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PREDICTING ORAL LANGUAGE DEVELOPMENT IN TODDLERS WITH SIGNIFICANT DEVELOPMENTAL DISABILITIES: THE ROLE OF CHILD AND PARENT COMMUNICATION CHARACTERISTICS

by

R. MICHEAL BARKER

Under the Direction of Rose A. Sevcik

ABSTRACT

To date, no studies have established the relationship between early communication characteristics for young children with significant disabilities and later language development. This study characterized communication for toddlers (n = 60) fitting this profile and their parents prior to a language intervention utilizing an observational coding scheme and tested whether child and parent communication characteristics were predictive of performance on oral language measures. Language transcripts were coded for child mode and pragmatic function and parent response to the utterance child utterances. Results indicated that children used contact gestures, answering and commenting at the highest rates relative to other communication characteristics. Parents utilized a related response type for 52% of child utterances. Hierarchical regressions revealed that sophisticated gesture usage, word usage, and sophisticated function rate were predictive of expressive oral language performance. Sophisticated gesture usage, sophisticated function rate, and parent MLU were predictive of receptive oral language performance.

INDEX WORDS: Language development, Expressive, Receptive, Disability, Beginning communicators, Prelinguistic communication, Transactional hypothesis

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Table of Contents

Acknowledgments iv

List of Tables vii

Introduction 1

The Ontogeny of Prelinguistic Skills 1

The Transition to Symbols 4

Questions 8

Method 9

The Larger Study 10

Participants 10

Baseline Observation 11

Language Interventions 12

Transcript Production of Video-Taped Interactions 13

Procedure 14

Observational Coding 14

Measures from Transcripts 16

Outcome Measures 17

Results 18

Descriptive Characteristics 18

Data Reduction 23

Regression Analyses 24

Child Communication Characteristics Results 27

Parent Communication Characteristic Results 31

Discussion 33

Child Communication Characteristics and Language Performance 34

Parent Communication Characteristics and Language Performance 37

Descriptive Information and Evidence for Differential Communication Profiles 40

Limitations and Future Directions 41

References 43

Appendix 50

List of Tables

Baseline Demographic Information 11

Reliability Estimates for Observational Coding 16

Predictor Variables 17

Bivariate Correlations of Dependent and Demographic Variables 19

Child Descriptive Characteristics 22

Parent Descriptive Characteristics 23

Bivariate Correlations of Independent Variables 26

MCDI Expressive Hierarchical Logistic Regression Results 28

SICD Expressive Hierarchical Multiple Regression Results 29

MCDI Receptive Hierarchical Multiple Regression Results 30

SICD Receptive Hierarchical Multiple Regression Results 32

It has been well documented that prelinguistic skills precede and may predict the subsequent emergence of symbol use in children (e.g., Wetherby, Warren, & Reichle, 1998); this is true both for typically developing children (Bates, 1979a; Bruner, 1983; Snow, 1977) and children with developmental disabilities (Brady, Marquis, Fleming, & McLean, 2004; McCathren, Yoder, & Warren, 1999; Mundy, Kasari, Sigman, & Ruskin, 1995; Yoder & Warren, 1999). Much is still unknown, however, about the early communication profiles of "beginning communicators" with significant developmental disabilities. The term "beginning communicator" refers to children with disabilities who have significant difficulty developing communication skills (Romski & Sevcik, 1996). By definition, these individuals have a spoken/symbol vocabulary with less than 50 words (Romski, Sevcik, Hyatt, & Cheslock, 2002). To date there is not a comprehensive descriptive study of the form and function of early communication attempts for children with significant developmental disabilities who do not speak and their primary caregivers. Likewise, very little is known about parental responses to communication attempts by these children. Consequently, it has not been well established whether these child and parent communication characteristics are predictive of oral language development for beginning communicators with significant developmental delays. What follows is a review of the relevant literature concerning the development of communication skills for typically developing children and young beginning communicators with disabilities.

The Ontogeny of Prelinguistic Skills

The term prelinguistic communication describes the communication system that children utilize before they begin to use symbols to communicate (Wetherby et al., 1998). Prelinguistic communication can further be classified as either preintentional or intentional. Preintentional

communication occurs when a child's communication partner interprets a child's behavior as conveying some message when in fact there was no clear demonstrable intent on the part of the child. The transition from preintentional communication to intentional communication is facilitated by sensitive caregiver responding and caregiver support of early proto-conversations (Snow, 1977). Intentional communication refers to instances in which the child's communicative behavior has the goal of making an impact on the behavior of the communication partner. Furthermore, the preintentional communication is thought to be necessary for intentional communication to occur, as preintentional communication bootstraps the development of intentional communication (Sachs, 2005; Snow, 1977).

The shift from preintentional communication to intentional communication occurs at 9–10 months of age (Bates, 1979b). Once this shift occurs, children begin to actively manipulate their world to attain goals. One common characteristic indicative of this shift is the emergence of alternating eye gaze between the child's communication partner and the child's goal (e.g., a desired object), frequently referred to as joint attention (see Adamson & Chance, 1998, for an overview). In part, it is through this ability to actively shift their attention from the object domain to the social domain that children obtain information about the symbols that will form their linguistic system.

Once children begin to exhibit intentional communication with their communication partners, they develop a repertoire of behaviors that serve pragmatic functions to convey their wants and needs. Broadly, these behaviors consist of gestures and vocalizations that serve a wide range of communicative functions (Iverson & Thal, 1998). As typically developing children shift into intentional communication, they first begin to engage their caregivers by requesting (the act of requesting is also referred to as a proto-imperative; Iverson & Thal, 1998;

Warren & Yoder, 1998). Requesting occurs when a child indicates to a caregiver that he or she desires some object or event. The child often will continue to request until the desired goal is obtained. Children may request by showing or giving objects to an adult or by reaching for a desired object. Early requesting is highly constrained by the context in which the behavior occurs. The communicative act of requesting is an important stepping stone for the emergence of more highly sophisticated commenting behaviors (the act of commenting is also referred to as a proto-declarative; Iverson & Thal, 1998). Commenting, which is less constrained than requesting, has the goal of conveying information about an object or event to a caregiver. For example, early commenting at this point in development children will point to a distant object while alternating eye gaze between the object and the communication partner (Iverson & Thal, 1998).

For typically developing children, success in the prelinguistic stages of communication occurs quickly and with relatively little difficulty. With the aid of responsive caregivers, typically developing children move relatively seamlessly from preintentional to intentional prelinguistic communication. In fact, the language development of typically developing children occurs so quickly that it is often difficult to document the subtle changes that transpire as children make this shift and subsequently begin to use symbols (Romski & Sevcik, 1996). This is not necessarily the case, however, for children with developmental disabilities.

Children with disabilities follow the same course of prelinguistic development as do typically developing children with few exceptions (one may be children with autism; e.g., Dawson et al., 2004). The major distinction between the two groups of children is in the achievement of milestones during prelinguistic development (e.g., Warren & Yoder, 1998). This includes the attainment of preintentional and intentional communication. Additionally, children

with disabilities may utilize forms of prelinguistic communication that may be more subtle or less conventional than typically developing children (Calculator & Dollaghan, 1982; Houghton, Bronicki, & Guess, 1987; Romski & Sevcik, 1996; Romski, Sevcik, Robinson, & Bakeman, 1994). The deficits in prelinguistic communication experienced by these children can have transactional impacts on the responsiveness of the caregivers (Yoder & Warren, 1999, 2001a). For instance, if a child with a disability utilizes a form of communication that is unconventional, their parent may not understand the communication attempt as such and therefore will not respond to the attempt. It is believed that the prelinguistic communication system is subsumed by, and thus provides an important foundation for, the developing linguistic system. Consequently, early difficulties with the prelinguistic communication system may lead to related difficulties with the linguistic communication system (Warren & Yoder, 1998).

The Transition to Symbols

As stated previously, the development of prelinguistic skills has been established as an important foundation for the development of linguistic communication skills (Bates, 1979b; Bruner, 1983). Similar to the contribution that caregiver responsiveness has on the emergence of intentional prelinguistic communication (Snow, 1977), caregiver responsiveness also plays a large role in the shift to using symbols to communicate (McLean & Snyder-McLean, 1978). Sensitive responding on the part of the caregiver supports the mapping of symbols onto pragmatic functions that prelinguistic gestures previously served (Bates, 1979a; Wetherby et al., 1998). For instance, Iverson and Goldin-Meadow (2005) demonstrated that the gestures used by typically developing children predicted the later development of words that served the same function as the earlier gestures. They concluded that this relationship may be explained by the

fact that the gestures may provide cues to which the caregiver can respond (Iverson & Goldin-Meadow, 2005).

This exchange of information between the caregiver and the child is of paramount importance. For example, Tamis-LeMonda and colleagues (Tamis-LeMonda, Bornstein, & Baumwell, 2001) found that maternal responses to child vocalizations at nine months of age significantly predicted the attainment of language milestones (i.e., first words, 50 words, combinatorial speech, and talking about the past) above and beyond the contributions of child vocalizations at nine months of age. This pattern also held true for observations at 13 months of age, although different types of responsiveness were predictive at different ages (i.e., maternal descriptions, affirmations, and play prompts were predictive at nine months; maternal imitations, play prompts, and questions were predictive at 13 months). This finding is important because it highlights the fact that, although the prelinguistic communicative attempts of the child are important, caregiver responsiveness may play a larger role in the development of language. However, Tamis-LeMonda et al. (2001) caution that, by definition, the role that responsiveness plays in language development is contingent on child factors. Thus, responsiveness may play a mediating role in the transactional process between child communicative attempts and language development (Yoder & Warren, 1999). It is from rich caregiver responses that children acquire much of their knowledge about language (Bruner, 1983).

Yoder and colleagues (Yoder, Warren, McCathren, & Leew, 1998) have further delineated different types of responsivity that may be helpful in facilitating the transition to symbolic communication. They described two types of contingent linguistic responses: one to the child's focus of attention and the other to the child's communicative act. Linguistic contingent responses to the child's focus of attention serves the function of giving linguistic

information to the child about objects or events to which the child is attending (Yoder, Warren, McCathren et al., 1998). For example, in the event that a child is playing with a toy, the mother may supply the child with a label for the object. This is thought to help children begin to understand the relationships between symbols and their referents. The second type of response, a linguistic contingent response to the child's communicative act, adds additional linguistic information to the child's communicative act (Yoder, Warren, McCathren et al., 1998). For instance, in the event that a child points to a toy train and labels it "choo-choo," the mother responds with "that's a train and it goes choo-choo." These responses are thought to help the child develop an increasingly more sophisticated linguistic system. This second type of responsivity represents a more sophisticated type of parental responding; that is, in order to respond to a communicative act, the parent must also respond to the child's focus of attention.

Caregiver responsiveness also is very important for the transition to symbolic communication for children with disabilities. But unlike typically developing children, the transactional processes that support this shift may be difficult to accomplish. This is because, as stated previously, children with disabilities may either have delays in attaining milestones in prelinguistic communication (Warren & Yoder, 1998) or utilize unconventional modes of prelinguistic communication that are not easily interpretable by the caregiver (Calculator & Dollaghan, 1982; Houghton et al., 1987; Romski & Sevcik, 1996). The resulting delay in the use of conventional symbols further exacerbates the breakdown in the transactional process that supports linguistic development. This is because a lack of conventional symbol use (e.g., speech) can result in decreased levels of linguistic input, differing styles of input (i.e., directive input instead of responsive input), and reduced input during joint attention episodes (Blockberger & Sutton, 2003).

A number of studies have established direct and indirect links between prelinguistic communication and subsequent language development for children with developmental disabilities. In a series of studies, Yoder and Warren (1998; 1999; 2001a; 2001b; 2002) demonstrated, in a sample of toddlers with developmental disabilities, that the relationship may be mediated by maternal responsivity. Specifically, they showed that the frequency of child prelinguistic communication attempts had a positive impact on the amount of maternal responsiveness a child received (Yoder & Warren, 2001a) that, in turn, had an impact on later measures of child lexical density (Yoder & Warren, 1999). In addition, Mundy and colleagues (1995; Mundy, Sigman, Kasari, & Yirmiya, 1988) have demonstrated that children with Down syndrome exhibit decreased levels of nonverbal requests in comparison to mental age matched typically developing children. This delay in nonverbal requesting was associated with decreased speech for these children compared to the typically developing children. Others have shown that there is a relationship between the rate of prelinguistic vocalizations used interactively by children with developmental disabilities and later expressive vocabulary (McCathren et al., 1999).

In addition to studies that document the relationship between prelinguistic communication and later linguistic communication, researchers also have demonstrated that it is possible to intervene in this process. For instance, Yoder and Warren (2001b; 2002) demonstrated that, utilizing a milieu teaching strategy, an increase in the number of prelinguistic communication attempts on the part of the child also increased maternal responses for young children with significant developmental and communication delay, both of which lead to improved language development. Hancock and Kaiser (2002) and Kaiser, Hancock, and Nietfeld (2000) also have demonstrated success utilizing milieu intervention techniques that target

prelinguistic communication by increasing caregiver responsiveness for preschool aged children with autism and concomitant language delays. An important characteristic of these interventions is the emphasis that the interventionist places on following the child's line of interest. Throughout the course of the intervention, communication goals are scaffolded such that increasingly sophisticated communication behaviors are elicited (i.e., proto-imperatives, then proto-declaratives, then spoken words). Kaiser and colleagues have demonstrated that interventions implemented by both parents (Kaiser et al., 2000) and trained interventionists (Hancock & Kaiser, 2002) are effective in increasing linguistic diversity and complexity for children with autism in addition to increased scores on standardized language measures.

Questions

The goal of the current research is to characterize early communication between very young beginning communicators with significant developmental disabilities and their parents in terms of both child and parent characteristics. Additionally, this research will attempt to determine whether these communication characteristics predict later oral language development following an intervention. In doing so, this study will attempt to answer the following questions. (a) What are the communication characteristics of young children with developmental disabilities at the beginning stages of language acquisition with respect to mode of communication, pragmatic function, and interaction with their communication partner? (b) What are the patterns of parental communication, including parental responsivity, to young beginning communicators with developmental disabilities? (c) What type of baseline communication characteristics of children predict oral language outcome following a three month parent-implemented language intervention? It is hypothesized that children who are using higher rates of more sophisticated communication characteristics will produce higher scores on assessments

of oral language development following intervention. In other words, children who are using higher rates of distal gestures, vocalizations, or spoken words for a range of communicative functions (i.e., answering, attention getting, requesting, and commenting) should score higher on measures of oral language development than children who are utilizing these characteristics at lower rates. And finally, (d) do patterns of parental communication characteristics, including responsivity, predict oral language outcome? Two hypotheses will be tested in relation to this question. First, it is hypothesized that mean length of parents' utterances in morphemes (mMLU) will significantly predict oral language development following intervention. Parents who exhibit higher mMLU, relative to other parents in the sample, will have children who score higher on language measures because these parents provide their children with more linguistic information in a given utterance. Second, it is hypothesized that children of parents who respond with high proportions of related responses to child communication attempts will exhibit higher scores on standardized oral language measures. Parents who use more related responses necessarily follow their child's line of interest to a greater extent and thus provide more relevant linguistic input to their children; which, in turn, supports the development of oral language.

Method

The data utilized in this study are part of a larger longitudinal project conducted by Romski and colleagues (2000). The goal of this larger longitudinal study is to describe the communication profiles of toddlers with significant developmental delays and to determine the relative effects of three parent-implemented language interventions on the communication skills, adaptive behavior, and educational placement of toddlers.

The Larger Study

Participants. A diverse sample (in terms of both ethnicity and disability status) of 60 toddlers with significant developmental disabilities and their primary caregiver participated in the larger study. Recruitment of these participants was facilitated by referrals from professionals (e.g., speech-language pathologists, psychologists, neurologists, etc.) from the metropolitan Atlanta area and by referrals from other families who participated in the study.

Children met the following criteria: (a) 24 and 36 months of age at the beginning of participation; (b) significant developmental delay as determined by the *Mullen Scales of Early Learning* (Mullen, 1995); (c) little or no functional speech as evidenced by an expressive vocabulary of less than 10 functional spoken intelligible words or word approximations; (d) evidenced intentional communication in the form of vocalizations and/or gestures; (e) sufficient upper extremity motor control to access a speech-generating device via direct selection; and (f) vision and hearing (corrected) in the normal range. This information was obtained by parent report and during an initial screening interview and assessment.

A wide range of developmental and communication disabilities were represented in the sample. Diagnoses included Down syndrome, cerebral palsy, pervasive developmental disorder, and developmental delay of unknown etiology, among many other diagnoses. The *Mullen Scales of Early Learning* (Mullen, 1995), designed to assess perceptual, motor, and language abilities in very young children, was used to obtain baseline measures of participants' general developmental level. The means and standard deviations of the participants' receptive, expressive language ages, along with the complete demographic breakdown of the sample are presented in Table 1.

Table 1

Baseline Demographic Information

				Mullen		
n	Sex	Ethnicity	CA[a]	Rec[a]	Exp[a]	ELC
60	19 Females	16 AfA (26.7%)	29.47(4.58)	17.07(7.56)	11.63(3.93)	59.02(13.18)
		7 AsA (11.7%)				
		37 EA (61.6%)				

Note. Mullen, E.M. (1995). *Mullen Scales of Early Learning*. Circle Pines, MN, American Guidance Service. CA = Chronological Age; Rec = Receptive Age; Exp = Expressive Age; ELC = Early Learning Composite of the Mullen. The ELC is a measure of general developmental level. AfA = African American or Black; AsA = Asian American; EA = European American or White.

[a] Means (and Standard Deviations) presented in Months.

Baseline Observation. Prior to assignment to a language intervention group, each dyad (parent and child) participated in a 30 minute semi-structured observation divided into three 10 minute segments. The parent was asked to interact with their child during the three distinct segments (i.e., play, book reading, and snack); each focused on a specific activity, providing a sample of communication interaction for the dyad. Observations were video recorded through a one-way mirror using a Sony DCR-HC30 digital video camera. The 10’ x 14’ observation room contained many different age appropriate objects (e.g., toys, books, etc.). The three segments of the observation session were designed to elicit different types of communication from the child and the parent. The first segment was the play segment. During this segment, the dyad was encouraged to interact with the toys in the room and focus their communication around these objects. This segment encouraged turn-taking and social interacting. The second segment was book reading. During this segment, parents were asked to focus their communication around the

activity of reading books. This segment supported commenting and labeling. The final segment was the snack segment. During this segment, the parent and the child shared some of the child's favorite snacks. This segment supported requesting on the part of the child. Taken together, the entire 30 minute observation afforded many opportunities for different types of communication between the child and the parent. Consequently, a rich representation of the dyad's communication was obtained prior to intervention.

Language Interventions. Following the baseline observation, participants were randomly assigned to one of three parent implemented interventions: Augmented Communication Input intervention (ACI), Augmented Communication Output intervention (ACO), and Spoken Communication Interaction (SCI). Although these three interventions each had distinct components, they all shared a common protocol and the goal of developing parent-child communication skills. All three interventions encouraged the use of basic language stimulation techniques such as modeling, expansions, and sabotage to facilitate interaction and communication with the child. As part of all three interventions, the interventionist provided coaching and feedback to the parents and answered any questions about the sessions. The interventions utilized the same play, book reading, and snack formats as described for baseline observation session.

Interventions were scheduled to occur over the course of 12 consecutive weeks with two 30 minute sessions scheduled for each week. During the first four weeks of intervention, parents observed the staff interventionist implement the intervention with the child through a one-way mirror. In the laboratory, after the fourth week, parents were systematically integrated into the intervention such that by the seventh week the parent conducted all three intervention segments.

An individualized target vocabulary appropriate to the three segments was chosen for each child in each of the language intervention groups. Vocabulary consisted of spoken words and visual graphic symbols (Mayer-Johnson Co.) for children in the ACI and ACO groups and spoken words for children in the SCI group. In collaboration with the project's speech-language pathologist, parents of the participants chose the relevant vocabulary on which to focus during the intervention. All words selected were not yet part of the child's spoken repertoire and were highly relevant to the child's environment. The child's vocabulary consisted of favorite foods, favorite books, favorite story characters, other highly relevant objects, or was related to daily interactions at the home. Information concerning the language interventions is presented here for descriptive purposes only; intervention condition will not be taken into account in this study.

Transcript Production of Video-Taped Interactions. Transcripts were produced of the 30 minute video-recorded baseline interactions reflecting the three 10 minute segments: play, book reading, and snack. Transcribers utilized the *Systematic Analysis of Language Transcripts* (SALT) program and its conventions (Miller & Chapman, 2002) for transcript production. Transcribers were instructed to record communication between the members of the dyad, regardless of its modality; vocal, symbol, and gestural communication forms were recorded.

Nine trained transcribers created the transcripts. Reliability of the transcripts was established by having each transcript reviewed by a second transcriber. The second transcriber made corrections and changes as appropriate according to SALT conventions and the transcription manual (Romski, Cheslock, Adamson, Sevcik, & Smith, 2005). Finally, transcripts were error checked by a third transcriber to ensure maximum accuracy.

Procedure

The current study utilized data from all 60 participants who took part in the larger study. Specifically, 60 pre-intervention language transcripts of the baseline observation sessions were systematically coded at the utterance level. The baseline observation sessions provided a representation of the child's communicative abilities in a social context. Information concerning the modality and function of child communication attempts and parent responding to those communication attempts was extracted from these transcripts. The rates (as opposed to proportions) of pre-intervention child characteristic codes were analyzed. This decision was made because of concerns that proportions would be inflated for the children in the sample who used very few utterances during the baseline observation session. The proportions of the parent response type codes were analyzed to control for differences in the number of utterances each child produced.

Observational Coding

The baseline transcripts were coded using an observational coding scheme designed to characterize aspects of the communication behavior of both the child and the parent. Each child utterance was characterized on three dimensions: its mode, its pragmatic function in the communication interaction, and the type of parent response to the utterance. For mode, two codes were assigned: one that characterizes the manual modality and one that characterizes the vocal modality. For manual modality, utterances were characterized as: (a) Physical Manipulation; (b) Contact Gesture; (c) Distal Gesture; (d) Representational Gesture; (e) Manual Sign; or (f) Not Applicable. For the vocal modality, utterances were characterized as (a) Vocalization; (b) Spoken Word; or (c) Not Applicable. The modalities were delineated in this fashion to accurately capture instances in which children were simultaneously utilizing both the

manual modality and the vocal modality. For example, some children vocalized and used a manual sign in the same utterance. In cases like this, the utterance was be assigned both the vocalization and manual code as appropriate. Both the manual modality codes and the vocal modality codes were mutually exclusive and exhaustive. Definitions of the child modality codes are presented in the Appendix.

In terms of pragmatic function, utterances were characterized as: (a) Affirming; (b) Negating; (c) Imitating; (d) Naming; (e) Answering; (f) Attention Getting; (g) Requesting; (h) Commenting; or (i) Not Applicable. The function codes were mutually exclusive and exhaustive. Definitions of the child function codes are presented in the Appendix.

Each utterance was also be characterized in terms of the type of parent response that followed the utterance. Specifically, the response type was coded as: (a) No Opportunity to Respond; (b) No Parent Response; (c) Unrelated Response; or (d) Related Response. The parent response type codes also were mutually exclusive and exhaustive. Definitions of the response type codes also are presented in the Appendix.

Inter-rater agreement for the coding scheme was assessed by having a second coder independently code 20% (12) of the entire corpus of transcripts. Cohen's Kappa (Bakeman & Gottman, 1997; Cohen, 1960) was utilized to determine agreement between coders. Fleiss (1981) characterized kappas of .60 to .75 as good and over .75 as excellent. Acceptable levels of inter-coder agreement were achieved throughout the observational coding process. Kappa's ranged from .89 for the verbal modality codes to .70 for the pragmatic function codes. Percent agreement ranged from 95.4% for the verbal modality codes to 75.0% for the pragmatic function codes. A complete description of the inter-coder reliability statistics is presented in Table 2.

Table 2

Reliability Estimates for Observational Coding

Code Set	Cohen's κ	% Agreement
Manual Modality	.86	91.5
Verbal Modality	.89	95.4
Pragmatic Function	.70	75.0
Response Type	.75	84.6

Measures from Transcripts

In addition to the information obtained from the observational coding of the transcripts and videotaped interactions, the baseline transcripts also were used to calculate the number of child turns and the rate of child communication. The number of parent turns and parent mean length of utterance in morphemes (mMLU; a commonly used measure of grammatical complexity) were also extracted from the transcripts. A summary of all of the predictor variables that were utilized is presented in Table 3.

Table 3

Predictor Variables

	Observational	Transcript
Child	Modality[a]	Number of Turns
	Function[b]	Rate of Communication
Parent	Response Type[c]	Number of Turns
		mMLU

Note. mMLU = Mean Length of Utterance in Morphemes.

[a] The rate that each of the modality codes occurs was analyzed. [b] The rate that each of the function codes occurs was analyzed. [c] The proportion of each of the function codes was analyzed.

Outcome Measures

Four standard oral language measures, collected as part of the larger study, were used to gain a more complete picture of the child's communication ability following the end of the intervention; no augmented language behaviors were considered in this thesis study. The words and gestures form of the *MacArthur-Bates Communicative Development Inventory* (MCDI; Fenson et al., 1992) was used as an assessment of expressive and receptive oral vocabulary size. The MCDI is a commonly used parent report inventory for estimating oral vocabulary that gives a raw tally of the number of words that a child is using and/or understanding. Additionally, studies have shown that the MCDI is a valid assessment for reporting vocabulary in children with developmental disabilities (Yoder, Warren, & Biggar, 1997).

The *Sequenced Inventory of Communication Development - Revised* (SICD-R; Hedrick, Prather, & Tobin, 1984) was used as an additional standardized measure of overall receptive and

expressive oral language age (as opposed to only vocabulary size). This assessment evaluates the child's functioning through a series of tasks administered directly to the child.

Results

Transcripts were created and coded for all 60 participants. Outcome data were obtained for all of the participants with two exceptions; MCDI expressive and receptive data were missing for two of the participants because the parent did not return the MCDI form. Furthermore, bivariate correlations of the dependent variables and the baseline Mullen scores are presented in Table 4. Results indicate that baseline Mullen language ages were highly correlated with SICD and MCDI language measures following intervention.

Descriptive Characteristics

Following the coding of the 60 baseline observation sessions, rates were calculated for all codes (i.e., code frequency/30 minutes) characterized by the observational coding scheme. For most of the variables, rates of codes were extremely positively skewed with many children scoring a rate of zero. As a result, the mean (*M*), median (*Mdn*), standard deviation (*SD*) and the percentage of children that scored zero on each code (*% Zero*) are reported. All children, however, used at least four communicative utterances (minimum = 4, maximum = 305) during the baseline observation session. The mean communication rate for the entire sample was 2.91 utterances/minutes (*SD* = 2.23) with a median score of 2.55 utterances/minutes. The mean number of child turns was 87.35 (*SD* = 64.65) with a median score of 64.65. The mean length of child turns in utterances was 1.12 (SD = 0.12) with a median of 1.11.

Table 4

Bivariate Correlations of Dependent and Demographic Variables

Variable	1	2	3	4	5	6	7	8
3. MCDI Receptive[a]	—							
1. MCDI Expressive[a]	.65**	—						
2. MCDI Expressive Binary[a]	.53**	.60**	—					
4. SICD RL Age[a]	.59**	.48**	.48**	—				
5. SICD EL Age[a]	.63**	.74**	.66**	.59**	—			
6. Mullen RL Age[b]	.50**	.38**	.43**	.89**	.45**	—		
7. Mullen EL Age[b]	.56**	.61**	.68**	.28*	.68**	.25	—	
8. Mullen ELC[b]	.46**	.50**	.37**	.86**	.53**	.79**	.27**	—

Note. MCDI Receptive = words understood; MCDI Expressive = words spoken; MCDI Expressive Binary = words spoken recoded into as a bianary variable; RL Age = receptive language in months; EL Age = expressive language in months; ELC = Early Learning Composite. The ELC is a measure of general developmental level.

[a] Post-intervention measures. [b] Pre-intervention measures.

*$p < .05$. **$p < .01$.

For the manual modality, children used very low rates of physical manipulation (*M* = 0.04, *Mdn* = 0.00, *SD* = .07, *% Zero* = 55.0). On the other hand, children used contact gestures at higher rates than any other gesture (*M* = 0.44, *Mdn* = 0.32, *SD* = 0.44, *% Zero* = 10.0). Distal gestures (*M* = 0.19, *Mdn* = 0.07, *SD* = 0.28, *% Zero* = 30.0), representational gestures (*M* = 0.17, *Mdn* = 0.03, *SD* = 0.30, *% Zero* = 40.0), and manual signs (*M* = 0.10, *Mdn* = 0.00, *SD* = 0.33, *% Zero* = 63.3) were all used at lower rates. These results indicate that, although children were not using gestures at very high rates (or at all), when they did, children often used contact gestures, an earlier developing gestural form than distal gestures. The manual modality descriptive statistics are summarized in Table 5.

Although the children in this sample were recruited because they did not use speech (i.e., less than 10 spoken conventional words), they used vocalizations at extremely high rates relative to rates of gesture usage (*M* = 2.58, *Mdn* = 2.07, *SD* = 2.08, *% Zero* = 0.0). All children used at least one vocalization during the baseline observation session, with a majority of children (73.3%) using one or more vocalizations/minute. Not surprisingly, words were used at much lower rates (*M* = 0.17, *Mdn* = 0.00, *SD* = 0.31). Furthermore, 56.7% of children used no words during the baseline observation and only 5.0% of children used one or more word/minute. The verbal modality descriptive statistics are summarized in Table 5.

Children used the different pragmatic functions characterized by the observational coding scheme at differing rates. In terms of the less sophisticated pragmatic functions characterized by the observational coding scheme, children used affirming at the lowest rate (*M* = 0.06, *Mdn* = 0.03, *SD* = 0.08). Affirming was highly positively skewed with 41.7% of children not demonstrating affirming during the baseline observation session. Children negated at much higher rates (*M* = 0.30, *Mdn* = 0.20, *SD* = 0.28, *% Zero* = 10.0). Children imitated their

communication partners at relatively high rates (*M* = 0.23, *Mdn* = 0.10, *SD* = 0.44, *% Zero* = 25.0). Finally, naming, occurred at relatively low rates (*M* = 0.13, *Mdn* = 0.03, *SD* = 0.32, *% Zero* = 45.0).

In terms of the more sophisticated pragmatic functions characterized by the observational coding scheme, children demonstrated answering at one of the highest rates compared to the other pragmatic functions (*M* = 0.63, *Mdn* = 0.37, *SD* = 0.87, *% Zero* = 10.0). Attention getting occurred at very low rates (*M* = 0.07, *Mdn* = 0.03, *SD* = 0.10, *% Zero* = 46.7). Requesting occurred at relative high levels (*M* = 0.22, *Mdn* = 0.15, *SD* = 0.25, *% Zero* = 28.3), while commenting occurred at the highest rate of all of the pragmatic functions (*M* = 0.64, *Mdn* = 0.35, *SD* = 0.65, *% Zero* = 11.7). The pragmatic function code descriptive statistics are summarized in Table 5.

In general, the positive skew present in the child data did not appear in the parent data. The mean mMLU for parents was 3.49 (*SD* = 0.59). The mean total number of turns for parents was 87.67 (*SD* = 59.17). The mean length of parent turns in utterances was 12.84 (*SD* = 13.57). The type of response that the parent used following a child utterance was coded for each child utterance. The percentage of each response type was calculated. It was extremely rare for parents to not respond to their child's communication attempt as this occurred only 2.0% of the time. Furthermore, 48.3% of parents responded every time their child attempted to communicate. In addition, parents responded more often with related responses (*M* = 52.4%) than they did with unrelated responses (*M* = 38.1%). The parent descriptive statistics are presented in full in Table 6.

Table 5

Child Descriptive Characteristics

Variable	*M*	*Mdn*	*SD*	*% Zero*
Overall Communication Rate	2.91	2.55	2.23	0
Total # of Turns	87.35	76.00	64.65	0
Mean Length of Turn in Utterances	1.12	1.11	0.12	0
Manual Modality				
Physical Manipulation Rate	0.04	0.00	0.07	55.0
Contact Gesture Rate	0.44	0.32	0.44	10.0
Distal Gesture Rate	0.19	0.07	0.28	30.0
Representational Gesture Rate	0.17	0.03	0.30	40.0
Manual Sign Rate	0.10	0.00	0.33	63.3
Verbal Modality				
Vocalization Rate	2.58	2.07	2.08	0
Word Rate	0.17	0.00	0.31	56.7
Pragmatic Function				
Affirming Rate	0.06	0.03	0.08	41.7
Negating Rate	0.30	0.20	0.28	10.0
Imitating Rate	0.23	0.10	0.44	25.0
Naming Rate	0.13	0.03	0.32	45.0
Answering Rate	0.63	0.37	0.87	10.0
Attention Getting Rate	0.07	0.03	0.10	46.7
Requesting Rate	0.22	0.15	0.25	28.3
Commenting Rate	0.64	0.35	0.65	11.7

Note. Rates are the occurrence of the coded behavior per minute

Table 6

Parent Descriptive Characteristics

Variable	*M*	*Mdn*	*SD*	*% Zero*
mMLU	3.49	3.44	0.59	0
Total # of Turns	87.67	81.00	59.17	0
Mean Length of Turn in Utterances	12.84	7.41	13.57	0
Response Type				
Proportion No Opportunity	.07	.06	.06	18.3
Proportion No Response	.02	.00	.04	48.3
Proportion Unrelated	.38	.39	.17	1.7
Proportion Related	.52	.52	.19	0

Note. mMLU = Mean Length of Utterance in Morphemes.

Data Reduction

Although this sample was large by disability research standards, it was necessary to reduce the data considerably in order to perform meaningful regression analyses because of the relatively small sample size. Consequently, some of the rates that resulted from the observational coding scheme were collapsed. Specifically, the distal gesture, representational gesture, and manual sign rates were combined into a new variable called sophisticated gesture rate. The mean sophisticated gesture rate was 0.46 per minute (*SD* = 0.76) with a median of 0.20. This new variable was highly positively skewed with 21 (35%) of the participants using no sophisticated gestures during the baseline observation. To make the regression analyses tenable

using this variable, it was necessary to recode the sophisticated gesture variable into a dichotomous variable called sophisticated gesture usage. This was done such that 0 represented children who did not use sophisticated gestures and 1 represented children who used sophisticated gestures during the baseline observation session. It also was necessary to recode word rate into a new variable called word usage in the same manner; 34 (56.7%) participants used no words during the baseline observation session.

The rates for answering, attention getting, requesting, and commenting also were collapsed into a new variable called sophisticated function rate. The mean sophisticated function rate was 1.56 (*SD* = 1.53) with a median of 1.12. Although slightly positively skewed, only 5 (8.3%) children did not use a single sophisticated function during baseline, making it unnecessary to recode this variable.

Furthermore, examination of the MCDI expressive scores revealed a severe positive skew (*M* = 61.22, *Mdn* = 18.50, *SD* = 83.94); 21 out of the 58 children for which scores were available scored 10 or fewer spoken words. As a consequence, the MCDI expressive scores were recoded into a dichotomous outcome variable that indicated whether children used either 10 or fewer words or greater than 10 words as reported on the post-intervention MCDI expressive subscale. The 21 children who were reported to use 10 or fewer words were coded 0; the remaining 37 children who were reported to use more than 10 words were scored 1. As a result, it was necessary to perform a hierarchical logistic regression analysis on the MCDI expressive data.

Regression Analyses

It was necessary to omit three of the intended independent variables (i.e., communication rate, total number of child turns, and total number of parent turns) from the regression models because of high multicollinearity. The bivariate correlations of the independent variables are

presented in Table 7. Consequently, five variables were used in each of the four planned hierarchical regression analyses: three child variables and two parent variables. The three child variables were: (a) sophisticated gesture usage (i.e., whether or not the child used sophisticated gestures during the baseline observation session), (b) word usage (i.e., whether or not the child used at least one word during the baseline observation session), and (c) sophisticated function rate. The two parent variables used in the analyses were (d) parent mMLU and (e) parent related response percent.

The results of the four regression analyses indicated significant findings. The hierarchical logistic regression for the MCDI expressive data had a *Naglekerke* R^2 of .50 for the final model ($\Delta X^2 = 28.48$, $df = 5$; see Table 8). *Naglekerke* R^2 is an estimate of *pseudo*-R^2 that serves as an analogue to *Multiple* R^2 used in Ordinary Least Squares Regression and is frequently used for comparative purposes (Menard, 2002). The final R^2 for the SICD expressive hierarchical multiple regression analysis was .41, $F(3,54) = 12.33$, $p < .01$ (see Table 9). The R^2's for the receptive hierarchical multiple regression analyses were as follows: .35 for the MCDI receptive, $F(3,52) = 8.32$, $p < .01$ (see Table 10), and .54 for SICD receptive, $F(3,56) = 16.63$, $p = .00$ (see Table 11).

Table 7

Bivariate Correlations of Independent Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Overall Comm. Rate	–											
2. Child Mean Length Turn[a]	.32*	–										
3. Sophisticated Gesture Rate	.64**	.12	–									
4. Sophisticated Gesture Usage	.43**	.25	.31*	–								
5. Word Rate	.45**	.14	.09	.28*	–							
6. Word Usage	.53**	.08	.30*	.44**	.64**	–						
7. Sophisticated Function Rate	.89**	.23	.74**	.40**	.43**	.57**	–					
8. Child Total # of Turns	.99**	.25	.66**	.41**	.40**	.50**	.88**	–				
9. Related Response Percent	–.05	–.41**	.14	–.02	.01	.01	.09	.00	–			
10. Parent mMLU	–.01	–.15	.01	.06	–.05	–.04	.06	.05	.29*	–		
11. Parent Total # of Turns	.98**	.24	.68**	.40**	.41**	.50**	.89**	.99**	.01	.00	–	
12. Parent Mean Length Turn[a]	–.60**	–.35**	–.30*	–.43**	–.31*	–.37**	–.50**	–.60**	.17	.18	–.63**	–

[a] Mean Length of Turn is presented in Utterances.

*p < .05. **p < .01.

Child Communication Characteristics Results. The child communication characteristic variables were responsible for much of the variance that was accounted for in each of the models. This was particularly true when considering the impact of child characteristics on expressive language following intervention. For the MCDI expressive analysis (see Table 8), the first step of the model was responsible for the *Naglekerke* R^2 of .50 reported previously (ΔX^2 = 26.39, df = 3). Examination of the individual variables in the first step indicated a significant effect of the use of sophisticated gestures, *Wald* = 5.44, p = .02. Children who used sophisticated gestures at baseline were 15.26 times more likely to use greater than 10 words on the MCDI expressive following intervention than children who did not use sophisticated gestures. No other child communication characteristic variables significantly predicted scores on the MCDI expressive.

The pattern of significance was different for the SICD expressive measure (M = 16.27, Mdn = 16.00, SD = 6.70). Step one of this analysis accounted for approximately 41% of the variance in outcome scores, $F(3,54) = 12.33$, $p < .01$ (see Table 9). In this case, sophisticated gesture usage did not significantly predict SICD expressive scores, but this variable did have a medium sized R^2 associated with its effect (R^2 = .15; see Table 9). Both word use, b = 3.83, β = 0.29, SE = 1.75, t = 2.19, p = .03, and sophisticated function rate, b = 1.59, β = 0.36, SE = 0.56, t = 2.84, $p < .01$, significantly predicted SICD expressive scores. Specifically, children who used at least one word during the baseline observation session scored, on average, 3.83 months higher on the SICD expressive measure than children who used no words, controlling for the other variables in the model. Additionally, for every increase of one sophisticated function usage per minute, there was a corresponding 1.59 increase in SICD expressive language age following intervention, controlling for the other variables in the model. In sum, children who used

sophisticated gestures at baseline were more likely to use more than 10 words according to the MCDI expressive following intervention; conversely, word use at baseline and higher rates of sophisticated pragmatic functions predicted higher SICD expressive language ages.

Table 8

MCDI Expressive Hierarchical Logistic Regression Results

			95% CI		
Variable	*B*	e^B	Lower	Upper	*p*
Block 1					
Sophisticated Gestures	2.72	15.26	1.54	150.71	.02
Word Use	0.71	2.03	0.39	10.59	.40
Soph. Function Rate	0.56	1.76	0.81	3.83	.16
Block 2					
Parent mMLU	0.47	0.68	0.42	6.00	.49
Related Response %	–2.53	1.86	0.00	3.05	.17

Note. mMLU = Mean Length of Utterance in Morphemes. *Naglekerke* R^2 = .50 for Block 1 (X^2 = 26.39, *df* = 3, $p < .01$); *ΔNaglekerke* R^2 = .03 for Block 2 (X^2 = 2.10, *df* = 2, *p* = ns).

Table 9

SICD Expressive Hierarchical Multiple Regression Results

			95% CI		
Variable	*B*	*β*	Lower	Upper	*p*
Step 1					
Sophisticated Gestures	1.87	.11	–2.03	5.77	.34
Word Use	3.83	.29	0.33	7.33	.03
Soph. Funct Rate	1.59	.36	0.47	2.72	.01
Step 2					
Parent MLUm	0.58	.05	–1.93	3.10	.64
Related Response %	–0.48	–.01	–8.12	7.16	.90

Note. mMLU = Mean Length of Utterance in Morphemes. R^2 = .41 for Step 1 ($F(3,54)$ = 12.33, $p < .01$); ΔR^2 = .00 for Step 2 ($\Delta F(2,54) < 1$, p = .89).

Unlike the pattern of significance described previously, the hierarchical regression analyses indicated similar patterns of results for the child communication characteristic variables on both of the receptive language measures. As a set, the baseline child communication characteristic variables accounted for 31% of the variance in MCDI receptive scores (M = 195.55, Mdn = 184.50, SD = 113.71) following intervention, $F(3,52) = 8.32$, $p < .01$ (see Table 10). The results indicated that both sophisticated gesture usage, $b = 79.14$, $\beta = 0.28$, $SE = 35.93$, $t = 2.20$, $p = .03$, and sophisticated function rate, $b = 20.40$, $\beta = 0.28$, $SE = 10.30$, $t = 1.98$, p = .05, significantly predicted outcomes. Specifically, children who used sophisticated gestures

during the baseline observation session had MCDI receptive scores that were 79.14 words higher following intervention than children who did not use sophisticated gestures at baseline, controlling for the other variables in the model. Furthermore, for every increase of one sophisticated function usage per minute, there was a corresponding increase on the MCDI receptive of 20.40 words, controlling for other variables in the model.

Table 10

MCDI Receptive Hierarchical Multiple Regression Results

			95% CI		
Variable	*B*	*β*	Lower	Upper	*p*
Step 1					
Sophisticated Gestures	79.14	.28	7.09	151.18	.03
Word Use	28.80	.13	–36.41	94.01	.38
Soph. Funct Rate	20.40	.28	–0.26	41.05	.05
Step 2					
Parent MLUm	31.55	.16	–14.81	77.92	.18
Related Response %	54.67	.09	–81.73	191.07	.42

Note. mMLU = Mean Length of Utterance in Morphemes. R^2 = .31 for Step 1 ($F(3,52)$ = 8.32, $p < .01$); ΔR^2 = .04 for Step 2 ($\Delta F(2,52)$ = 1.70, p = .19).

For the SICD receptive scores (M = 21.98, Mdn = 20.00, SD = 8.54), the child communication characteristic variables, as a group, accounted for 43% of the variance in outcomes, $F(3,56) = 16.63$, $p = .00$ (see Table 11). The use of sophisticated gestures approached conventional levels of significance in predicting SICD receptive scores, $b = 4.72$, $\beta = 0.22$, $SE = 2.43$, $t = 1.94$, $p = .06$. This means that children who used sophisticated gestures during the baseline observation session scored, on average, 4.72 months higher on the SICD receptive measure following intervention, compared to other children. In addition, rate of sophisticated function usage also was a strong predictor of SICD receptive scores following intervention, $b = 3.22$, $\beta = 0.58$, $SE = .70$, $t = 4.59$, $p = .00$. Specifically, every increase of one use of a sophisticated function per minute during the baseline observation session corresponded to an increase of 3.22 months in SICD receptive language age following intervention, controlling for other variables in the model. In sum, similar patterns of results occurred for both receptive language measures. The use of sophisticated gestures at baseline predicted receptive language performance: significantly for the MCDI receptive and approaching significantly for the SICD receptive. Sophisticated function rate significantly predicted receptive language ability for both assessments.

Parent Communication Characteristic Results. With one exception, parent MLU in morphemes and related response percent contributed very little to the overall amount of variance accounted for in each of the models. This was particularly true in the case of the expressive analyses. For instance, adding the parent variables to the model in the second step of the MCDI expressive analysis did not significantly improve fit over and above the first step ($\Delta X^2 = 2.10$, $df = 2$); this step resulted in no change in *Naglekerke* R^2 (see Table 8). Likewise, the addition of the parent communication characteristic variables did not account for any additional variance above

and beyond the child variables for the SICD expressive analysis, $\Delta F(2,54) < 1$, $p = .89$ (see Table 9).

Table 11

SICD Receptive Hierarchical Multiple Regression Results

			95% CI		
Variable	*B*	*β*	Lower	Upper	*p*
Step 1					
Sophisticated Gestures	4.72	.22	–0.15	9.60	.06
Word Use	–1.28	–.07	–5.66	3.11	.56
Soph. Funct Rate	3.22	.58	1.81	4.62	.00
Step 2					
Parent MLUm	4.59	.32	1.76	7.42	.00
Related Response %	2.14	.05	–6.46	10.75	.62

Note. mMLU = Mean Length of Utterance in Morphemes. $R^2 = .43$ for Step 1 ($F(3,56) = 16.63$, $p = .00$); $\Delta R^2 = .11$ for Step 2 ($\Delta F(2,54) = 6.39$, $p < .01$).

Parent communication characteristics had a greater affect on children's receptive language scores. For the MCDI receptive, the parent variables resulted in a change in R^2 of .04; however, this change was not significant $\Delta F(2,52) = 1.70$, $p = .19$ (see Table 10). Parent MLU in morphemes, $b = 31.55$, $\beta = 0.16$, $SE = 23.11$, $t = 1.37$, $p = .18$, did not reach conventional levels of statistical significance. This variable did, however, display a small effect on MCDI

receptive scores, as its individual R^2 was .03. The percent of utterances that were followed by a related response did not significantly predict MCDI receptive scores following intervention.

The parent communication variables accounted for an additional 11% of the variance present in SICD receptive scores, $\Delta F(2,54) = 6.39$, $p < .01$ (see Table 11). Parent MLU in morphemes, $b = 4.59$, $\beta = 0.32$, $SE = 1.41$, $t = 3.25$, $p = .00$, was responsible for the entirety of the variance accounted for in this step. This means that for every increase of one morpheme per utterance there was a corresponding increase in SICD receptive language age of 4.59 months. Parent related response percent did not significantly predict SICD receptive language outcomes. In sum, although related response percentage did not significantly predict receptive language ability, parent MLU in morphemes showed small to moderate effects in predicting scores on the MCDI receptive and SICD receptive assessments, respectively.

Discussion

The goal of the current study was two-fold: first, to provide a rich description of the communication characteristics of very young children with significant developmental disabilities and their parents, prior to their participation in a language intervention, and second, to establish the relationship between the communication characteristics of children and parents and child oral language outcomes following participation in an intervention. To this end, an observational coding scheme was employed to characterize the communication attempts of children and their parents during a 30-minute semi-structured baseline observation prior to participation in a language intervention. Following a 12-week language intervention, children's expressive and receptive oral language abilities were measured using two standardized language measures. Hierarchical regressions were conducted to determine the relationship between pre-intervention communication characteristics and post-intervention language performance.

Child Communication Characteristics and Language Performance

The hierarchical regression analyses indicated very strong relationships between baseline child communication characteristics and post-intervention oral language performance. The effect sizes reported were consistent with those reported by other studies that have investigated prelinguistic predictors of language development (i.e., Watt, Wetherby, & Shumway, 2006). Specifically, the use of sophisticated gestures and the use of higher rates of sophisticated functions predicted the development of receptive language as indicated by the MCDI and SICD language assessments for young beginning communicators. This finding is interesting as much language research for both typically developing children and children with developmental disabilities focuses only on the development of expressive language. The finding indicates that children who were using more sophisticated means to communicate with their caregivers, such as distal gestures and comments, prior to intervention understood spoken words to a greater extent following intervention than children who were using less sophisticated means to communicate prior to intervention. This may be because children who gesture to a greater extent and engage their parents with more sophisticated communication intents create opportunities for their parents to provide linguistic information that is both higher in quantity and quality. These findings support the results of other studies that have included receptive language development as a variable of interest (Brady et al., 2004; Sevcik, Romski, Watkins, & Deffebach, 1995; Watt et al., 2006; Yoder & Warren, 2004). Brady and colleagues (2004) found that children with disabilities who engaged others by pointing scored higher on a measure of receptive language. Warren and Yoder (2004) found significant correlations between number of child comments, number of child requests, and number of child communication attempts used at baseline and receptive language ability 6 months later. Likewise, Watt and colleagues (2006) found that

gesture usage early in the second year of life significantly predicted receptive language ability for 3-year-old typically developing children. The fact that gesture usage and pragmatic function predict receptive language has important implications for the intervention and remediation of language difficulties for children with disabilities. It provides a potential point at which professionals may intervene in the language development process to support greater understanding of language input (Romski & Sevcik, 1996; Sevcik, 2006; Sevcik & Romski, 1997); greater understanding of language on the part of the child has been found to be associated with the development of later expressive language (Sevcik & Romski, 1997).

Different child communication characteristic variables were found to predict the development of expressive language. The use of sophisticated gestures at baseline was predictive of vocabulary size following intervention, as reported on the MCDI. Neither word use nor pragmatic function rate were predictive of MCDI expressive scores. Conversely, sophisticated gesture usage was not predictive of SICD expressive language age (although it did have a medium effect size, $R^2 = .15$); word usage and pragmatic function rate, however, were predictive. The reason for this disparity between the two expressive language measures is not fully clear. What is clear is that the variability associated with the MCDI expressive scores was considerably large ($M = 61.22$, $SD = 83.94$). This high amount of variability calls into question any particular findings associated with the MCDI expressive scores. Furthermore, when investigating the standard errors associated with each of the child characteristic variables in the logistic regression model, it becomes clear that high variability was also an issue in this analysis (see Table 8). It may be the case that the high standard errors that resulted from the high variability in the MCDI expressive data made it very unlikely that any statistical significance would be found.

One potential reason why sophisticated gesture usage may have been significant for the MCDI expressive analysis, regardless of the high variability of the measure, may relate to the number of children in each cell of the original logistic regression analysis. Specifically, when examining the association between sophisticated gesture usage and MCDI scores from a descriptive perspective, only 1 of the 12 children who did not use sophisticated gestures during the baseline observation used more than 10 words on the MCDI expressive assessment following intervention. There is reason to believe that the X^2 associated with the logistic regression analysis may be unstable when a cell containing only one participant is present, particularly when one considers the relatively small sample size used for this analysis (Howell, 2002). Considering this, it is probably more appropriate to simply use the descriptive data just reported to guide decisions concerning the relationship between sophisticated gesture usage and expressive vocabulary size.

This issue notwithstanding, the results of the two expressive analyses are supported by previous research; for both typically developing children and children with disabilities. Bates and colleagues (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979) demonstrated many significant correlations between the use of gestures in young typically developing children and expressive language development over the course of a four-month observation. In addition, Mundy and colleagues (Mundy et al., 1995; Mundy et al., 1988) demonstrated that the number of nonverbal gestures used by children with Down syndrome was associated with expressive language such that children who used more gestures also exhibited greater amounts of speech 13 months later. Watt and colleagues (2006) also found that the number of words spoken, as recorded by laboratory observation, by children late in the second year of life significantly predicted expressive language performance for 3-year-old children.

The fact that children who used sophisticated functions at higher rates predicted expressive language age is also supported by previous research (Bates, 1979a; Iverson & Thal, 1998). In the current study, children who used sophisticated functions at high rates were answering their parents, directing their parent's attention, requesting, and commenting more with their parents (usually by vocalizing or gesturing) compared to children who used lower rates of sophisticated functions. It is likely that the increased occurrence of these behaviors provided more communicative opportunities upon which symbols (e.g., speech, visual-graphic symbols) could eventually be mapped. Taken together, the use of both of these more sophisticated prelinguistic communication characteristics (i.e., gestures and functions) may represent a readiness on the part of the child to progress to using symbols to communicate with their caregivers (Yoder & Warren, 1993; Yoder, Warren, & McCathren, 1998).

Parent Communication Characteristics and Language Performance

The effect sizes associated with the parent response variable (the largest was $R^2 = .01$) were in stark contrast to those related to the child communication characteristics. Contrary to expectations, parents who responded to their children with high proportions of related responses did not have children who performed better on any language measure following intervention. There are at least two potential explanations for this lack of findings.

The first explanation has to do with the observational coding scheme itself. It may be the case that the definition of a related response utilized in this study needs to be refined. The definition of related response utilized in this study was "an instance in which the child utterance being coded is followed by a parent utterance that is congruent with the topic of the child utterance." This was done to ensure that all instances in which the parent was following the child's line of interest were captured by the coding scheme. Consequently, this code probably

characterized many parental responding behaviors that did not specifically support the development of language. This result demonstrates that instances in which parents stay on topic with their children may not be sufficient to support language development on their own.

Some other research has used more restricted definitions of responsiveness. Specifically, Yoder and Warren (1998; 1999; 2001a; 2002) have restricted the definition of responsiveness to instances in which the parent utilizes linguistic mapping (recasting the child's non-verbal communication into words), compliance (complying with child's intentions), and vocal imitation (imitating the child's vocalization exactly or with slight modification). It is likely that if the coding scheme had been more restrictive, caregiver responsiveness may have significantly predicted language outcomes. This definitional issue notwithstanding, the result from this study demonstrates that it may not be sufficient for parents to simply stay on topic with their children in order to support language development for their children with disabilities; instead, it may be necessary for parents to specifically use linguistic mapping, compliance, and/or vocal imitation strategies to support language development in their children.

The non-significant parent response findings also may be explained by the fact that this study only characterized linguistic contingent responses to children's communicative acts (Yoder, Warren, McCathren et al., 1998). That is, parent utterances were only characterized as a response if they followed a communicative attempt from the child. This decision was made because the primary focus of the study was on how parent responses to child communicative attempts helped support the development of language. It may have been fruitful, however, to have examined instances in which the parent also performed a contingent linguistic response to the child's focus of attention. For example, there were many instances throughout the baseline observations in which the parent provided the child with linguistic input in situations where the

child was simply attending to an object and not clearly communicating with the parent (e.g., the child bangs a toy train on the table, to which the parent responds "that's a train"). Therefore, it may have been more developmentally appropriate to have considered also the role that parent responding to the child's focus of attention may have played in the development of early language. Furthermore, considering the communication profiles of the children who participated in this study and the concordant difficulty many of them had communicating with their parents, it seems likely that much of the linguistic information the children received from their parents was on occasions when the child did not initiate a communicative attempt, a point further evidenced by the fact that answering was one of the most frequently utilized pragmatic functions.

Although the response type that parents used, as coded by the observational coding scheme, did not significantly predict language outcomes, parent MLU in morphemes did. Specifically, children of parents who used more grammatically complex utterances at baseline had significantly higher receptive language ages following intervention. This finding implies that more complex speech input from the parent may foster greater understanding on the part of the child. This finding, however, is correlational in nature; therefore, it is impossible to determine causality for this relationship. To help explain this finding, the relationship between baseline receptive language scores and parent MLU in morphemes was investigated. The significant positive correlation ($r = .48$, $p < .01$) that resulted between parent mMLU at baseline and baseline SICD receptive language age implies that it is probably not the case that parent mMLU at baseline is exclusively driving higher receptive language scores following intervention. In fact, according to the transactional account of language development (McLean & Snyder-McLean, 1978), it is more likely that both parent mMLU and child receptive language ability drive increases in each other. It may be the case that parents of children who understand

more spoken linguistic input use more sophisticated language as a result of their child's greater understanding. This more sophisticated input may provide more linguistic experience for the child, which results in greater understanding of language. Interestingly, this is the first time that this pattern of influence from parent mMLU to child receptive language has been observed in very young children with intellectual disabilities, although similar patterns have been described for older children with intellectual disabilities (Sevcik et al., 1995).

Descriptive Information and Evidence for Differential Communication Profiles

In addition to providing insights into the relationship between child and parent communication characteristics and language outcomes, this study also provided a comprehensive description of the characteristics of communication for very young children with developmental disabilities. The fact that most of the child communication characteristics coded in the observational coding scheme had a severe positive skew may be indicative of a differential achievement of distinct milestones for children with disabilities in this sample. For instance, results indicated that, at baseline, 12 of the 60 children in the study were not using sophisticated gestures; these children showed no instances of distal gestures, representational gestures, or manual signs during the 30-minute baseline observation session. Additionally, 34 children did not use any words during the baseline observation session, though this is not surprising considering the inclusion criteria for the study. And finally, 21 of the 58 children for which MCDI data were available displayed 10 or fewer words on the MCDI expressive following intervention, thus showing no improvement in parental report of spoken expressive vocabulary after the intervention. Furthermore, as described previously, only 1 of the 12 children who did not use sophisticated gestures during the baseline observation used more than 10 words on the MCDI expressive following intervention. It was also the case that of the 25 individuals who

used at least one word during the baseline observation, only 3 scored 10 or fewer words on the MCDI following the intervention. These findings lend support to the idea that different communication profiles may exist even for very young children with significant disabilities, as they do for older individuals with significant disabilities (Romski & Sevcik, 1996; Sevcik & Romski, 1997). It may be the case that the children who did not use sophisticated gestures at baseline represent a group of "beginning achievers" as described by Romski and Sevcik (1996; Sevcik & Romski, 1997). The children in this study who fit this profile seem to have had considerable difficulty learning to speak new words and thus achieving the linguistic milestone of 50 first words, compared to the other children in the study.

Limitations and Future Directions

Because this study is correlational in nature, it is not possible to make any causal inferences with the results of this study. Furthermore, although the analyses performed in this thesis study are longitudinal in nature, they represent a relatively simple approach for answering questions about change over time. As a result of the two time-points taken into account in this thesis, it is difficult to know whether the observed changes in language by young beginning communicators were linear in nature as a function of time or followed a non-linear trajectory. Adding additional observations to the analyses would help to clarify the larger picture as it relates to the trajectory of language development for very young children who do not speak.

Additionally, a more complex design, such as a longitudinal design with multiple measurement points, is also necessary to determine whether some of the children in this study exhibited a "beginning achiever" profile described by Romski and Sevcik (1996; Sevcik & Romski, 1997). One potential way to do this is to determine if the communication characteristics displayed at baseline by the potential beginning achievers in this sample are present at many

subsequent points of observation. More specifically, it must be determined if children who did not use sophisticated gestures at baseline also were less likely to use them following intervention. By utilizing a methodology with multiple observations it would be possible to determine for what amount of time children displayed a beginning achiever profile. This methodology also would answer questions related to if and when children began to display evidence of breaking from the beginning achiever communication profile.

This study provided important information about communication development for young beginning communicators as it relates to child and parent communication characteristics. First, it showed that there is a clear connection between the communication characteristics of young children with developmental disabilities and their language outcomes following intervention. In addition, this study provided evidence for the transactional relationship between the parent mean length of utterance in morphemes and the development of receptive language abilities in children. Third, it demonstrated that the observational coding scheme utilized in this study can be a reliable and useful tool for characterizing children's communication characteristics. Consequently, this study may represent an important beginning point for future research that takes a more fine-grained longitudinal approach to characterize the communication development of very young children with developmental disabilities.

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Appendix

Observational Coding Scheme Definitions

Child Communication Characteristic Codes:

Mode: These codes characterize the modality of the communication attempt of the child

Manual Modality: This code characterizes the physical gestures the child uses communicatively

Physical Manipulation: is defined as an act of physically leading or guiding the communication partner in some way to gain an outcome

Contact Gesture: is defined as a communicative movement of the hands or arms that occurs when the child is in contact with the referent (e.g., showing or giving a toy to the parent)

Distal Gesture: is defined as a communicative movement of the hands or arms that occurs when the child is out of reach of the referent (e.g., pointing to a toy)

Representational Gesture: is defined as a communicative movement of the hands, arms, or face that is interpreted by the listener (parent and/or coder) as conveying symbolic content (e.g., nodding head yes; shaking head no)

Manual Sign: is defined as a movement of the hands or arms that is interpreted by the listener (parent and/or coder) as a conventional symbol or symbol approximation (e.g., American Sign Language)

Not Applicable: None of the above codes applies or no manual communication occurs

Vocal Modality: This code characterizes the vocal sounds the child uses communicatively

Vocalization: is defined as a sound or sequence of sounds that is not intelligible to the listener (parent and/or coder) as a word

Spoken Word: is defined as a sound or sequence of sounds that is understood by the listener (parent and/or coder) to be a word

Not Applicable: None of the above codes applies or no vocal communication occurs

Function: This code characterizes the pragmatic use of each child utterance

Affirming: is defined as agreeing with an utterance or confirming an utterance or behavior of the parent

Negating: is defined as objecting to the behavior or utterance of the parent or declining an object, action, or event

Imitating: is defined as repeating exactly or partially the parent's utterance

Naming: is defined as identifying an object or person spontaneously or in response to a "What's this" or "What are these" question

Answering: is defined as responding to a question or comment of the parent

Attention Getting: is defined as an attempt to gain the attention of the parent either to oneself, an object, or an event

Requesting: asking the parent for an object or to perform some action

Commenting: is defined as conveying information to the parent concerning some object, event, or another person

Not Applicable: any utterance that does not meet the definition of the defined function codes

Parent Communication Characteristic Codes:

Response Type: This code characterizes the parent response to the child utterance being coded.

No Opportunity to Respond: is defined as an instance in which the child utterance being coded is immediately followed by another child utterance or event that makes it impossible for the parent to respond

No Parent Response: is defined as an instance in which the child utterance being coded is not followed by a parent utterance within 5 seconds

Unrelated Parent Response: is defined as an instance in which the child utterance being coded is followed by a parent utterance that is not congruent with the topic of the child utterance

Related Parent Response: is defined as an instance in which the child utterance being coded is followed by a parent utterance that is congruent with the topic of the child utterance

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Adapted From Romski, M. A., & Sevcik, R. A. (1996). *Breaking the Speech Barrier: Language Development through Augmented Means*. Baltimore: Paul H. Brookes.