Important Distinctions in Measuring Maternal Responses to Communication in Prelinguistic Children with Disabilities

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Two research hypotheses were tested in the research reported here: The first was that nonlinguistic maternal responses to intentional child communication, but not to preintentional communication, will predict later intentional communication but not later language development. The second hypothesis was that linguistic mapping of intentional communication, but not of preintentional communication, will predict later language development but not later intentional communication. Study participants were 58 children with disabilities or developmental delays and their primary caretakers. Receptive language, prelinguistic communication, and maternal responses were measured at Time 1 (entry into study) and Time 2 (6 months later). Vocabulary level was measured at Time 2. Expressive and receptive language were measured at Time 3 (12 months after entry into study). After controlling for initial measures of child communication or language, number of maternal nonlinguistic responses to intentional communication were positively related to Time 2 rate of intentional communication and to Time 3 expressive and receptive language scores. After controlling for initial child language, number of linguistic mapping responses to intentional communication was positively related to Time 3 expressive and receptive language scores. The results of this study showed no relationship between responsiveness to preintentional communication and later language or communication, thus emphasizing the importance of responding differentially to preintentional and intentional communications.

Professionals have been teaching parents and teachers to be responsive to children's communication for years. Indeed, the professional literature targets adult responsiveness to child communication as one of the most important characteristics for facilitating optimal language development (Cook, Tessier, Klein, & Armbruster, 2000). Interventions have been developed that specifically teach adults to be responsive to young children's communication (MacDonald, 1989; Warren & Yoder, 1998; Wilcox, 1992; Wilcox, Shannon, & Bacon, 1992; Yoder, Kaiser, & Alpert, 1991). Many of these interventions

have been effective in facilitating various aspects of child communication or language development (see Yoder, Warren, McCathren, & Leew, 1998, for review).

The present study targeted adult response types that are appropriate for children in the prelinguistic stage of development. The prelinguistic communication period of development begins at birth and gradually fades as children begin to use words as their primary means of communicating thoughts, feelings, and needs. This period is divided into preintentional and intentional communication stages. The preintentional communication stage is characterized by behaviors that are presumed to have no intended outcome or are not directed toward a partner. The preintentional communicator's behavior is communicative only because another person assigns it communicative meaning. At about 8 to 9 months of age, infants begin to act in ways that are clearly intended to have an effect on the listener (Bates, 1979; McLean, 1990). Infants coordinate eye gaze, vocalizations, and gestures to communicate with a partner. For many children with special needs, this critical transition from preintentional to intentional communication is delayed or does not occur at all, inhibiting the development of symbolic communication. Although communication delays often are not identified until children are 24 to 30 months old and not talking, the roots of the communication delay or disability may have begun during the prelinguistic stage of development (Mundy, Kasari, Sigman, & Ruskin, 1995). Interventions that target prelinguistic communication skills may help many children with special needs become effective intentional communicators, thus laying the foundation for the development of language.

Among the many techniques parents and teachers of prelinguistic children use to facilitate communication and language development, responding to children's communication is among the most important (Cook et al., 2000). There are two types of adult responses—*nonlinguistic* and *linguistic* (Warren & Yoder, 1998). Nonlinguistic responses include imitating physical actions and vocalizations and complying with child requests for objects or actions. Linguistic responsivity includes any verbal response to a child's communication behavior. The type of verbal response examined in this study—adult linguistic mapping—is putting into words what the child is communicating.

Although published studies have demonstrated the effectiveness of several interventions that include responsiveness as a component, a number of questions have yet to be addressed. First, little is known about which kinds of responsive behavior are associated with specific aspects of child communication development. For example, there may be different effects related to adults' use of linguistic versus nonlinguistic responsive acts. Second, it is unclear whether responding differentially to children's newly emerging skills may be more facilitative of development than responding to all child communicative behaviors. Answers to these questions may result in the development of more efficient early interventions. Additionally, this information may help develop more specific models of how adult–child interactions affect the child's communication and language development.

ADULT RESPONSIVE BEHAVIORS

It has been argued that nonlinguistic responsivity to a child's prelinguistic communication acts should have different effects on development than linguistic responsivity because the two types of responses provide the child with different types of information about the environment (Yoder et al., 1998). Nonlinguistic responsivity may enhance later communication development because it may facilitate some of the cognitive underpinnings of intentional communication. In particular, it may help the child develop means–end understanding, or the understanding that certain behaviors (e.g., making requests) are necessary to achieve certain goals (e.g., obtaining desired objects). A randomized group experiment demonstrated that teaching mothers to use nonlinguistic responses facilitated infants' generalized contingency learning (a type of means–end task; Riksen-Walraven, 1978). Means–end understanding has been found to be associated with intentional communication in typically developing infants (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979). However, the effect of nonlinguistic responsivity on intentional communication is unclear. Although nonlinguistic responsivity has been found to affect contingency learning and means–end understanding, no study has found a specific relationship between nonlinguistic responsivity and later intentional communication. It is possible that nonlinguistic responsivity may fail to directly facilitate language development because linguistic information is not necessarily provided to the child in this type of response.

Linguistic responsivity to child communication is thought to be important to communication development and is included as a target in all responsiveness training. One type of linguistic response to the child's prelinguistic communication that may be particularly likely to facilitate language development is linguistic mapping (Yoder et al., 1998). Linguistic mapping occurs when the adult says an utterance that contains the noun, verb, or function word implied in the child's previous nonverbal message. Linguistic mapping may enhance language acquisition in prelinguistic children because they may be better able to learn the associations between the words and the referent when they hear the words that label their intended message (Bloom, 1993). However, linguistic mapping may not facilitate intentional nonverbal communication because this type of response does not necessarily provide the effect the child wanted. That is, a child who is pointing to a cup may be interested in getting the cup, not the label for it. Therefore, because the exchange doesn't fulfill the child's intent, the child may not increase future attempts to request a cup. The use of linguistic mapping has been found to be concurrently associated with larger vocabularies in typically developing children (Masur, 1981). However, no such relationship has been reported in any longitudi-

nal correlational study or in any studies with children with disabilities.

CHILD COMMUNICATION BEHAVIORS

More theoretical consideration has been given to the types of responses mothers use than to the types of prelinguistic communication acts to which mothers respond. However, the type of acts to which mothers respond may be very important. Bruner (1975) and Harding (1983) pointed out that as children develop, many mothers require the clearest level of communication the child is capable of before complying with the child's communication (i.e., "upping the ante"). Bruner and Harding also posited that differentially complying with infants' most clear communication acts may consequently influence the child to use more clear forms of communication. Linguistically mapping clear communication acts may be particularly likely to facilitate vocabulary acquisition. Clear communication tends to indicate the child's attentional focus better than unclear communication and makes it easier for the adult to accurately identify and label the object or event that is the referent of the child's communication. It may be the match between the child's communicative intent and the adult's linguistic input that aids the referent–word association (Bloom, 1993). One problem in testing whether responding to clear communication facilitates later communication and language development is that there is no universally accepted definition of what constitutes an "unclear" versus a "clear" communicative act.

One way to infer what mothers generally consider a clear act is to determine to which types of acts mothers respond most frequently. Past research has shown that mothers of children with disabilities tend to interpret and respond more to prelinguistic infants' intentional communication acts more than to their preintentional acts (Yoder & Munson, 1975; Yoder, Warren, Kim, & Gazdag, 1994; Yoder & Warren, in press). Intentional communication acts are those that include (a) coordinated attention between an object and an adult or (b) the use of conventional or symbolic forms of communication that are directed toward the listener (Adamson & Bakeman, 1991; Bates et al., 1979; Yoder & Munson, 1995). Preintentional communication acts do not show coordinated attention nor include conventional or symbolic forms of communication. These acts include unconventional gestures and vocalizations that show attention to the adult but do not demonstrate the attributes of intentional communication (Wetherby & Prizant, 1993) and behaviors that do not show attention to the adult but are considered communicative by many prelinguistic communication instruments (e.g., Lombardino, Stapell, & Gerhardt, 1987) and mothers (Harding, 1983; e.g., reach for an out-of-reach object). Many mothers of infants with disabilities attribute communicative value to and respond to preintentional behaviors (Yoder & Feagans, 1988). It is not clear whether such a practice is a positive adaptation to a child's disability or whether it deprives the child of otherwise helpful information.

RESEARCH DESIGN

When the research hypotheses are as specific as those for the present study, a longitudinal correlational design has much to give. A simple longitudinal correlational design measures at least the proposed causal variable (e.g., maternal responses) at the first assessment period (Time 1) and the proposed affected variable (e.g., child intentional communication) at the second assessment period (Time 2). In the context of early intervention for prelinguistic children, correlational designs are more precise than intervention studies in specifying which aspect of the adult's behavior is associated with relatively rapid child development. The longitudinal aspect of the design eliminates a common, but trivial, explanation of the adult response to child development association. For example, assume we find that an early measure of maternal nonlinguistic responses is related to later child intentional communication. Also assume that this relationship becomes nonsignificant when we control for Time 1 intentional communication level. These results would be consonant with the hypothesis that individual differences in intentional communication at Time 1 elicit maternal responses at Time 1 and would also indicate that individual differences in intentional communication tend to be stable from Time 1 to Time 2. This child-driven result could explain the association in a way that would not justify increasing maternal responses through an intervention. In addition, controlling for the initial measure of the outcome construct (e.g., intentional communication) reduces the possibility that the associations are due solely to the possibility that mothers of the most advanced children are able to give more responses to intentional communication because such children use relatively more intentional communication. Therefore, it is important to control for early measures of the outcome variable's construct to eliminate these types of explanations for the predicted longitudinal correlations. This study does so.

HYPOTHESES

Children may communicate using preintentional or intentional communications acts and adults may respond either linguistically or nonlinguistically. No published study has examined the relationships among the type of communication act by the child, the type of response by the adult, and the effect on the child's intentional communication or language development. This study was conducted to examine two research hypotheses:

1. Nonlinguistic maternal responses to intentional child communication, but not to preintentional communication will predict later

intentional communication but not later language development.
2. Linguistic mapping of intentional communication, but not of preintentional communication, will predict later language development but not later intentional communication.

When testing both research hypotheses, early measures of the outcome construct (i.e., intentional communication or language) will be statistically controlled. Predicted relationships are expected to remain significant even after controlling for early measures of the outcome constructs.

METHOD

Participants

The current study was part of a longitudinal treatment study conducted by the first and third authors (Yoder & Warren, 1999a). In the longitudinal study, the 58 children were randomly assigned to receive one of two prelinguistic interventions. In both treatments, mothers were not given detailed information about or allowed to observe the specific interventions used with the children or the variables being measured. Because the results of the present investigation could have been influenced by the different treatments the children experienced in the larger experiment, we tested whether the outcomes of this study were predicted by statistical interactions between group assignment and the study's predictor variables. First, we tested whether the relationship between any of the independent and dependent measures was different between groups (i.e., we tested the interaction between treatment group and predictor variables predicting the criterion variables). Second, we tested to see if there were group differences on adult responsivity measures or child communication measures. The results of these preliminary analyses showed no evidence that the different treatments influenced the relationships we are reporting in the present study. Therefore, the remainder of the analyses and presentation will not refer to the larger study.

The children were recruited through three early intervention programs for children with developmental disabilities. The selection criteria for the study were as follows:

- Bayley Mental Development Index (MDI; Bayley, 1969, 1993) score between 85 and 35 (using the extrapolated norms in Naglieri, 1981, for the 1969 version and those computed using the same procedure for the 1993 version; McCathren & Yoder, 1994);
- children were in the prelinguistic stage of development;
- at least one instance of coordinated attention to person and object, reach to a distant object, or vocalization to an adult;
- hearing within normal limits as indicated by an audiological screening;
- no visual impairment as indicated by school files and parent and teacher report;
- ability to hold an object while rotating the torso (i.e., making coordinated attention while playing with objects possible);
- chronological age between 17 months and 36 months; and
- display of at least five instances of preintentional or intentional communication in a parent–child interaction session at the beginning of the study.

We determined that the children were in the prelinguistic stage of development through teacher report and direct observation of three communication samples. Seven of the 58 children used words during the communication samples. The children used a total of five different words: mama, no, bye-bye, baby, and uh-oh. Two of the children spoke two words, and the other five children each spoke just one word.

The participants were 58 children with disabilities or developmental delays and their primary caregivers (defined as the caregiver who spent the most time with the child). Because 90% of these caregivers were mothers, we will use the term *mothers* for the remainder of the article. Table 1 presents the medians and ranges for various descriptor variables for in the children who participated in the study. Medians and ranges for the variables used to test the research hypotheses can be found in Table 4 in the Results section.

Seventy-one percent of the children were boys. All of the children fit the Tennessee definition for developmental delay (i.e., 40% delay in one domain or 25% delay in two domains). The etiology for the developmental delays varied. Of the 58 children in the study, 4 had Down syndrome, 4 were premature births with medical complications, and 3 were "failure to thrive." Two had pervasive developmental delay, 1 had macroencephaly, and 1 had Duane's syndrome. One had neonatal meningitis, 1 had fetal alcohol syndrome, and 1 had

TABLE 1. Medians and Ranges for Selected Child Descriptor Variables at Time 1

Variable	Median	Range
Chronological age	23 months	17–33 months
Mental age	15 months	9.5–20 months
Mental Development Index[a]	54	35–84
# of different words/signs used in combined sessions[b]	.03	0–2

[a]From Bayley Infant Scales of Mental Development (Bayley, 1969, 1993).
[b]Parent–child and Communication and Symbolic Behavior Scales (Wetherby & Prizant, 1993).

tuberous sclerosis. The remaining children had no identifiable etiology or diagnosis other than developmental delay.

The median occupational status of the sample was 23 (range 10–88). The mean of the sample was 31.23, with a standard deviation of 22.35. The median occupational status of the U.S. population is 34.5 (SD = 8; Stevens & Cho, 1985). Therefore, our sample's occupational status was lower than that in the general population and was more variable. Sixty-seven percent of the families characterized themselves as Caucasian, 33% as African American, and the remaining 8% as "other." The average formal education of the mothers was high school graduate and ranged from a seventh-grade education to postgraduate training.

Design

We used a longitudinal correlational design. Time 1 was the point at which the children entered the study. Time 2 was 6 months after Time 1, and Time 3 was 12 months after Time 1. We measured maternal responses to child communication and receptive vocabulary at Time 1 and Time 2. Intentional communication and expressive language were measured at Time 2. Expressive and receptive language was measured at Time 3. Intentional communication was measured using the Communication and Symbolic Behavior Scales (CSBS; Wetherby & Prizant, 1993), and expressive and receptive language were calculated from the Reynell Developmental Language Scale (Reynell & Gruber, 1990). Both tests were administered by staff members. The mothers did not interact with the children during testing sessions in order to avoid the possible within-session effect of variation in adult responsiveness on child behaviors. See Table 2 for a listing of the variables measured at the three measurement times.

Procedure

Overview. At Time 1, the mothers and children came to our playroom. The mothers filled out a demographic questionnaire—from which we derived our measure of occupational status and formal education—and the receptive scale from the MacArthur Communication Development Inventory Infant Scale (CDI/I; Fenson et al., 1991). Meanwhile, a staff member administered selected parts of the CSBS. Afterwards, the mothers interacted with their children in a parent–child interaction session, which is described below. At Time 2, the parents filled out the CDI/I, the children and mothers participated in a parent–child interaction session, and the children were again administered the CSBS. At Time 3 the children's language was tested using the Reynell scale.

CDI/I. During the Time 1 and Time 2 assessment periods, the mothers filled out the CDI/I, which is a checklist of 386 words broken into 19 categories (e.g., animal names, vehicles, food and drink, people). The mothers were asked to indicate whether their child "understands only" or "understands and says" each word. The number of words "understood only," plus the number of words "understood and says," was used in these analyses to represent receptive vocabulary.

Parent–Child Interaction Session. At Time 1 and Time 2, each mother was asked to play with her child for a total of 15 minutes. During these sessions, the child was seated in a chair that was attached to the table to discourage him or her from getting up during the session. All the sessions were videotaped for later coding of child communication and maternal responses. The mother was seated across the corner of the table so that the child would have to turn his or her head toward the mother to see her. The camera angle maximized the proportion of the session in which we could view the mother, the child, and the child's focus of attention.

Some degree of contrivance and structure was provided for two out of the three 5-minute segments of the interaction session. This was deemed necessary to maximize the frequency and diversity of the children's communication acts, thereby allowing us to discriminate among the different types

TABLE 2. Variables Measured at Times 1, 2, and 3

Time	Measurement tool	Variable
Time 1	CDI/I	Child receptive vocabulary
	CSBS	Child intentional communication, Child nonimitative words
	Interaction session	Maternal responses
Time 2	CDI/I	Child receptive vocabulary
	CSBS	Child intentional communication, Child nonimitative words
	Interaction session	Maternal responses
Time 3	Reynell	Receptive language
		Expressive language

Note. CDI/I = MacArthur Communication Development Inventory, Infant Scale (Fenson et al., 1991); CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 1993); Reynell = Reynell Developmental Language Scale (Reynell & Gruber, 1990).

of maternal responses to the children's acts. Pilot-testing indicated that unstructured parent–child interaction sessions resulted in almost no coded communication acts in some dyads. The contrivance was considered acceptable because we were interested in relative, not absolute, levels of maternal responses. This structure may have also reduced some measurement error due to differences in the way that the individual mothers played with their children.

In the first segment, developmentally appropriate toys were placed in clear containers so the child could see them but could not gain access to them without assistance from the mother. The mother was told to begin playing with a toy she thought the child would like. When the child let the mother know that he or she wanted the toy, the mother was to put it back into the container and give the closed container to the child. When the child requested the toy for a second time, the mother was to open the container and give the toy to the child. If the child lost interest in the toy, the mother was to repeat the procedure with a new toy.

In the second segment, the mother was given juice, cereal, and cookies and told to give small portions to the child when the child indicated that he or she wanted some. While the child was eating the snack, brief animal noises occurred every 1.5 minutes for a total of three times. Also during this second segment a Slinky™, which was suspended by a clear fishing line from the ceiling, was lowered to about 5 feet above the floor. The mother was told to ignore these events until the child drew her attention to either the sound or the Slinky.

The last segment of the interaction session was free play. The toys were placed at the end of the table. The mother chose one toy and gave it to the child when the child indicated that he or she wanted the toy. Once a toy was selected, the mother was instructed to play with the child as if they were at home.

Selected Section of the CSBS. The Communication Temptations and Book Sharing sections of the CSBS were administered to derive estimates of the child's rate of intentional communication and language use. These sections are procedures designed to elicit a variety of child-initiated communicative acts with varying pragmatic functions. Communication Temptations consists of structured communication-eliciting situations; Sharing Books provides a less-structured sampling context. The selected sections of the CSBS were administered by an experienced examiner who was not the child's teacher during the intervention.

Coding

Interaction Session Variables. From the interaction session we coded the number of

- maternal nonlinguistic responses to intentional child communication,
- maternal nonlinguistic responses to child preintentional communication,
- maternal linguistic mapping to intentional child communication, and
- maternal linguistic mapping to preintentional child communication.

It should be noted that the proposed predictors for the present study were the number of, not the proportion of, child acts to which the mothers responded. This metric was selected because it was the amount of responsive input the child experienced that should affect later language development, not just the proportion of acts to which his or her mother responded. Even if a mother responded to 100% of her child's communication, the child would not receive much facilitating input if he or she communicated infrequently. In contrast, if the child communicated frequently, but the mother responded to only a moderate proportion of the child's communication acts, he or she still received a great deal of facilitating input. Frequent communicators with highly responsive mothers would receive the most facilitating input. The definitions for types of communication acts and types of responses are presented in Table 3. Unconventional gestures are those listed in the CSBS manual. Conventional gestures are those that have a meaning that assimilated adults in U.S. society agree upon. These include distal points, head nods and shakes, the "shhh" sign, shrugging the shoulders, upturned and extended palm, and waving.

As indicated in Table 3, one way a child's act could be scored as intentional was by the presence of an approximation of a spoken word or sign. A word approximation had to fulfill four criteria: The sound sequence had to

1. share at least one phoneme in the correct position with the adult form of the word,
2. share the same number of syllables as the adult form of the word,
3. have nonlinguistic support, and
4. be an approximation of a word that was included in an unabridged English dictionary (*The American Heritage Dictionary of English Language*, 1992) or was included on the CDI/I.

A sign approximation had to meet Criteria 3 and 4 from above. In addition, the movement and location of the hands with respect to the rest of the body and to each other had to be similar to the conventional sign. The hand shape (i.e., the way the fingers were positioned) did not have to match the conventional sign.

CSBS Session Variables. We coded the number of child intentional communication acts at Time 1 and Time 2, prorated for differing lengths of testing sessions (i.e., rate of intentional communication acts per minute) from the CSBS. The definition for child intentional communication is provided in Table 3. Child intentional communication at Time 1 was used in analyses designed to identify potential correlates

TABLE 3. Definitions and Examples of Child's Communication Acts and Maternal Responses

Variable	Definitions	Examples
Child's intentional communication	• Unconventional gesture or vocalization with coordinated attention to adult and object or event • Conventional gesture or symbol with attention to adult	• Handing object to adult • Pointing to object and looking at adult • Signing "more" and looking at adult
Child's preintentional communication	• Unconventional gesture or vocalization with attention to adult OR to object (no coordinated attention) • Sustained change in affect	• Reach to object (no attention to adult) • Vocalization to adult • Vocalization to object • Change from neutral facial expression to smile for 3 seconds
Maternal nonlinguistic response	• Complying with the presumed meaning of the immediately prior communicative message by the child • Imitate some component of the immediately prior communication act by the child	• Child reaches for toy that is out of reach. Mother gets toy for child. • Child rolls the ball to mother. Mother rolls the ball back to the child.
Maternal linguistic mapping	• Maternal utterance that includes the main verb, noun, or function word implicit in the immediately preceding child nonverbal act	• Child points to a toy bird. Mother says, "That's the bird." • Child reaches for a cookie. Mother says, "You want a cookie." • Child pushes the spoon away. Mother says, "You're finished eating."

of maternal response variables and later child outcome variables. Time 2 child intentional communication was used as the potential outcome variable in analyses designed to determine (a) whether maternal responses predicted later child intentional communication and (b) whether intentional communication mediated the relationship between Time 1 maternal nonlinguistic responsivity and Time 3 child language.

In addition, at Time 2 the number of different nonimitative words was counted. This variable was used as a possible covariate of the relationship between Time 2 linguistic mapping and Time 3 child language.

Reynell Scale

At Time 3 all children were administered the receptive and expressive scales of the U.S. version of the Reynell. The raw scores were used to quantify children's language level. The split-half consistency of the British version of these scales is in the .80 to .90 range (Allen, 1985). (The U.S. and British versions of the Reynell are very similar).

Reliability

Reliability for all coded variables was calculated using generalizability (G) coefficients. One advantage of G coefficients is that they take into account between-subject variability, thereby reflecting the seriousness of varying degrees of error due to differences among observers (Cronbach, Gleser, Norda, & Rajaratnam, 1972). They also allow for summary-level reliability estimates on the exact variables used in the analyses. Summary-level reliability was desirable because the analyses were conducted on summary-level variables.

Interobserver reliability was estimated on 15 randomly selected sessions from each of the interaction sessions and CSBS procedures at Time 1 and Time 2. Pairs of trained observers independently coded all reliability sessions. Test–retest reliability across a 2-week period was estimated for the receptive scale of the CDI on 20% of the sample. The reliability sample was randomly selected. The G coefficient for the variables ranged from .75 to .94. Mitchell (1979) considered G coefficients of .60 and above to be acceptable.

RESULTS

Descriptive Statistics

The medians and standard deviations for the maternal responses, child communications, and child language variables are presented in Table 4. In addition to means and standard deviations, we also included medians and ranges because some of the variables were positively skewed.

TABLE 4. Medians and Ranges for Child Communication, Maternal Responsivity, and Child Language Variables

Variable	Median	Range	*M*	*SD*
	Time 1			
Child communication				
Interaction session				
# intentional acts	14	1–69	18.98	13.53
# preintentional acts	25	2–79	27.84	18.17
CSBS				
# intentional acts[a]	20	2–46	20.85	10.05
Maternal responses from interaction session				
To intentional acts				
# nonlinguistic responses	4.5	0–27	6.03	4.95
# linguistic mapping responses	4	0–19	5.22	4.23
To preintentional acts				
# nonlinguistic responses	7	0–31	8.4	6.18
# linguistic mapping responses	8	0–43	9.6	8.92
	Time 2			
Child communication				
Interaction session				
# intentional acts	28	0–80	29.65	17.74
# preintentional acts	25	3–77	29.3	16.92
CSBS				
# intentional acts[a]	29	5–70	33.15	17.1
Maternal responses from interaction session				
To intentional acts				
# nonlinguistic responses	9	0–33	6.46	5.16
# linguistic mapping responses	7	0–36	9.49	8.39
To preintentional acts				
# nonlinguistic responses	8	1–35	9.16	5.68
# linguistic mapping responses	9	0–29	9.633	7.7
	Time 3			
Reynell receptive scale raw scores	19	2–39	19.79	10.22
Reynell expressive scale raw scores	21	0–41	21.09	8.76

Note. CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 1993); Reynell = Reynell Developmental Language Scale (Reynell & Gruber, 1990).
[a]Prorated for 15 feet.

Maternal Nonlinguistic Responses and Child Communication

As Table 4 indicates, Time 1 number of maternal nonlinguistic responses to intentional communication was positively related to Time 2 rate of intentional communication in the CSBS and to Time 3 Reynell receptive scale scores. When we controlled for rate of intentional communication in the CSBS at Time 1, the relationship with later intentional communication remained significant ($t = 2.6$, $p = .01$; see Table 5 for partial correlation coefficients). When we controlled for the receptive scale of the CDI/I at Time 1, the relationship with the later receptive Reynell at Time 3 became nonsignificant ($t = 1.95$, $p = .056$).

Time 2 number of maternal nonlinguistic responses to intentional communication was positively associated with the receptive and expressive scales of the Reynell at Time 3 (Table 6). When the receptive scale for the CDI/I at Time 2 was controlled, the relationship with the receptive Reynell remained significant (see Table 5). When the expressive scale for the CDI/I at Time 2 and the number of different words spoken in the CSBS at Time 2 were controlled, the relationship remained significant (see Table 5).

Maternal nonlinguistic responses to preintentional communication at Time 1 were positively correlated with Time 2 intentional communication (see Table 4). However, when Time 1 intentional communication in the CSBS was statistically controlled, this relationship became nonsignificant ($t = 1.9$, $p = .06$). Maternal nonlinguistic responses to preintentional communication at either Time 1 or Time 2 did not predict either language measure at Time 3.

TABLE 5. Statistically Significant Zero-Order Bivariate Associations

Predictor	Outcome: Time 2 intentional communication	Outcome: Time 3 Reynell receptive	Outcome: Time 3 Reynell expressive
Time 1			
Nonlinguistic response to			
Intentional communication	.43**	.35**	
Preintentional communication	.33*		
Linguistic mapping to			
Intentional communication			.28*
Preintentional communication			
Time 2			
Nonlinguistic response to			
Intentional communication		.35**	.35**
Preintentional communication			
Linguistic mapping to			
Intentional communication		.44**	.39**
Preintentional communication			

*$p < .05$. **$p < .01$. Those not shown were not statistically significant.

TABLE 6. Significant Partial Correlation Coefficients Controlling for Initial Measures of the Outcome Construct

Predictor	Outcome: Time 2 intentional communication	Outcome: Time 3 Reynell receptive	Outcome: Time 3 Reynell expressive
Time 1			
Nonlinguistic response to intentional communication controlling for Time 1 intentional communication in CSBS	.32*		
Linguistic mapping to intentional communication controlling for Time 1 # of words reported on CDI/I			.26*
Time 2			
Nonlinguistic response to intentional communication controlling for:			
• Time 2 # of spoken words in CSBS			.27*
• Time 2 # of words reported on CDI/I		.36***	.40***
Linguistic mapping to intentional communication controlling for:			
• Time 2 # of words spoken in CSBS			.42***
• Time 2 # of words reported on CDI/I		.45***	.29*

Note. CSBS = Communication and Symbolic Behavior Scales (Wetherby & Prizant, 1993); CDI/I = MacArthur Communication Development Inventory, Infant Scale (Fenson et al., 1991). Only significant correlations are shown.
*$p < .05$. ***$p < .001$.

Maternal Linguistic Mapping and Child Communication

As indicated in Table 6, Time 1 linguistic mapping to intentional communication was related to Time 3 expressive language. When Time 1 expressive CDI/I scores were controlled, this relationship continued to be statistically significant (see Table 5). Similarly, Time 2 linguistic mapping to intentional communication was related to Time 3 receptive and expressive language. As indicated in Table 5, when we controlled for Time 2 language, these relationships continued to be statistically significant.

In contrast, maternal linguistic mapping to preintentional communication at Time 1 was not related to Time 2 intentional communication in the CSBS. Finally, maternal linguistic mapping to preintentional communication at Time 1 and at Time 2 were not associated with Time 3 Reynell scores.

DISCUSSION

The results provided in Table 5 are most informative for future interventions and for explaining why current responsivity training interventions may be effective. These results remained significant after controlling for measures of intentional communication or language at the same time the predictor was measured. The use of such control techniques reduced the probability that the associations could be explained merely by the fact that children who were relatively advanced in terms of development could have received more responses simply because they gave more intentional communications. However, like many predictive models with only one or two variables, the overall variance accounted for in our results was relatively small to moderate, ranging from 7% to 20%.

As expected, only maternal responses to intentional communication, not preintentional communication, were significant predictors of later child intentional communication and language. Also as expected, linguistic mapping to intentional communication predicted later receptive and expressive language. Furthermore, nonlinguistic responses to intentional communication predicted later intentional communication. An unexpected result was that maternal nonlinguistic responses to intentional communication also predicted receptive and expressive language.

Effects of Responding to Communication

The results of the current study demonstrated for the first time that maternal responses to intentional communication acts, not to preintentional acts, predicted child communication and language outcomes. This is not to say that complying with or linguistically mapping preintentional communication inhibits communicative development. In no case were responses to preintentional communication negatively related to child outcomes. In addition, associations in the context of nonexperimental research designs, such as that used by the present study, cannot be taken as evidence that maternal responses cause individual differences in child communication and language. Instead, we should view these correlations as reason for further examination of the hypothesis that paying attention to the type of communication act children provide and matching that with the type of maternal response may increase the efficiency of parent responsivity training interventions.

The present study's results suggest that children who are capable of intentional communication may not learn from instances in which their preintentional communication is responded to by linguistic mapping, compliance, or imitation. Golinkoff (1986) suggested using requests for clarification after unclear communication acts. Golinkoff called this "negotiating meaning." Kim (1996) found that differentially complying with intentional communication over preintentional communication was concurrently related to intentional communication only when mothers negotiated the meaning of the preintentional communication. Requests for clarification after preintentional communication may signal to the child that his or her communication is insufficiently clear and that more information is needed. It should be emphasized, however, that adults should not withhold their compliance in lieu of communication that is more mature than what the child is presently able to produce. In fact, Bruner (1975) and Harding (1983) suggested that adults should comply with preintentional communication when this reflects the most advanced means by which the child is capable of communicating. It should also be noted that the children in the current study all used at least one intentional communication act in at least one of the communication samples at Time 1. Therefore, according to Bruner and Harding, because they were all able to intentionally communicate, negotiation for a clearer communication would have been appropriate.

Further research is needed to determine whether treatment approaches based on these correlational findings would generate differential effects depending on the type of communication act to which the caregiver responds, as this analysis has suggested. For example, in a comparative intervention study, an adult might request clarification and withhold compliance briefly for a more clear communication in response to a preintentional communication. Then in response to intentional communication, the adult would respond with compliance and linguistic mapping. This approach could be compared to a contrast treatment in which there would be immediate compliance and linguistic mapping to both intentional and preintentional child communications.

While possessing a higher degree of internal validity than longitudinal correlational studies, intervention studies will inevitably teach parents to do more than just respond to children's communication (e.g., giving the child an opportunity to communicate, providing behavior management). Therefore, it is not possible to determine whether the effects of such studies are due only (or even at all) to responsiveness, much less to a particular type of response. The probability of

influencing several aspects of the mother–child interaction besides responsiveness increases when we are studying mother–child pairs in which the child has a disability. The pressing needs of an individual child often call for attention from an interventionist, and the response to that pressing need usually reduces the precision of the interpretation of the results of such intervention studies.

Effects of Maternal Responses on Outcomes

Linguistic Mapping. Our analysis also showed that linguistic mapping to intentional communication predicted later language level. This is the first time this finding has been reported with children in the prelinguistic stage of development (Yoder et al., 1998), although recent work by Girolametto, Weitzman, Wiigs, and Pearce (1999) found similar results for children in the early linguistic stage of development. The distinction between talking about the child's focus of attention (descriptive talk) and talking about the child's communicative referent (linguistic mapping) may be important for a number of reasons. Although the latter has better theoretical support, the former has been studied more and thus has more empirical support as a potential facilitator of language development during the prelinguistic period. Presumably, one reason why linguistic mapping to intentional communication may facilitate early language may be that a child who is communicating about an object or event is looking for a response and therefore may be paying close attention to the adult's words. Second, communicating about an object or event may be a more accurate window into a child's specific thoughts than simply playing with or looking at an object or event, making it easier for the adult to match the child's thoughts with words. Such a match may aid the child in associating words with referents or meanings (Yoder et al., 1998). In one of the only studies that examined the association between language development and descriptive talk or linguistic mapping, Girolametto et al. (1999) found that the former did not have concurrent or predictive associations with later language but the latter did.

Nonlinguistic Responses. The relationship between maternal nonlinguistic responses to intentional communication and later intentional communication has also not been previously reported in the literature. This may reflect the literature's emphasis on predictors of language. In a study of typically developing 9-month-olds, Riksen-Walraven (1978) found that teaching parents to be more responsive nonlinguistically resulted in enhanced evidence of means–end understanding, a cognitive correlate of intentional communication (Harding, 1983). The relationship between compliance and intentional communication has been used as a rationale for teaching compliance as an intervention method for several years (MacDonald, 1989).

We did not predict that maternal nonlinguistic responses to intentional communication would predict language development, but it did. It is possible that mothers who often responded to intentional communication nonlinguistically also frequently responded linguistically. If that was the case, then the significant results might have been an artifact of the intercorrelations of the responsivity measures. However, in a follow-up analysis, Time 1 linguistic and nonlinguistic responses to intentional communication were not significantly correlated. At Time 2 there was a correlation of .38 ($p = .004$).

Although the type of communication act was not specifically defined in these studies, maternal nonlinguistic responses predicted later receptive vocabulary (Beckwith & Cohen, 1989) and later intelligence (Bornstein & Tamis-LeMonda, 1989) in two samples of typically developing infants. We originally thought that the lack of linguistic information would prevent it from being predictive of language. However, it is quite possible that nonlinguistic responses facilitate the cognitive underpinnings of language such as means–end learning, which in turn affect language. When intentional communication at Time 2 was statistically controlled, the relationship between nonlinguistic responses to intentional communication at Time 1 and receptive Reynell scores at Time 3 became nonsignificant ($t = 1.37, p = .18$). In addition, nonlinguistic responses might have facilitated intentional communication, which in turn might have elicited language-facilitating maternal responses. Previously reported data on the same participants found that increasing intentional communication did elicit maternal nonlinguistic and linguistic responses (Yoder & Warren, in press), which in turn was related to later expressive and receptive language (Yoder & Warren, 1999a).

CONCLUSION

There is a need for further intervention research on the differential efficacy of various kinds of responsiveness to various kinds of communication acts. These future studies should be based on the present study's correlational findings. First, our data did not indicate any relationship between responsiveness to preintentional communication and later language or communication outcomes after initial measures of those outcome constructs were controlled. Therefore, the contrasting treatments need to vary, depending upon to which types of child communication acts (preintentional or intentional) the adult responds. Second, responding to children's intentional communication was associated with individual differences in the development of language and communication. In future studies, the proposed treatment would need to increase the adult's use of responses to the child's intentional communication while the comparison treatment would need to increase the adult's use of responses to both types of communication acts. The different types of responses the mothers in our study made to the children's intentional communication appeared to have different correlates. Linguistically mapping children's intentional communication may facilitate language development. However, complying with and imitating intentional commu-

nication may facilitate intentional communication and language development. Therefore, future intervention studies would need to increase the adult's use of nonlinguistic responses and linguistic mapping and use language development as the outcome. On its own, the present study provides more support for targeting frequent intentional communication. Intentional communication is not only more frequently responded to by mothers (Yoder & Munson, 1995; Yoder & Warren, 1999b), but responses to intentional communication, not to preintentional communication, predict individual differences in children's later communicative level.

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AUTHORS' NOTES

1. Thanks is given to Carol Chapman, Kim Gilbert, Dana Oman, Betsy Reineke, Melissa Crim, Anne Edwards, Sandy Cooper, and Martha Shy for recruiting participants and coding videotaped procedures; to the Susan Gray School, Duncanwood, and Heads Up schools for allowing us to recruit families through their programs; and to the families that participated in the study for their cooperation and trust.
2. This research was supported in part by the National Institute of Child Health and Human Development Grant No. RO1HD27549 and U.S. Department of Education Grant No. HO23C20152. The views expressed herein are solely those of the authors.

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