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Clarifying the Relation Between Degree of Infant Handicap and Maternal Responsivity to Infant Communicative Cues: Measurement Issues

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ABSTRACT: Sixteen mother-handicapped infant pairs were used to clarify the relation between maternal responsivity and degree of infant handicap through the use of two novel measures of maternal responsivity. One measure was based on responses to researcher-defined and coder-identified infant cues. The other was based on responses to mother-defined and -identified infant cues. The second measure allowed the investigator to measure responsivity to subtle cues that unfamiliar observers may fail to code. The infants' neuromotor status was used as the measure of degree of infant handicap. Degree of infant handicap was related positively to maternal responsivity to mother-identified cues, but nonsignificantly related to coder-identified cues. Additionally, mothers tended to respond to mother-identified cues more than to researcher-defined cues. Possible differences in the types of cues that the mothers and the coders identified were used to clarify the results. The present study used measures of maternal responsivity that controlled for the number of infant cues, which allowed the author to study the effect of infant handicap on maternal responsivity above that accounted for by the increasing frequency of infant communication that accompanies development.

RÉSUMÉ: Une étude a été conduite sur seize couples formés d'une mère et de son enfant handicapé dans le but de clarifier la relation entre les réactions de la mère et le degré de handicap du nourrisson; deux façons nouvelles d'évaluer les réactions de la mère ont été utilisées. Une de ces façons était basée sur les réactions aux signaux déterminés par les chercheurs, et aux signaux identifiés par le codeur. L'autre façon était basée sur les réactions aux signaux déterminés et identifiés par la mère. Cette deuxième méthode a permis aux chercheurs de mesurer les réactions à des signaux subtils que les observateurs peu familiarisés

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avec ces signaux auraient manqué de décoder. Le statut neuromoteur des nourrissons a été utilisé pour mesurer le degré d'handicap de l'enfant. Ce degré d'handicap était sans aucun doute lié à la réaction maternelle aux signaux identifiés par la mère mais pas aux signaux identifiés par le décodeur. En plus, les mères avaient tendance à répondre aux signaux identifiés par les mères plus qu'aux signaux déterminés par les chercheurs. Les différences possibles existant entre les genres de signaux identifiés par les mères et les décodeurs ont été utilisées pour expliquer les résultats. Cette étude a utilisé les mesures de réaction maternelle qui contrôlaient le nombre des signaux des enfants. Ceci a permis aux auteurs d'étudier les effets de l'handicap de l'enfant sur les réactions de la mère en plus de ceux que l'on peut expliquer par l'augmentation de la fréquence de communication de l'enfant qui accompagne le développement.

RESUMEN: Se usaron dieciseis pares de madres de niños anormales para clarificar la relación entre el interés maternal y el grado de anormalidad infantil, a través del uso de dos tipos de medidas nuevas de la respuesta maternal. Una medida estaba basada en respuestas a estímulos infantiles de dos clases: definidas por el investigador e identificadas por el código. La otra estaba basada en respuestas a estímulos infantiles definidas e identificadas por la madre. Esta segunda medida permitió al investigador medir la respuesta a estímulos sutiles que un observador no familiarizado con ellos podría pasar por alto inadvertidamente. El estado neuromotor de los niños fue usado para medir el grado de incapacitación del niño. Éste apareció positivamente relacionado con la respuesta maternal a los estímulos identificados por la madre pero no apareció significativamente relacionado con los estímulos identificados por el código. Además, las madres tendieron a responder más a los estímulos identificados por ellas que a los estímulos definidos por el investigador. Se usaron las posibles diferencias entre los tipos de estímulos que las madres y los códigos identificaron para explicar los resultados. El presente estudio usó las medidas de respuesta maternal que controlaron el número de estímulos infantiles. Esto permitió al autor estudiar el efecto de la incapacitación infantil en la respuesta maternal arriba mencionada, que justifica la creciente frecuencia de comunicación infantil que acompaña al desarrollo.

Maternal responsivity in mother-child interaction has been shown to increase the amount of mutual engagement between mother and child (Field, 1977) and may facilitate various aspects of sensory-motor development, e.g., cause-effect relations and conventional communication behaviors (Harding, 1984). Dunst's (1983) modification of Goldberg's (1977) model predicts that mothers of severely handicapped infants are less responsive than other mothers. However, the empirical literature on the relation between degree of handicap and maternal responsiveness is difficult to interpret because of discrepant procedures across studies. The purpose of the present study is two-fold: First, I will discuss four of the measurement issues involved in measuring maternal responsiveness to handicapped infants' cues. Second, I will use the resulting measurement recommendations to clarify the extent to which degree of infant handicap is related to maternal responsiveness to infant cues.

The literature on maternal responsiveness to handicapped children initially may seem confusing partly because samples under study differ with respect to the type of handicap that is represented. For example, there is consensus that mothers of infants who are hyperactive or have difficult temperaments are relatively less responsive (Campbell, 1979; Cunningham & Barkley, 1979; Donovan & Leavitt, 1985; Mash & Johnston, 1982; Milliones, 1978). In contrast, there are conflicting findings with regard to the relative maternal responsivity to infants of varying disorders not necessarily associated with a high incidence of hyperactivity and difficult temperament (i.e., handicapped samples with unspecified temperaments). In the latter group of studies, there are researchers who have interpreted their results as evidence of a negative relation (Brooks-Gunn & Lewis, 1984; Crawley & Spiker, 1983; Wasserman, Allen, & Soloman, 1985), a positive relation (Cunningham, Reuler, Blackwell, & Deck, 1981; Vietze, Abernathy, Ashe, & Faulstich, 1978; Wasserman et al., 1985) and no

relation between presence or degree of handicap and maternal responsiveness (Buckhalt, Rutherford, & Goldberg, 1978; Cunningham et al., 1981; Cunningham, Siegel, van der Spuy, Clark, & Bow, 1985; Vietze et al., 1978).

These discrepant findings in samples of handicapped populations with unspecified temperaments may be due to important differences in the way that the researchers have measured maternal responsiveness. First, studies differ on whether the number of infant cues is controlled when one is deriving the score for maternal responsiveness. Second, differences occur over the method for determining the occurrence of an infant cue.

When the number of infant cues is not controlled in the measure of maternal responsiveness, three competing explanations for individual differences exist. First, a mother may have a high responsivity score solely because her infant presented her with more opportunities to respond, i.e., more cues. Second, a mother may have a high score because, when a cue does occur, she responds to the cues more frequently than do other mothers. Third, a high scoring mother may be influenced by some combination of these two circumstances.

Therefore, when the researcher's intent is to measure differences in whether the mothers respond to their infants, responsivity is indexed best by using a score that controls for the number of infant cues. For example, one can derive a score in which the number of mother responses is the numerator and the number of infant cues is the denominator. This method allows the researcher to measure individual differences in maternal responsiveness when a cue does occur.

Results differ greatly depending on whether the number of infant cues is controlled when one is measuring maternal responsiveness. Those studies that use proportion scores to control the number of infant cues when maternal responsiveness is quantified have found that mothers of handicapped children are approximately as responsive as (Cunningham et al., 1981 at PPVTs < 28 months; Cunningham et al., 1985) or more responsive (Cunningham et al., 1981 at PPVTs > 28 months) than mothers of normally developing peers. In contrast, those studies that rate or count the number of maternal responses without controlling the number of infant cues conclude that maternal responsiveness appears to increase with chronological and mental age (Brooks-Gunn & Lewis, 1984; Crawley & Spiker, 1983; Wasserman et al., 1985). (Cf. Buckhalt, Rutherford, & Goldberg, 1978.) This latter interpretation of the data may be inaccurate because the number and clarity of infant cues increases with developmental level (Yoder, 1986a, 1986b). Therefore, mothers of handicapped children may have responded less frequently simply because they had fewer opportunities to respond.

Differences that concern ways in which the occurrence of an infant cue is measured also may account for the discrepancies in the literature on handicapped samples with unspecified temperaments. One such difference is the use of a few discrete behavior classes that most researchers agree are communicative vs. the use of a coding system that allows many forms of infant behavior to be considered communicative.

When one is studying a sample of developmentally varied infants, the latter method is preferable for two reasons. First, no one form of infant behavior accurately represents the total number of cues that mothers or any one researcher considers communicative. Second, the exact form of an infant behavior that mothers call communicative varies with developmental level (Harding, 1984; Yoder, 1986c). For ex-

ample, Yoder (1986c) found that as severity of handicap increased, the proportion of communicative infant cues that showed attention to mother increased and the proportion that showed attention to toys only decreased. Yoder's finding suggests that the use of only a few discrete classes of infant behavior, such as smiles, gazes to mother, and gestures, may represent inaccurately the number of opportunities that mothers of handicapped infants have to respond (e.g., Brooks-Gunn & Lewis, 1984; Buckhalt et al., 1978; Vietze et al., 1978).

With the importance of ecologically valid measures of handicapped infant communication in mind, Yoder (1986a) suggested the use of both trained observers and mothers to judge the occurrence of a handicapped infant's cues. Mothers may identify idiosyncratic cues that a coder who is unfamiliar with the child does not recognize as communicative (Yoder & Feagans, 1986). This is particularly important in the present study because severely handicapped infants may have a greater proportion of subtle cues than do other infants (Yoder, 1986b). The more common use of the coder's judgment is maintained to allow comparison with the mothers' judgment as well as comparison among children and studies. No published study exists that has investigated the mother's responses to both mother-identified and coder-identified cues.

The present study used the above measurement recommendations to examine the extent to which the degree of infant handicap was related to level of maternal responsiveness to infant cues. First, the number of infant cues was controlled when the score for maternal responsiveness was derived. Second, the measurement method used to judge the occurrence of an infant cue and maternal response allowed many forms of infant and maternal behaviors to be scored. Third, the judgments of both trained observers and mothers were used to identify the occurrence and number of infant cues. In addition, within-handicapped group analyses were used to test the predicted relation to acknowledge and explore individual differences within the handicapped sample (Crawley & Spiker, 1983; Yoder & Feagans, 1986). Specific research questions were as follows: (a) To what extent is the degree of infant handicap related to the proportion of mother-identified infant cues to which mothers respond? (b) To what extent is the degree of infant handicap related to the proportion of researcher-defined infant cues to which mothers respond?

METHOD

Subjects

Sixteen mother-handicapped infant pairs volunteered to participate in the study. Subjects were recruited through educational service delivery agencies in the vicinity of Chapel Hill, NC.

The selection criteria for inclusion into the study were (a) infant chronological age of approximately 11 months; (b) significant delay in one or more areas of infant development; and (c) infant hearing and vision within normal limits. Primary infant diagnoses were (a) severe physical and mental handicap ($N = 5$); (b) Down syndrome ($N = 4$); (c) primary physical handicap, but near average cognitive functioning ($N = 3$); (d) mild overall delay ($N = 3$); and (e) developmentally at risk ($N = 1$). The severity of represented cognitive ($M = 65.5$, $SD = 28.93$) and motor ($M = 32.6$, $SD = 15.87$) handicaps also varied.

The sample was composed principally of Caucasian (93.75%) infants who averaged 11.6 months old ($SD = .78$); most were first or second born (50% and 37.5%, respectively). As is reflected in the handicapped population, there were more males ($N = 10$) than females ($N = 6$). No sex effects were found on any variable of interest. The mothers were on the average 31.6 years old ($SD = 5.01$) and had only one or two children who were living at home (50% and 37.5%, respectively). Table 1 indicates that all but one family were considered middle class according to their income level and maternal education. The exception represents the lower SES level.

Table 1
Description of Sample

| Variables | |
|------------------------------------|-------------|
| Infant chronological age in months | |
| <i>M</i> | 11.6 |
| <i>SD</i> | .78 |
| Infant race | |
| Caucasian | 15 (93.75%) |
| Black | 1 (6.25%) |
| Other | 0 |
| Infant birth order | |
| 1st | 8 (50.0%) |
| 2nd | 6 (37.5%) |
| 3rd | 0 |
| 4th | 2 (12.5%) |
| Maternal age in years | |
| <i>M</i> | 31.6 |
| <i>SD</i> | 5.0 |
| Number of children at home | |
| 1 | 8 (50.0%) |
| 2 | 5 (37.5%) |
| 3 | 0 |
| 4 | 2 (12.5%) |

Procedure

Assessment of degree of infant handicap. While the mother completed other procedures, a trained examiner assessed the infant's neuromotor status with the Movement Assessment of Infants (MAI; Chandler, Andrews, & Swanson, 1980). The MAI assesses four aspects of the infant movement status: (a) muscle tone; (b) autonomic reactions; (c) primitive reflexes; and (d) volitional movement. Composite subscale scores were the sum of the ratings on the quality of elicited infant behaviors relevant to each of the four subscales. A total risk score was derived from the sum of these subscale scores. Higher scores indicate more risk or indication of a motor handicap. The MAI was selected as the index of degree of infant handicap for the following reasons. (a) The MAI measures skills that directly affect the clarity and frequency of communicative signals, e.g., muscle tone (Gallagher, Jens, & O'Donnell, 1983). (b) Unlike the Bayley MDI (Bayley, 1969), the MAI allows continuous measurement

of the entire range of neuromotor status represented in the present sample. Although the MAI directly indexes neuromotor status, cognition (as measured by Bayley MDI) and neuromotor status covaried strongly in this sample ($r = -.80, p < .001$).

Free-play session. Each mother-infant pair engaged in a 20-minute free-play session at the Frank Porter Graham Research Center in Chapel Hill, NC. The setting for the session was a carpeted area of the lab that had two large pillows, a mat, several developmentally appropriate toys, a small table and chair, a changing table, and a few magazines. The mothers were instructed to play with their children just as they would if they were at home. Sessions were videotaped for subsequent viewing.

Mother-identified infant cues. Immediately after the free-play session, the mother was instructed to push a button on a data collection device to indicate when her child communicated during the first 10 minutes of the videotaped free-play. Mothers coded the videotape for infant cues while the tape was running continuously to prevent their coding a cue after seeing their response. The data collection device (the OS-3 by Observation Systems, Inc.) recorded time of occurrence and frequency of these events. The number of times that the mother pushed the button to indicate that the baby had begun to communicate was the measure of the frequency of mother-identified cues: The denominator of one of the measures of maternal responsivity.

It should be noted that mothers were not given any instruction as to our definition of communication or what unit of analysis to use to segment the session. This was left up to the mothers because we were interested in units of behavior and definitions of communication that were meaningful to the mothers.

Data Collection

Mothers' response to mother-identified infant cues. An observer used a two-step process to code whether the mother responded to the infant behaviors that occurred during the segment of videotape that mothers had identified previously as containing a communicative infant behavior cluster. First, the coder located the communicative infant behavior cluster by the time of occurrence of the mother-identified cue. More detail on criteria for segmenting the mother-identified communication behavior cluster is available in Yoder (1986c). Second, the coders judged whether the mother responded to any of the infant behaviors in the behavior cluster. A mother behavior was considered a "response" when it (a) followed a mother-identified infant cue and (b) imitated, complied with, or acknowledged the infant cue. The score that indexed maternal responsivity to mother-identified cues was the number of mother responses/the number of mother-identified cues.

Mothers' response to researcher-defined infant cues. Two observers coded videotapes of the first 10 minutes of each free-play session for two target behavior classes: (a) the occurrence of a researcher-defined communicative infant behavior and (b) the presence or absence of a maternal response to each infant cue. Disagreements were reconciled by a third coder.

The author defined an infant cue conceptually as any infant behavior that (a) resembles conventional communicative signals (e.g., nonfuss vocalizations or gestures);

(b) allows a coder to identify the object of the infant's interest or disinterest; and/or (c) indicates a sudden change in emotional state. These cues could occur at the beginning of, between, and during play episodes. A play episode was defined as joint attention to each other or an object for 3 seconds or more. (See Table 2 for operational definitions and examples of researcher-defined cues.)

Table 2
Types and Examples of Researcher-defined Cues

| Type of cues | Examples |
|--|--|
| Unintentional clues | |
| Sustained shift of attention to new toy | 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 | Baby was mouthing stack rings, but now stops and starts shaking the stacking pole for at least 3 seconds |
| Sudden shift in emotional state | Baby suddenly begins to cry |
| Strained or frustrated directed action | Baby maintains a strained reach for a toy that is out of reach |
| Nonfuss or noncry vocalization | Baby says "ah" while separating connecting beads |
| Intentional cues | |
| Conventional gesture | Baby points to object |
| Word approximation | Baby says "baba" while playing with doll |
| Coordinated attention to object and mother | Baby gives object to mother Baby looks from object to mother while vocalizing |

Due to low occurrence of intentional cues in this sample, researcher-defined infant cues included, but did not distinguish between, intentional and unintentional cues. Only 3 of the 16 infants exhibited an instance of an intentional cue. These 3 subjects gave no more than two instances each of intentional communication during the coded portion of the free-play.

The mother was judged to have responded to an infant cue when she imitated, complied with, or acknowledged the identified infant cue. For example, when the child initiates play with the blocks and vocalizes, the mother may respond by imitating the vocalization, join the child in playing with the blocks, or comment that the child is interested in the blocks. The score that indexed maternal responsivity to researcher-defined cues was the number of mother responses/the number of researcher-defined cues.

Reliability

Interobserver reliability estimates on the above variables were estimated by use of intra-class correlations or G-coefficients (Berk, 1979; Cronbach, Glesser, Nanda, & Rajaratnam, 1972). G-coefficients are based on the analysis of sources of variance (ANOVA) of a sample of scores. Such an approach allows for the partitioning of variance in scores to several different sources, e.g., different observers, and subjects.

One advantage of G-coefficients is that they control for chance agreement due to limited variability of scores or underestimated agreement due to extreme variability of scores (Berk, 1979).

G-study interobserver reliability estimates for the present study were as follows: (a) The proportion of researcher-defined cues to which mother responded had an estimated reliability of .85 ($N = 16$). (b) The proportion of mother-identified cues to which mother responded had an estimated reliability of .65 ($N = 8$). (c) The MAI had an estimated interobserver reliability of .98 ($N = 10$) (Kasari, 1985). Harris and Swanson (1984) estimated the test-retest reliability for the MAI scale to be .72.

Although the two measures of the number of infant cues were not variables in any of the analyses, they were the denominators for the two measures of maternal responsiveness to infant cues. Therefore, their estimated reliability is of interest. The interobserver G-coefficient for the number of researcher-defined cues was .78 ($N = 16$). Test-retest agreement among pilot mothers on the number of mother-identified cues averaged .81 (range = .67 to .93).

RESULTS

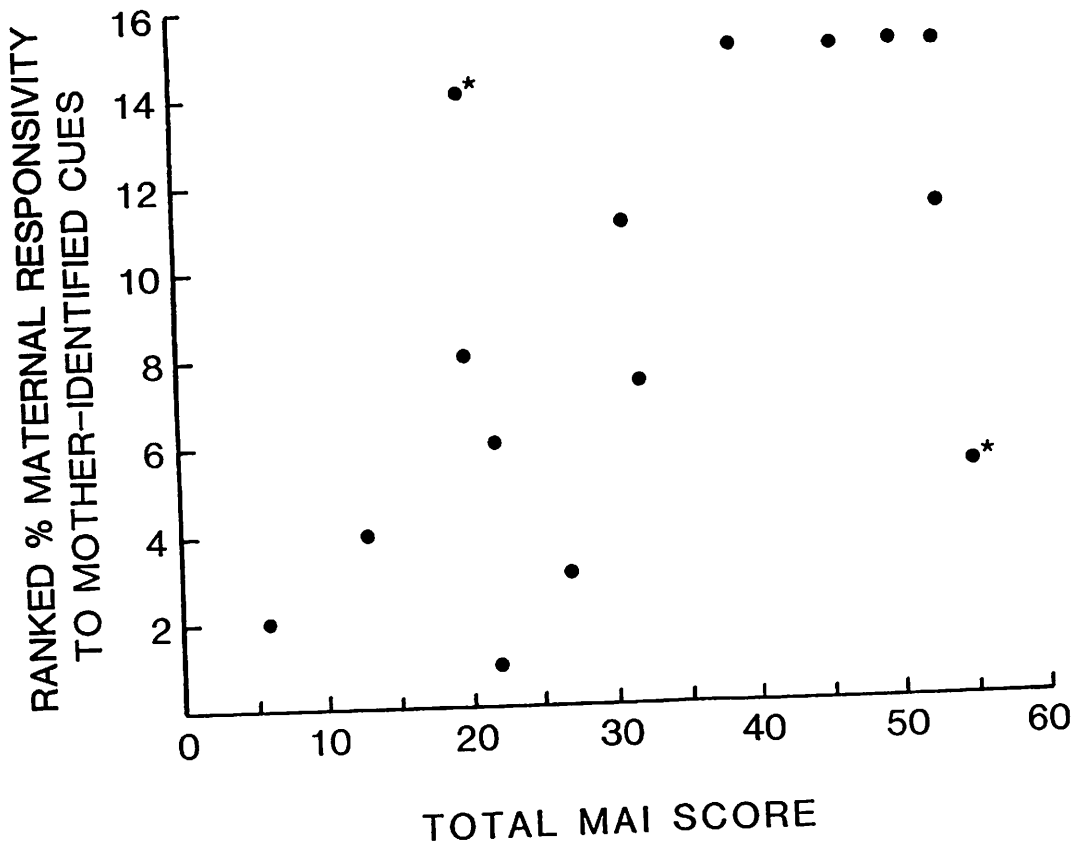
The hypotheses were tested by use of two simple regression analyses. Due to infant fatigue, we were unable to administer the MAI (our measure of degree of infant handicap) to one moderately handicapped child. Therefore, unless otherwise stated the following analyses were carried out on 15 mother-infant pairs.

As previously mentioned, the score that indexed maternal responsiveness to mother-identified cues was the number of mother responses/the number of mother-identified cues. Therefore, any subject with fewer than five mother-identified cues was dropped from the sample ($N = 1$) to avoid misleading proportions. The rank transformation (via SAS, 1982 PROC RANK program) of the proportions was used as the criterion measure because the original scale resulted in a non-normal distribution and, thus, violated an assumption of regression analyses.

The result of this analysis indicated that mothers of severely handicapped infants tended to respond more frequently to infant behaviors that they called communicative than did mothers of less handicapped infants. In statistical terms, there was a positive linear relation between the MAI risk scores and the ranked percentage of mother-identified cues to which mothers responded ($r = .57, p < .05$). Figure 1 illustrates this relation and shows that 4 mothers (i.e. those who scored 15) responded to all of the infant cues that they had identified. The existence of the two noted outliers in this figure will be discussed later.

Normal distribution of scores and sufficient occurrence of researcher-defined cues allowed the original sample and scale of dependent scores to be used for the following analysis. The results indicated that mothers of severely handicapped babies responded to about the same proportion of researcher-defined infant cues as did mothers of more mildly handicapped babies. That is, there was a nonsignificant positive linear relation between MAI risk score and the proportion of researcher-defined cues to which mothers responded ($r = .43, p > .10$).

Given these results, it is a reasonable hypothesis that the types of cues that mothers identified elicited a response more frequently than did those identified by coders. In



*Outliers (standardized residuals $> \pm 1.50$)

FIG. 1. Relation between MAI and the ranked percentage of mother-identified cues to which the mother responded.

support of this explanation, there was greater responsivity to mother-identified cues (median = 94.0; $SD = 12.40$) than to researcher-defined cues (median = 80.0; $SD = 17.46$; matched Wilcoxon $T(15) = 1, p < .001$). This difference existed despite the fact that no difference was found between the number of mother-identified and researcher-defined cues ($M = 21.6, SD = 13.19$; $M = 22.3, SD = 6.18$, respectively; matched $t = .019, p > .05$).

DISCUSSION

This study was conducted to clarify the relation of degree of infant handicap and the extent to which mothers respond to their infants' cues. The appropriate population to which the results reasonably may be generalized is middle-class, Caucasian, American mothers and their sensorily intact, but motorically and cognitively handicapped pre-linguistic babies.

The Relation of Degree of Infant Handicap to Maternal Responsiveness

As expected, mothers of severely handicapped infants tended to respond to cues that they identified as communicative more than did mothers of less handicapped

infants. One possible explanation of this correlation is that the proportion of responsiveness to severely handicapped infants' cues was higher simply because the denominator of these proportions was smaller. That is, because the measures of maternal responsiveness were proportions in which one of the two measures of the number of infant cues acted as the denominator, it is reasonable to test whether mothers of severely handicapped children identified fewer cues than did mothers of less handicapped children. The results of Yoder and Feagans' (1986) study on this same sample indicate that this was not the case. Degree of infant handicap was not related to the number of mother-identified cues ($r = .17$).

Another explanation for this significant relation may be that the cues that mothers of severely handicapped infants identified are types that generally elicit more frequent responses than the types of cues identified by mothers of less handicapped infants. With this sample, Yoder (1986c) found that mothers of severely handicapped infants identified cues that were observed to contain proportionately more instances of attention to mother and vocalization and less attention to toy than was observed in the cues of less handicapped infants. Vocalizations that co-occur with attention to mother are component behaviors of the vocal turn-taking games described in the interactions of mothers with their very young infants (Kaye, 1982). This type of interaction may require mothers to take their turn for the interaction to continue. In contrast, interactions with toys may not require mothers to respond as frequently.

Differences in the type of cue identified also may account for why degree of infant handicap was related to maternal responsiveness to mother-identified cues, but not related to maternal responsiveness to researcher-defined cues. This explanation implies two assumptions. First, it is assumed that when mothers viewed the severely handicapped infants' behavior, they may have identified more subtle cues than did coders. Second, it is assumed that the subtle mother-identified cues elicited more responsivity than did the more conventional coder-identified cues.

Our other research on this sample supports the notion that the mothers identified a greater proportion of subtle cues than did coders. To achieve reliable scores, the researcher-defined cues were necessarily more conventional and clearly defined infant cues. Thus, it is understandable that the coders identified fewer researcher-defined cues (Yoder, 1986a) and had more difficulty agreeing on the occurrence of cues (Yoder, 1986b) in severely handicapped infants than in mildly handicapped infants. In contrast, one-fourth of the handicapped sample compensated for the subtlety of their infants' cues by identifying more cues than did the coders (Yoder & Feagans, 1986).

There is also evidence that many of the cues that mothers identified and that coders missed may have been the type that elicit more maternal responsiveness. As mentioned in the Results section, the mothers did respond to a greater proportion of mother-identified cues than to researcher-defined cues. This difference occurred despite the fact that no difference occurred in the number of researcher-defined vs. mother-identified cues.

Although temperament was not measured directly in the present sample, the present results concur with others that (a) measured maternal responsivity while they controlled for the number of cues and (b) studied handicapped samples of unspecified temperaments. The literature indicates no group differences or higher levels of maternal responsivity in mothers of handicapped when compared with mothers of normally

developing MA peers (Cunningham et al., 1981, 1985). This conflicts with Dunst's (1983) prediction that mothers of handicapped children are less responsive than other mothers.

The Measurement of Maternal Responsivity

The discrepancy between the present results and Dunst's prediction may be due to two differences in the way that maternal responsiveness was measured in the present and many previous studies. These measurement differences are not trivial. They point to the need to refine our theory of how degree of handicap may affect maternal responsivity.

First, it is important to specify whose judgment is used to identify the occurrence of an infant cue. The use of both the mothers' and the coder's judgment allows the investigator to examine the influence of both subjective and objective definitions of "infant cue." The present results suggest that when the sample under study includes severely handicapped infants, mothers may identify cues that otherwise would go uncoded. Additionally, these idiosyncratic and subtle cues that mothers identify may elicit mother responses more frequently than do coder-identified cues.

However, it is necessary to maintain a measure of researcher-defined cues so that the investigator can compare the results under both subjective and objective definitions of "infant cue." For example, Yoder (1986a) found that degree of handicap was related to the number of researcher-defined cues ($r = -.51, p < .05$), but was not related significantly to the number of mother-identified cues.

Second, it is important to specify exactly what we mean by maternal responsiveness. When we use a frequency count of the number of responses mothers exhibit during a free-play session as the measure of maternal responsiveness, we really are measuring a product of both child and mother influences. That is, individual differences in scores may be due to two sources: (a) differences in the number of infant cues to which mothers could respond; and/or (b) differences in whether the mothers respond to a cue when it does occur. By quantifying levels of maternal responsiveness while controlling for the immediate influence of the number of infant cues, differences among mothers' responsivity to cues once communication has occurred can be studied.

It is widely accepted that both infants and mothers influence social interaction (Bell & Harper, 1977). However, the time has come to specify more precisely the contribution of each actor. To specify the actor and mechanism of primary influence, it is useful to measure aspects of the interaction in ways that control for the immediate influence of the nontarget actor. The present study examined differences in maternal responsivity, while it controlled for differences in the frequency of infant communication. Such a practice allowed greater specification of how degree of infant handicap influenced individual differences in maternal responsivity.

Strength and Weakness of the Present Design

Regardless of the explanation for the results, of concern in any group design is the possibility that the summary statistic (e.g., a correlation coefficient) does not indicate the extent to which the predictor (degree of infant handicap) failed to predict

accurately the criterion variable (maternal responsiveness to mother-identified cues). Figure 1 indicates that 2 subjects were outliers (the standardized difference scores between their actual and predicted scores were -1.89 and 2.02 , respectively).

These outliers illustrate the weakness and the strength behind all nonmanipulative correlational designs. The weakness is that, despite the statistical significance of the relation, only 32% of the variance in the scores that indexed maternal responsiveness to mother-identified cues was related to the degree of infant handicap. Clearly, there are additional unmeasured variables that also account for the degree to which mothers respond to infant cues, e.g. SES level, type and intensity of parent intervention, clarity of infant cue, and meaning of infant cue. The strength of this design is that by not controlling these other factors, one can assess the extent to which degree of infant handicap predicts maternal responsiveness in an uncontrolled interaction.

SUMMARY

In summary, the results of the present study helped to clarify the relation of degree of infant handicap to maternal responsiveness by (a) controlling for the number of infant cues when deriving the scores for maternal responsiveness and (b) including both mother and coder judgements of the occurrence of an infant cue when quantifying maternal responsiveness. As was found with other studies that controlled for the number of infant cues in handicapped samples that did not specify infant temperament, degree of infant handicap did not significantly predict individual differences in maternal responsiveness to researcher-defined cues. However, mothers of severely handicapped infants tended to respond to mother-identified cues more frequently than did mothers of less handicapped infants. It was speculated that mothers of severely handicapped infants may adapt to the subtlety of their infants' cues by identifying cues that coders miss. Additionally, it was found that these mother-identified cues elicited more responsiveness than did the types of cues identified by coders. Finally, it was noted that degree of infant handicap is but one of the variables that account for individual differences in maternal responsiveness. Future research is needed to identify other influences.

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