05$). Further, every mother in the smaller subgroup judged that their babies communicated more frequently than the coder judged.

One possible explanation for why some mothers identified more cues than did coders was that these mothers adapted to scarce or subtle infant cues by interpreting cues that coders did not. To test this possibility, we used a difference score of mothers' attributions to their own children minus coder-identified cues as our dependent measure and used the mothers' general tendency to attribute communication to an unknown child as our predictor. Although this relation was significant and in the predicted direction, $r = .50, p = .025$, 1-tailed, identical subgrouping so that seen previously rendered this relation uninterpretable.

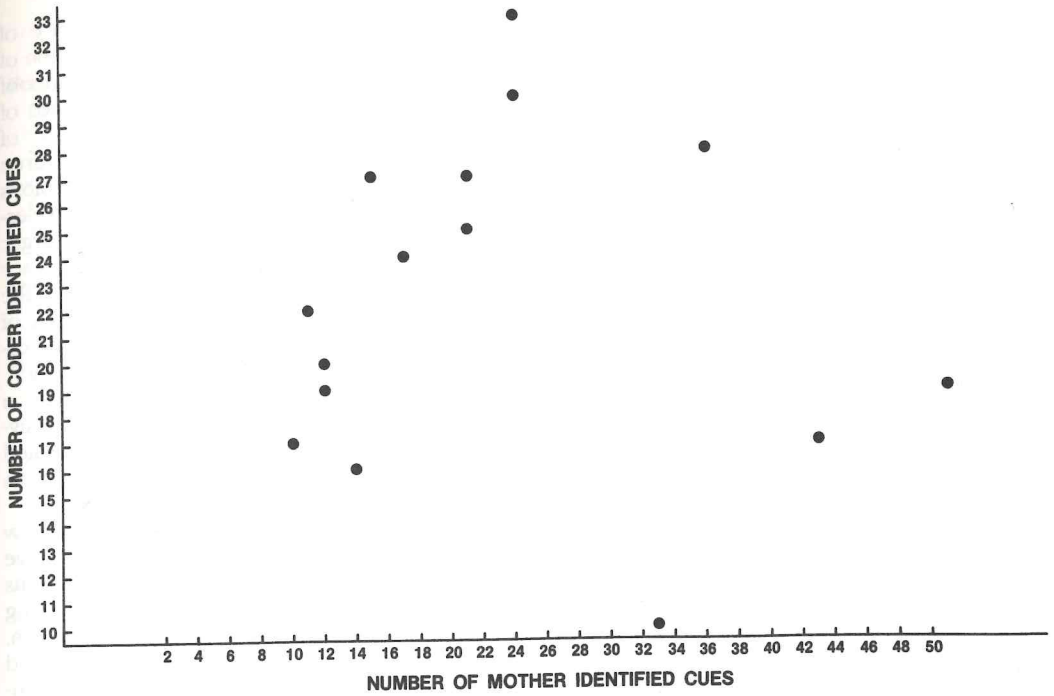

Figure 1. Relation between the number of maternal attributes to own infant and coder-identified cues.

A separate correlation for the small subgroup indicated that, as expected, there was a strong positive relation between mothers' tendency to attribute communication and the amount of deviation of the number of mother attributions from the number of coder-identified cues, $r = .92$, $p < .05$, 1-tailed. There was no apparent relation in the larger subgroup.

Discussion

The present study was conducted to test several hypotheses relevant to two alternative models for predicting the number and type of maternal attributions to their own handicapped children. Dunst's (1983) prediction that degree of infant handicap is negatively related to the frequency of mother-identified cues was not supported.

The general pattern of the results supports the explanation that some mothers of severely handicapped infants identified as many cues as did mothers of mildly handicapped infants because they adapted to their infants' handicaps by interpreting behaviors that coders and other mothers did not. Four findings support the notion of adaptation. First, the severely handicapped infants tended to exhibit fewer behaviors that we considered to be communicative. Second, the mothers of these infants tended to have a higher general tendency to attribute communication (to the unknown infant's behavior). Third, this general tendency to attribute was related to the types of infant behavior observed in their own infants' mother-identified cues. Fourth, severity of infant handicap was related to the types of infant behavior that mothers interpreted as communicative.

The results of the post hoc analyses, however, indicated that degree of infant handicap did not always predict which mothers adapted to their infants by interpreting subtle cues. It is possible that the difference in degree of handicap was not significant because of insufficient sample sizes; however, post hoc results most reasonably form the basis for conclusions about the specific sample and for future hypotheses.

Experimental and developmental research is needed to determine whether such adaptation is facilitative or even harmful for future development. Harding's (1984) theory suggests that as long as the adaptive mothers (i.e., those that attributed to cues that we did not) differentially

attribute and respond to increasingly more clear and conventional communicative signals, their high rate of attribution may be facilitative because the resulting differential responsivity to increasingly clear infant behaviors reinforces the child's use of such behaviors to communicate. On the other hand, if the adaptive mothers continue to attribute to very subtle cues even after the infant begins to exhibit more clear cues, then "overinterpretation" of the child's behavior may not provide necessary incentive for the child to increase the clarity and conventionality of his or her communication behaviors.

Although not directly addressed here, the present data call into question the frequently accepted generalization that mothers of handicapped infants are less responsive than are other mothers. Many have assumed that mothers of handicapped infants will respond less frequently because their infants provide fewer opportunities to respond (e.g., Dunst, 1983, for review). Following Harding's (1984) model, maternal attributions of meaning mediate which infant behaviors are considered opportunities for responding. The current data do not suggest that mothers of severely handicapped infants are less likely to attribute meaning. In fact, in another study on this same sample, mothers of such infants responded to a greater proportion of the cues that they called "communicative" than did mothers of mildly handicapped infants (Yoder, 1986). Recent reviews on this topic indicate that, in fact, there are conflicting data on the relation between the degree of handicap and maternal responsivity (see Rosenberg & Robinson, in press; Yoder, 1986). The conflicting results may be due, in part, to across-study differences in the methods of measuring responsivity and in the populations of handicapped children under study and in the methods of measuring responsivity (Yoder, 1986).

Regardless of the effect of the mothers' responsivity on the infant, we may need to direct investigation to the mother. Mothers may need to feel that they are interacting with a competent infant in order to be responsive. Mothers of handicapped infants, therefore, may interpret more subtle infant behaviors than do mothers of nonhandicapped infants in order to maintain and feel good about their interaction with their babies (Feagans, Robinson, & Anderson, in press).

Finally, some readers may reasonably question whether our measures of maternal attributions reflect what mothers do while interacting with their children because our attribution measures were self-reports taken in contrived situations. Although we have no direct evidence of their relevance, some discussion of the relation of these self-report measures to other measures of interactions is presented as indirect evidence of these measures' relevance. The frequency of mother-identified cues from their own children seen in videotapes of the mother–child sessions was positively related to the number of coder-identified cues from the same session in the larger subgroup. Further, the mothers' general tendency to attribute to an unknown child was related to the infants' degree of handicap and to the types of behaviors the mothers identified as communicative in the videotapes of the mother–child session. Finally, using a measure from another study on this sample (Yoder, 1986), the mothers' responsivity to coder-identified cues was positively related to the mothers' general tendency to attribute to an unknown child, $r = .57, p < .05$.

In conclusion, when faced with atypically low levels of objectively defined infant communicative behaviors, these mothers of handicapped infants attributed meaning to subtle cues, thus providing themselves with a basis for responsive interaction. Such information may help prevent clinicians and researchers from prematurely assuming that mothers of such infants necessarily interpret fewer instances of their babies' behavior as communicative.

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