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Types of Parent Verbal Responsiveness That Predict Language in Young Children With Autism Spectrum Disorder

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Abstract

Purpose: This study examined short-term predictive associations between 5 different types of parent verbal responsiveness and later spoken vocabulary for 32 young children with a confirmed diagnosis of autism spectrum disorder (ASD).

Method: Parent verbal utterances were coded from videotapes of naturalistic parent–child play sessions using interval and event-based coding. A vocabulary difference score, calculated using the MacArthur Communicative Development Inventories (L. Fenson et al., 1993), was used as the outcome measure of spoken vocabulary 6 months later.

Results: Parent follow-in comments and follow-in directives predicted spoken vocabulary after controlling for child engagement. Parent expansions of child verbal utterances predicted spoken vocabulary after controlling for child talkativeness. When entered together into a regression analysis, metrics that represented (a) the number of parent utterances following into the child's focus of attention and (b) the number of parent utterances responding to child verbal communication acts both accounted for unique variance in predicting change in spoken vocabulary from Time 1 to Time 2.

Conclusion: Parent verbal utterances that follow into the child's current focus of attention or respond to child verbal communication acts may facilitate the process of early vocabulary acquisition by mitigating the need for children with ASD to use attention-following as a word-learning strategy.

Keywords

autism; parent responsiveness; vocabulary acquisition

The goal of the current study was to examine longitudinal associations between verbal language input provided by parents and spoken lexical status 6 months later for a group of preschool-age children diagnosed with autism spectrum disorder (ASD). Children with ASD who achieve meaningful, flexible, and frequent spoken language during the preschool years

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have better long-term outcomes than children who do not develop this type of spontaneous verbal communication (DeMyer et al., 1973; Gillberg & Steffenburg, 1987; Howlin, Goode, Hutton, & Rutter, 2004; Venter, Lord, & Schopler, 1992). Thus, improving spoken language is a priority for professionals who provide intervention services to young children with ASD.

A transactional model of development (Sameroff & Fiese, 2000) stresses the importance of reciprocal and bidirectional exchanges between child and environment as the context for early learning within the domains of language, social skills, and cognition. With regard to language development, this model suggests that the attainment of early language milestones can be facilitated by parents who are verbally responsive—that is, by parents who respond predictably and contingently to child signals, who follow into the child's current focus of attention, and who provide verbal input that is relevant to the child's current activity (Spiker, Boyce, & Boyce, 2002; Yoder, Warren, McCathren, & Leew, 1998) or "plan of the moment" (Girolametto, Weitzman, Wiigs, & Pearce, 1999, p. 365). The child's contribution to this bidirectional process is to provide attentional leads and communication acts to which parents can respond. Parent verbal responsiveness has been shown to predict early language learning for typically developing children (Bornstein, Tamis-LeMonda, & Haynes, 1999; Hoff & Naigles, 2002; Smith, Adamson, & Bakeman, 1988) as well as for children with developmental delays other than autism (Brady, Marquis, Fleming, & McLean, 2004; Mahoney, Boyce, Fewell, Spiker, & Wheeden, 1998).

Acquiring the meaning of new vocabulary words requires that children make a mapping, or associative pairing, between a label that is provided by a communicative partner and the object, action, or event to which this label refers (Carey & Bartlett, 1978). When the adult labels a referent to which the child is attending at the moment the new word is provided, a correct mapping can be established on the basis of temporal co-occurrence between label and referent (Baldwin, 1995). Opportunities for temporal contiguity between label and referent are likely to be maximized during episodes of coordinated joint engagement, when child and adult share a common focus of attention during play. Such episodes are considered to optimize the efficiency and accuracy of early word learning (Bakeman & Adamson, 1984). In naturalistic contexts, however, the task of early word learning is complicated by the fact that, when talking to their child, parents often do not make explicit the objects and events to which they intend to refer (M. Harris, Jones, & Grant, 1983). When a parent talks about a referent that is discrepant from his or her child's current focus of attention, accurate word learning can occur only if the child modifies his or her own visual focus and correctly identifies the parent's intended referent.

Following into the attentional focus of a communication partner, by interpreting social cues conveyed by eye gaze and/or gestures, is an especially important skill for early word learning because it enables children to learn new words even in situations where the correspondence between label and referent is not overtly obvious (Baldwin, Markman, Bill, Desjardins, & Irwin, 1996; Yoder, Kaiser, Alpert, & Fischer, 1993). This process often is difficult for children with ASD who experience challenges in attention-following. The construct of *attention-following*, also termed *responding to joint attention*, refers to the child's response to social–pragmatic cues (e.g., head turns, eye gaze, or distal points) that indicate the speaker's referential focus of attention (Baron-Cohen, Baldwin, & Crowson, 1997; McDuffie, Yoder, & Stone, 2006; Yoder & McDuffie, 2006). Deficits in attention-following are especially likely in children with ASD who have mental ages of less than 20 months (Leekam, Hunnisett, & Moore, 1998; Mundy, Sigman, & Kasari, 1994) and who are at the earliest stages of vocabulary development. In fact, a number of studies have confirmed the predictive association between attention-following and language outcomes for children with ASD (Bono, Daley, & Sigman, 2004; Charman et al., 2003; McDuffie, Yoder, & Stone, 2005; Mundy, 1987; Sigman & McGovern, 2005; Sigman & Ruskin, 1999; Sigman & Ungerer, 1984). Challenges in the development of attention-following make it less likely that young children with ASD will access sufficient incidental language input from communication partners to support adequate lexical development (Yoder & McDuffie, 2006).

Parents who provide verbal input at a time and in a way that allows their children to more optimally extract and process the linguistic information contained in this input may compensate for challenges to attention-following faced by young children with ASD. By following into the child's current focus of attention and providing language that is relevant to what the child is looking at, touching, playing with, or communicating about, the parent may lessen the cognitive and affective demands of coordinating attention to object and person during early word learning. Such a proposal is compatible with the transactional model of language development and is based on the premise that children can receive more processable linguistic input when parents follow into the child's current focus of attention, leading subsequently to enhanced spoken language outcomes. While verbal responsiveness often is targeted in interventions for children with ASD that include a parent-training component (Aldred, Green, & Adams, 2004; Fey et al., 2006; Girolametto & Weitzman, 2006; Yoder, McCathren, Warren, & Watson, 2001), there is limited empirical evidence identifying the specific types of parent verbal responsiveness that best support language learning for children with ASD.

For the current study, two broad categories of responsive verbal language input were identified as potential strategies to support word learning when used by parents of children with ASD. These categories can be distinguished based on the aspect of child behavior to which the parent responds. The first category, responsiveness to the child's focus of attention, includes parent utterances that refer to what the child is looking at or playing with just prior to the adult verbal response. The second category, responsiveness to child communication acts, includes parent utterances that are contingent on the child's preceding gestural or verbal acts of intentional communication. Both categories of parent verbal responsiveness support and maintain a triadic context in which parent and child share a referential focus. Theoretically, both types of parent language input should facilitate early lexical learning by making the correspondence between label and referent more explicit and by eliminating the need for young children with ASD to use attention-following as a word-learning strategy.

Responsiveness to the Child's Focus of Attention

Using a longitudinal correlational design with 25 children with ASD, Siller and Sigman (2002) demonstrated that parents who talked about their preschooler's focus of attention during play were more likely to have children with relatively high language skills as teenagers. These parents provided language input by following the child's lead and verbally interpreting the child's actions, without suggesting the child do something different with their toys. Siller and Sigman (2002) proposed that this type of language input was beneficial because it was synchronous with the child's focus of attention as well as undemanding relative to the child's actions. For the current study, this type of parent synchronous and undemanding talking is termed *follow-in commenting*.

Siller and Sigman (2002) failed to detect a positive association between parent verbal responses and later language when parent responses were synchronized with the child's focus of attention but included a request that the child change his or her ongoing behavior (although such an association was detected when ranked variables were used). For the current study, this type of parent utterance is termed *follow-in directing*. Despite the null findings of Siller and Sigman (2002), there is evidence to suggest that a positive association may exist between follow-in directives and later language.

In a review and interpretation of the literature examining the role of directives in early language development, McCathren, Yoder, and Warren (1995) proposed that adult language that communicates an expectation that the child do something may directly or indirectly support language development if the adult directive is one that follows into, rather than redirects, the child's current focus of attention. Empirically, directives have been shown to have a positive association with later language for children with Down syndrome (S. Harris, Kasari, & Sigman, 1996) and for typically developing infants (Akhtar, Dunham, & Dunham, 1991). Suggesting that a child change some aspect of his or her current behavior (without redirecting his or her attention) may be especially important for children with ASD who are likely to show restricted interest in objects and who may not explore objects in a productive manner (Bruckner & Yoder, 2007).

In an extension of their 2002 study, Siller and Sigman (2008) used multilevel modeling to examine rates of language growth, across approximately 3½ years, for a group of preschoolers with an autism diagnosis. In the 2008 study, Siller and Sigman employed two metrics of parent verbal responsiveness: utterances that were synchronized with the child's focus of attention and utterances that were synchronized with both the child's attention and play actions. Thus, parent utterances belonging to the former category would include both follow-in comments and follow-in directives, while the latter category would include only follow-in comments. Results of Siller and Sigman (2008) demonstrated that children's rate of language growth was predicted by the child's initial level of attention-following as well as by both measures of parent verbal responsiveness. However, the findings of Siller and Sigman (2008) do not reveal whether parent use of follow-in directives alone accounted for unique variance in predicting spoken language outcomes for young children with autism.

Thus, the current study examined two types of parent verbal responsiveness to the child's current focus of attention: (a) talking about the child's focus of attention without telling the child what to do (follow-in commenting) and (b) talking about the child's focus of attention while suggesting the child change some aspect of his or her play with the toys (follow-in directing). The critical distinction between follow-in commenting and follow-in directing rests in whether the parent verbally conveys an expectation for the child to alter his or her ongoing behavior.

Responsiveness to Child Communication Acts

One type of parent verbal responsiveness, contingent on child acts of intentional communication, is linguistic mapping (Yoder & Warren, 1998, 1999, 2001). *Linguistic mapping* provides language input by putting into words the presumed meaning of the child's immediately preceding prelinguistic communication act. When using linguistic mapping, the parent verbally encodes the child's gestural message using a noun, verb, or function word (Yoder et al., 1998). Parent use of linguistic mapping is associated with increased vocabulary in children with typical development (Goldin-Meadow, Goodrich, Sauer, & Iverson, 2007; Masur, 1981; Masur, Flynn, & Eichorst, 2005) and mediates the relationship between prelinguistic intentional communication and later spoken language for children with developmental delays other than autism (Yoder & Warren, 1999, 2001). For a group of typically developing toddlers who were followed from ages 10 to 24 months, Goldin-Meadow et al. (2007) demonstrated that parents who used linguistic mapping to respond to children's nonverbal communication acts had children with larger spoken vocabularies. We hypothesized that a similar association would be observed for a group of children with autism who were at a similar language level as that of the typically developing participants in Goldin-Meadow et al.'s study.

In addition to responding to gestural communication acts, parents also have the opportunity to respond to child verbal communication acts by repeating the child's words or by expanding the child's message. Sokolov (1993) suggested that repetitions of the child's previous utterance may function to maintain child attention and support comprehension. Similarly, temporal proximity between a child's utterance and the parent's expansion may scaffold child spoken language by allowing children to make a comparison between their own utterance and the more semantically or syntactically advanced adult utterance (Nelson, 1989; Scherer & Olswang, 1984; Yoder, Spruytenburg, Edwards, & Davies, 1995).

Thus, three types of parent responses to child communication acts were considered for the current study: (a) putting into words the presumed meaning of the child's immediately preceding communication act (i.e., linguistic mapping), (b) repeating the child's immediately preceding approximation of a word with adult pronunciation (i.e., repeating), and (c) adding words or grammatical structure to the child's immediately preceding spoken utterance (i.e., expansion). Although previous studies have examined the role of expansions on outcome measures of grammar or syntax (e.g., mean utterance length), the current study examined the predictive association between early parent expansions and children's later spoken lexical status.

Choice of a Metric for Verbal Responsiveness

Siller and Sigman (2002) reported that long-term gains in language for participants in their study were not correlated with the frequency of parent verbal behaviors or with the duration of child object-focused attention. Thus, these authors computed a complex proportion to represent their construct of synchronous and undemanding talking. The numerator of this metric was the frequency of parent synchronous and undemanding talking divided by the total number of parent verbalizations. The denominator of the metric was the duration of child toy-directed attention divided by the duration of the coded play sample, which consisted of four 30-s intervals for all children. A similar proportion metric was used for the analyses in Siller and Sigman (2008). One can imagine several reasons for utilizing such a metric. It is possible that children may tune out parents who talk a great deal and for whom verbal utterances that follow into the child's focus of attention represent only a small proportion of their total utterances. Additionally, children who are engaged less often would have fewer opportunities to receive language-facilitating input even if their parents were verbally responsive.

Compound proportions, however, are difficult to interpret and assume a positive linear association between the numerator and denominator (Cohen & Cohen, 1984), an assumption that was never tested in the Siller and Sigman studies. The consequence of computing complex proportions, when this assumption is not met, is an over-or underestimation of the construct of interest, depending on the specific pattern of correlations (Cohen & Cohen, 1984). We reasoned that later spoken language should depend on the absolute quantity of parent verbal input that is accessible to the child. Clearly, this quantity will depend on both parent and child, as the child must provide the opportunities for parent responses. Thus, the decision was made to employ number of parent utterances as the metric for each category of parent responsiveness used in the analyses for the current study.

Research Questions

This study examined the short-term longitudinal associations between several types of parent verbal responsiveness and later spoken vocabulary for a group of young children with autism. At the present time, only follow-in comments (Siller & Sigman, 2002) and a composite variable including both follow-in comments and follow-in directives (Siller & Sigman, 2008) have been found to predict later language for this group of children. The current study examined the following research questions:

1. Are there significant bivariate associations between the five types of parent verbal responsiveness and later lexical status?

2. Which types of parent verbal responsiveness account for unique variance in predicting later lexical status?

Method

Participants

Thirty-two children (27 boys and 5 girls) with a diagnosis of ASD (29 with autistic disorder and three with pervasive developmental disorder-not otherwise specified [PDD-NOS]) participated in the current study. These children represented a subset of participants in a randomized treatment study for whom a play sample at the appropriate time point was available for coding. Participants met the following inclusion criteria prior to entry into the treatment study: (a) clinical diagnosis of autism or PDD-NOS; (b) chronological age between 18 and 60 months; (c) evidence of using fewer than 10 non-imitative, spoken words across three communication sampling contexts—the Early Social Communication Scales (Mundy, Hogan, & Doehring, 1996), a 15-min unstructured free-play session with an examiner, and a 20-min unstructured free-play session with the parent; (d) no evidence of severe sensory or motor impairment; and (e) English as the primary language spoken in the home.

At the pretreatment assessment, participants had received a clinical diagnosis of autism or PDD-NOS from a licensed psychologist with extensive experience in early identification of children with ASD. Module 1 of the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000) was administered at the pretreatment by a graduate student in clinical psychology who had completed research reliability training for this module. All participants received ADOS scores consistent with a diagnosis of autism (i.e., total score on the Communication and Social Interaction scales equal to or greater than 12). For the treatment study, participants had been randomly assigned to one of two treatment conditions ($n = 16$ for both): the Picture Exchange Communication System (PECS; Bondy & Frost, 1994) or Responsive Education and Prelinguistic Milieu Teaching (RPMT; Yoder & Warren, 1998, 2001, 2002). Both interventions were implemented by trained clinicians with sessions held three times a week for 20 min. The intervention program lasted for 6 months. Descriptive information for the participants is presented in Table 1.

Treatment Description

PECS—A communication intervention developed for children with ASD, PECS uses a series of treatment phases and prompting procedures to teach children to communicate by giving a picture of a desired object to a message recipient. During the intervention project, the PECS curriculum was followed and implemented by two trained speech-language pathologists. To increase the likelihood of across-person generalization, the clinicians exchanged roles as message recipient and physical prompter once a child reached criteria on a particular phase. The parent component of the PECS treatment involved demonstration and discussion of ways to promote the use of PECS outside of the treatment setting. See Yoder and Stone (2006) for further details regarding implementation of PECS.

RPMT—A communication intervention developed to increase intentional communication in young children with developmental delays, RPMT focuses on establishing object-focused play routines that then serve as the context for prompting and rewarding children’s use of requesting behaviors. The RPMT clinician also models the use of gestures in declarative contexts. In the RPMT treatment condition, a primary clinician worked with the child 2 days a week, and a secondary clinician worked with the child once per week, to encourage across-person generalization. When children used at least one spontaneous act of requesting and initiating joint attention per minute during the treatment session, milieu language teaching was used to target spoken language goals (Warren, 1991). The parent component of the RPMT condition involved teaching parents to use play routines to prompt and reward communication behaviors outside of the treatment setting. See Yoder and Stone (2006) and Yoder and Warren (1998) for further details regarding the implementation of RPMT.

Overview of Design and Procedures

This study used a longitudinal correlational design. As part of the larger study, participants received intervention sessions three times weekly for 6 months, and measurement procedures were completed at three time points: pretreatment, posttreatment (i.e., after 6 months of treatment sessions), and 6-month follow-up (i.e., 6 months following the end of treatment sessions). Data for the current study were derived from measurement sessions at the posttreatment time point (Time 1 for the current study) and the 6-month follow-up visit (Time 2 for the current study). However, diagnosis, cognitive testing, and administration of the ADOS were completed at the pretreatment time point, and these results are included in Table 1 to provide a fuller description of the sample.

The parent responsiveness variables were coded from an unstructured, parent–child play session conducted at the postintervention time point (i.e., Time 1 for the current study). A parent report measure of spoken vocabulary was collected at Time 1 and at the 6-month follow-up (i.e., Time 2 for the current study). The preintervention measurement period was not used to represent Time 1 because one of the interventions in the randomized comparison included a parent education component in which parents learned responsive interaction strategies. Because one or both of the treatments could affect the association between parent verbal responsiveness and later language, the associations of interest were measured during a time period when parent behavior and child communication were not targeted by project interventions.

Procedures

ADOS—The ADOS is a semistructured instrument that is used to provide a 30- to 45-min context for the standardized measurement of communication, social interaction, and play for individuals who are suspected of ASD. The ADOS consists of four modules, and the module that is administered is selected based on the participant's developmental and language level. Each module of activities is designed to provide a context within which the types of behaviors that are relevant to a diagnosis of autism are likely to be elicited. Each ADOS module yields a diagnostic algorithm—based on the Diagnostic and Statistical Manual of Mental Disorders (4th ed.; American Psychiatric Association, 1994)—that allows classification of the tested individual as meeting the criteria for autism or ASD.

MacArthur Communicative Development Inventories (CDI)—The CDI (Fenson et al., 1993), a widely used parent report instrument, was used to assess vocabulary comprehension and production. The Words and Gestures subscale (CDI:WG) contains a vocabulary checklist of 396 words typically acquired by children exposed to American English between 8 and 16 months of age. None of the participants reached the ceiling level in number of words understood or spoken, indicating that the CDI: WG was developmentally appropriate for this group of children. CDI raw scores were used as the metric for the size of comprehension vocabulary at Time 1 and size of spoken vocabulary at Time 2. PECS symbol use was not included in the spoken vocabulary totals at Time 2.

Unstructured free-play session with parent—This 20-min procedure was used to measure parent use of the two broad categories of verbal responsiveness. Parents were allowed to select five toys from a larger set and were given the following instructions: “We are interested in what it is like when you try to join your child in doing the things that he or she likes. We are also interested in how he or she will communicate with you during this time.” After the first 10 min, parents were allowed to change toys, if desired. Definitions and examples of the parent variables coded from this procedure are summarized in Table 2.

Coding and Reliability

The parent–child play sample at Time 1 was video-taped, captured into digital format, and coded using ProcoderDV (Tapp, 2003), a software system that allows frame-by-frame coding of observational data from digital media. Fifteen minutes of each parent–child play sample was coded for the five variables representing parent verbal responsiveness. In addition, the following two variables also were coded: (a) the number of intervals during which the child demonstrated active engagement with the toys and (b) the number of child communication acts. After coding, data files were exported into MOOSES (Multi-Option Observation System for Experimental Studies) software (Tapp, Wehby, & Ellis, 1995) for calculation of cumulative frequencies. Details of the coding process are provided in the following paragraphs.

Responsiveness to child’s focus of attention—Two types of verbal responsiveness to the child’s focus of attention (i.e., follow-in comments and follow-in directives) were coded using a 5-s interval coding procedure that yielded 180 intervals for each play sample. Coding these behaviors involved two separate passes through the media files. In the first step, each 5-s interval was coded for child productive engagement with objects using a mutually exclusive and exhaustive coding system. Intervals were coded as *engaged*, *not engaged*, or *uncodable*. Intervals were considered *uncodable* if the child was crying during the interval, if the child’s body was offscreen during the interval, or if the coder could not see the object the child was looking at or playing with. During a 5-s interval that was coded as “engaged,” the child was required to show at least 2 consecutive seconds of active object-focused engagement. To be judged as actively and productively engaged, the child was required to be looking at, actively manipulating, or talking about an object. The child was not judged to be actively engaged if he or she was engaged in perseverative, self-stimulatory, or compulsive use of an object.

During the second pass through the media file, all intervals during which the child was judged to be productively engaged were examined to determine whether the parent talked about the child’s focus of attention during these intervals. The parent was considered to use a follow-in comment if he or she (a) talked about the child's focus of attention, (b) did not tell the child what to do, (c) did not convey an expectation that the child communicate about his or her focus of attention, and (d) provided the child with lexical information, in the form of grammatical words, about the object or event that represented the child's focus of attention (e.g., the child drops the blue ball down the marble chute, and the parent says, "The blue ball is rolling down!"). Follow-in commenting was not coded if the parent utterance redirected the child's attention in any way. A parent utterance could be considered a follow-in comment, even if an object label was not included, as long as the utterance provided lexical information (e.g., " You've got them all now!").

The parent was considered to use a follow-in directive if he or she (a) talked about the child's current focus of attention and (b) instructed the child to change some aspect of his or her action with the toy. This could involve doing something different with the same toy (e.g., the child is pushing the blue truck, and the parent says, "Make the blue truck stop!") or doing the same action with a different toy (e.g., the child puts a horse piece in a puzzle, and the parent says, "Now put the pig in!"). Questions that required a verbal response from the child were not considered to be follow-in directives (e.g., "What is that?"). Parent utterances were coded as *other talking* if the utterance did not meet the definition of a follow-in comment or a follow-in directive. Finally, intervals with no talking or containing unintelligible parent utterances were also coded.

Responsiveness to child communication acts—Responsiveness to child communication acts used a frequency coding procedure and also required two passes through the digitized media file. On the first pass, child acts of intentional communication were identified using the coding conventions specified in Yoder and Fey (2006). A *child intentional communication act* was defined as the nonprompted production of (a) a real word (containing at least one consonant and one vowel) that labeled an object present in the play context; (b) a conventional sign; (c) a gesture accompanied by a look to the adult (e.g., head nod or shake, wave, clapping, "shh" or blowing a kiss gesture, shoulder shrug, moving an object toward the adult, reaching, or distal or proximal pointing); (d) a gesture that intrinsically showed coordinated attention to the object and adult (e.g., approaching with upturned palm, giving, or showing); (e) a nonword vocalization accompanied by a look to the adult; or (f) handing a PECS symbol or strip to the parent.

During the second pass through the media file, the file was examined to determine whether a parent verbal response occurred within 3 s of each child act of intentional communication. A parent verbal response that occurred within 3 s of a nonverbal communication act was coded as *linguistic mapping* if the adult put the presumed meaning of the child's communication act into words by labeling the referent, verb, or function word implicit in the child's act. A parent verbal response that occurred within 3 s of a verbal communication act was coded as a *repeat* if the adult provided an adult model of the child's utterance or as an *expansion* if the adult added linguistic information to the child's spoken utterance. (Additional details about both the interval and frequency coding procedures are available from the first author.)

Interobserver reliability for 20% of the play samples was calculated using *g* coefficients. According to Suen and Ary (1989), *g* coefficients with values above .6 are considered acceptable. Reliability between two coders across seven randomly selected samples was uniformly above .80 for the following variables: engaged and unengaged intervals, follow-in commenting, follow-in directives, no talking, other talking, child verbal and nonverbal communication acts, linguistic mapping, repeats, and expansions.

Analysis Methods

Multivariate permutation testing (Pesarin, 2001; Yoder, Blackford, Waller, & Kim, 2004) was used to control for experiment-wise error while identifying statistically significant bivariate correlates between the parent responsiveness variables and later spoken vocabulary. This method adjusts the alpha (.05 in this case) based on the intercorrelation of predictors with the criterion variable. A simulation study has shown this method to be less conservative than the Bonferroni approach and effective in controlling for experiment-wise error due to multiple significance testing (Yoder et al., 2004).

Examination of the bivariate correlations was followed up with a series of regression analyses to determine whether any of the parent variables was a unique predictor of spoken vocabulary. If the multivariate permutation tests indicated that three or more types of parent verbal responsiveness predicted spoken vocabulary, we planned to create aggregate variables by summing across empirically associated and conceptually similar component variables (Rushton, Brainerd, & Pressley, 1983). The criterion level of empirical association used was equivalent to what Cohen and Cohen (1984) term a " large" bivariate association (i.e., $r \geq .37$). Conceptual similarity was based on whether the adult utterance was responsive to the child's focus of attention or to child communication acts. Summing across component variables was justifiable because the coding categories were mutually exclusive within behavior sampling methods (i.e., interval vs. event-based). Additionally, the same type of behavior sampling method was used for all component variables that represented conceptually similar types of parent verbal responsiveness (i.e., all variables that represented responsiveness to child focus of attention were sampled using interval coding, and all variables that represented responsiveness to child communication acts were sampled using event-based coding). One-tailed *p* values were used in the regression analyses because all predictions were for positive associations between the measures of parent responsiveness and later language.

Results

Descriptive Statistics

Table 3 presents the descriptive statistics for the coded variables, including those representing parent verbal responsiveness. It is clear that children were productively engaged during most of the intervals and that a substantial frequency of child communication acts occurred during the parent–child interaction. That is, on average, parents had opportunities to use verbally responsive strategies to follow into their child's focus of attention and to respond to child communication acts. However, there also was much individual variability in the frequency with which children provided their parents with opportunities for verbal responsiveness.

Bivariate Correlations Between Parent Responsiveness and Spoken Vocabulary

Table 4 presents the association of the putative predictors and control variables with spoken vocabulary. Spoken vocabulary was positively associated with both types of parent utterances that followed into the child's focus of attention (follow-in comments and follow-in directives). As expected, a positive association was not observed between spoken vocabulary and the two control variables (i.e., no talking and other talking). Spoken vocabulary also was positively associated with two of the three types of parent responsiveness to child communication acts (i.e., repeats and expansions). Contrary to expectations, linguistic mapping at Time 1 did not predict spoken vocabulary at Time 2.

Unique Predictors of Spoken Vocabulary

A series of stepwise linear regression analyses was conducted to determine which of the parent responsiveness variables that had been identified as significant bivariate correlates of later spoken vocabulary also were unique predictors. To control for spoken vocabulary at Time 1, the outcome measure for these regression analyses was a spoken vocabulary difference score computed by subtracting spoken vocabulary at Time 1 from spoken vocabulary at Time 2. Child engagement was entered as a covariate into the two regression analyses examining the unique contribution of follow-in comments and follow-in directives to later vocabulary. Similarly, child verbal communication acts were entered as a covariate into the two regression analyses examining the unique contribution of repeats and expansions to later spoken vocabulary. In each regression model, the covariate was entered into the analysis at the first step, followed at the second step by the parent responsiveness variable appropriate to that analysis.

After controlling for child engagement, follow-in commenting was a significant predictor of change in spoken vocabulary, $t = 1.97$, $p < .02$, one-tailed, R^2 change = .14. Similarly, follow-in directives were a significant predictor of change in spoken vocabulary after controlling for child engagement, $t = 1.95$, $p < .03$, one-tailed, R^2 change = .11. Finally, when engagement, follow-in commenting, and follow-in directives were entered stepwise into a regression analysis predicting change in productive vocabulary, neither follow-in commenting nor follow-in directives accounted for unique variance over and above the other type of parent responsiveness to the child's focus of attention. Child engagement did not account for significant variance in predicting change in spoken vocabulary in any of the three regression models.

After controlling for the number of verbal utterances that child participants produced, parent repeats of child utterances no longer accounted for unique variance in predicting change in spoken vocabulary, $t = -0.98$, $p < .17$, one-tailed, R^2 change = .03. Parent expansions of the participant's verbal utterances continued to account for a small but significant proportion of unique variance in predicting spoken vocabulary, after controlling for number of child verbal utterances, $t = 1.70$, $p < .05$, one-tailed, R^2 change = .07.

Conditional effects of treatment—Potential effects of the treatments on the relationship between the parent responsiveness variables and later spoken vocabulary were evaluated. For these analyses, the parent responsiveness variables that were unique predictors of spoken vocabulary (i.e., follow-in commenting, follow-in directives, or expansions) were entered into separate regression analyses along with the dummy coded treatment group variable and a product term representing the Group Assignment × Parent Responsiveness interaction. As continuous predictors, the parent responsiveness variables were centered to reduce multicollinearity between the lower order and interaction terms (Aiken & West, 1991, pp. 37–38). For the regression examining the Group × Follow-In Commenting interaction, $t = -1.55$, $p < .13$, two-tailed, R^2 change = .06. For the regression examining the Group × Follow-In Directives interaction, $t = 0.359$, $p < .72$, R^2 change = .003. For the regression examining the Group × Expansions interaction, $t = 1.07$, $p < .29$, R^2 change = .02. Thus, for all analyses, the interaction term failed to reach significance, indicating that the interventions did not moderate the predictive association between the parent variables and later spoken language.

Intercorrelation of conceptually similar and significant predictors—The two measures of verbal responsiveness to the child's focus of attention (follow-in comments and follow-in directives) were significant individual predictors of spoken vocabulary. In addition to being conceptually similar, these variables also were highly related. Therefore, these two variables were aggregated by summing to limit the number of predictors entered into the regression analysis that addressed the second research question. Aggregating multiple measures of the same construct provides a more stable and representative estimator of the construct than does a single measurement (Rushton et al., 1983). In addition, aggregating the conceptually similar variables reduced the number of predictors entered into the regression analysis relative to the number of participants in the current study. The intercorrelations of the proposed predictor and control variables are presented in Table 5.

When controlling for child engagement, parent verbal responses to the child's focus of attention, $t = 2.02$, $p < .03$, one-tailed, R^2 change = .10, and parent expansions, $t = 2.53$, $p < .01$, one-tailed, R^2 change = .15, both accounted for significant unique variance in change in spoken vocabulary outcomes, with medium effect sizes. Similarly, when controlling for the number of child verbal utterances, parent verbal responses to the child's focus of attention, $t = 1.85$, $p < .04$, one-tailed, R^2 change = .08, and parent expansions, $t = 1.69$, $p < .05$, one-tailed, R^2 change = .06, both accounted for moderate and unique variance in predicting change in spoken vocabulary outcomes.

Discussion

This longitudinal correlational study examined the predictive associations between several categories of parent verbal responsiveness with later spoken vocabulary for a group of young children who had been diagnosed with ASD. One broad category of parent utterances followed into the child's current focus of attention during play, while the second broad category responded to the child's nonverbal or verbal communication acts. Within the category of verbal responses to the child's focus of attention, parent follow-in commenting was a unique predictor of later spoken vocabulary when controlling for the amount of time children spent actively and productively engaged with objects. Given a difference in the metrics employed to represent the construct of follow-in commenting, this finding partially replicates Siller and Sigman's (2002) finding that parent use of synchronous and undemanding talking during the preschool years predicted spoken language outcomes 10 years later for children with autism.

The current study used the frequency of parent follow-in comments as the predictor while covarying child engagement in the analysis, as compared with Siller and Sigman's (2002) use of a compound proportion (i.e., a ratio divided by a ratio). The difference in the metrics used in the two studies is nontrivial and deserves examination in future studies. The current study did not employ a proportion metric for several reasons. If a proportion metric increases, there is no way to know whether this increase is the result of the numerator increasing or the denominator decreasing (Johnston & Pennypacker, 1993). In practice, a correlational finding involving a proportion metric that predicts later language could not guide treatment implementation because it would not be clear whether the treatment goal should focus on increasing the behavior in the numerator or decreasing the behavior in the denominator. Finally, consider the case in which a parent produces six total verbal utterances of which three are responsive (proportion = .5), and compare that with the case in which a parent produces 50 total verbal utterances of which 25 are responsive (proportion = .5). In this instance, very different absolute amounts of parent input could appear identical.

The frequency metric used in the current study was based on the premise that it is the absolute amount, and not the proportion, of processable language input received by the child that supports subsequent language acquisition. Parent verbal input that follows into the child's current focus of attention can be considered optimally processable, relative to language input that introduces new topics or redirects the child's focus of attention, because such input is presented at a time and in such a way as to increase the probability that the child will uptake such input. To avoid possible disadvantages of a proportion metric and because it is clear that some readers would want to know whether the observed associations could be solely driven by individual differences in children's attentional focus or communication, the current study statistically controlled for differences in the parent's opportunity to respond by entering a covariate (i.e., the number of 5-s intervals during which the child was actively engaged or the number of child verbal communication acts) into the corresponding regression equations.

A positive association with spoken vocabulary also was observed for parent utterances that followed into the child's focus of attention during play, even if these utterances directed the child to change his or her current toy-related action. While both follow-in comments and follow-in directives can be considered to be "synchronous," only the former type can be considered to be "undemanding." In the current study, follow-in directives accounted for as much variance in later spoken vocabulary as did follow-in comments. This finding does not necessarily contradict the findings of Siller and Sigman (2002), as these authors observed a significant association between total caregiver synchronized verbalizations (i.e., both nondirective and directive parent utterances) and spoken language when this association was analyzed using Spearman's ranked order correlation. The finding of the current study raises the question of whether the non-obligatory distinction within the broader category of follow-in talking is a necessary component of effective verbal input to children. For young children with ASD, the critical feature of parent verbal utterances that facilitate later spoken language development may be whether the parent utterance maps onto the child's current focus of attention. Such utterances would make the associative pairing between label and referent more explicit and would take advantage of temporal contiguity as a passive support to facilitate accurate and efficient word learning. Children with ASD—who are likely to have restricted interests in objects and who may not have a diverse repertoire of play actions—may benefit from parent follow-in requests to modify some aspect of their current behavior.

Within the category of verbal responses to child communication acts, the current study found a positive bivariate association between parent use of both repeats and expansions with later spoken language. The association between repeats and later language was attributable to child talkativeness, as the number of repeats was no longer a unique predictor of spoken vocabulary when controlling for the number of child verbal utterances. Expansions, on the other hand, continued to predict unique variance in later vocabulary over and above the contribution of child verbal utterances. One may speculate that expansion provides the language-learning child with both semantic and grammatical information about new words and the ways in which they can be used in connected speech.

A regression analysis revealed that both broad categories of responsiveness accounted for unique variance in predicting spoken vocabulary. This finding is important because it indicates that during periods of development and at moments when a child is not communicating, parents may verbally respond to the child's focus of attention as a language facilitation strategy. The parent need only follow the child's lead in play and describe what the child is doing or playing with. At times when the child does verbally communicate, the parent may use expansions as language facilitation strategies.

The effectiveness of either type of parent verbal responsiveness for enhancing spoken language development for children with autism will depend on opportunities for the parent to provide these types of input. For example, opportunities for parents to provide follow-in comments or follow-in directives depend on the frequency or length of time during which the child explores, manipulates, or engages in actions with a variety of objects. Similarly, the opportunity for parents to respond to child communication acts depends on the frequency with which the child directs these bids to the parent. Thus, children who demonstrate higher levels of sustained, productive object engagement should have better language outcomes because their parents have more opportunities to provide follow-in talking. Using a similar logic, children who produce more acts of intentional communication should have better language outcomes because their parents have more opportunities to provide contingent verbal utterances. Such a transactional explanation for language learning is supported by studies demonstrating a positive association between both intentional communication (McDuffie et al., 2005; Stone & Yoder, 2001; Toth, Munson, Meltzoff, & Dawson, 2006; Yoder & Stone, 2006) and object play (Toth et al., 2006; Sigman & Ruskin, 1999; Yoder, 2006) with later language for children with ASD.

Limitations of the Study

The current study is characterized by at least two limitations that are present in many correlational studies of language in young children with autism: (a) a reliance on parent report measures of vocabulary and (b) the possibility that a third variable could account for the observed associations.

It is possible that parents who are responsive also would notice their children's behavior better than parents who are nonresponsive. This type of correlated measurement error could potentially account for the associations. However, the primary argument for using a parent report measure is that such a tool draws upon the parent's vast knowledge of the child's behavior rather than relying upon an unfamiliar, one-shot assessment. In the comprehension domain, parent report is virtually all we have in the way of psychometrically sound measures of vocabulary for children with developmental ages below 24 months. Replication of the current findings with direct observation measures of vocabulary would strengthen our confidence that the associations indicate what types of parental utterances are processable by children with autism.

As in all correlational studies, other variables (some of which may be unmeasured) may be responsible for the observed associations (i.e., the third variable explanation). One common third variable explanation is that initial levels of spoken language at Time 1 may be driving the associations of interest. Controlling for Time 1 language in the present study was inadvisable because the intercorrelation between Time 1 language and the putative predictors would surely have rendered the associations of interest nonsignificant. Disregarding the observed associations because of this Time 1 intercorrelation among language and putative predictors may have resulted in reduced attention to potentially important facilitative factors. Experimental studies that manipulate the predictors are necessary to determine whether parent linguistic responsiveness facilitates spoken vocabulary in children with autism.

Clinical Implications

Results of the current study suggest that children with ASD may benefit when responsive parents use verbal strategies that follow into and maintain the child's current focus of attention. These strategies include talking about the child's focus of attention and responding contingently to child verbal communication acts. The potential benefits of such strategy use are suggested by Adamson, Bakeman, and Deckner (2004), who examined parent–child interaction for toddlers with typical development during episodes of *symbol-infused supported joint engagement*, a triadic state in which the child is engaged actively with an object while the parent uses verbal utterances that follow into and maintain the child's focus of attention (Adamson et al., 2004). While Adamson et al. did not measure the absolute amount of verbal input children received during the interaction, it is clear that verbal input represents a defining feature of this state of child engagement. Relative to the current study, the critical feature of symbol-infused supported joint engagement is that the child does not contribute actively to the maintenance of the triadic interaction but is the passive recipient of the linguistic information provided by the parent.

Adamson and colleagues (2004) expected to find a positive association between later language and time spent in coordinated joint engagement (in which the child plays an active role in maintaining a triadic interaction by switching attention between the adult and an object). Instead, these researchers observed that, after controlling for initial language and cognitive status, the amount of time children spent receiving verbal language input within the context of supported joint engagement at 18 months of age predicted unique variance in receptive and expressive vocabulary at 30 months. Adamson and colleagues proposed that the provision of verbal language input during episodes of supported joint engagement creates a “privileged” context for language learning. A goal of the current study was to quantify the amount of language that children received while they were actively engaged with objects and while the parent was providing verbal input based on the child’s focus of attention. The conceptual and theoretical similarities between the construct of symbol-infused supported joint engagement and our measures of follow-in verbal responsiveness suggest an explanation for the facilitative effect of parent utterances that follow into the child’s focus of attention during play.

By maintaining a triadic engagement state, parent talking that follows into the child’s focus of attention can enhance the process of pairing labels with objects, actions, and events. It is of clinical importance to continue this line of research to maximize our ability to teach parents how best to facilitate language development in young children with autism. Presumably, parent use of follow-in talking should facilitate vocabulary understanding as well as the productive use of spoken words. Passive measures of comprehension, such as eye tracking, may allow future studies to investigate whether and how parent verbal responsiveness can support the growth of lexical understanding for children with autism.

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Table 1

Descriptive characteristics of the participants ($N = 32$).

Measure	*M*	*SD*	Range
ADOS[a]			
Communication[b]	6.06	1.16	4–8
Social Interaction[c]	11.22	1.75	7–14
Cognitive standard score[a,d]	51.38	5.49	48–67
Time 1 CA (in months)	40.65	8.62	27–60
Time 1 vocabulary comprehension	155.47	103.67	13–371
Time 1 vocabulary production	52.96	65.75	0–232
Time 2 CA (in months)	46.63	8.61	32–67
Time 2 vocabulary comprehension	199.34	114.13	15–393
Time 2 vocabulary production	105.19	107.26	0–343

Note. ADOS = Autism Diagnostic Observation Schedule (Lord et al., 2000); CA = chronological age.

[a]Administered at pretreatment period.

[b]Autism cutoff = 4.

[c]Autism cutoff = 7.

[d]Mullen Scales of Early Learning (Mullen, 1992).

Table 2

Definition and examples of the parent responsiveness variables.

Code	Definition	Example
	Responsiveness to child's focus of attention	
Follow-in commenting	Frequency of 5-s intervals of child active, object-focused engagement during which the parent provided verbal language that followed into the child's current focus of attention and described what the child was looking at or playing with, without conveying the expectation that the child do something different or respond verbally to the parent.	Child plays with toy piano. Parent: "Pretty music!" Child feeds baby. Parent: "Baby is hungry!" Child pushes truck up ramp. Parent: "Red truck is going up!" Child watches parent hammer ball. Parent: "Mommy is pounding."
Follow-in directive	Frequency of 5-s intervals of child active, object-focused engagement during which the parent provided verbal language that followed into the child's current focus of attention and conveyed a request that the child change some aspect of their play with the toys.	Child is holding ball. Parent: "Roll the ball to me!" Child puts horse in barn. Parent: "Now, put the cow in the barn!"
	Responsiveness to child communication acts	
Linguistic mapping	The frequency with which the parent responded verbally to child nonverbal acts of intentional communication by putting into words the noun, verb, or qualifier that represents the presumed meaning of the child's act.	Child reaches for red ball with look to parent. Parent: "You want the *red* ball!" Child shows cow to parent. Parent: "Brown cow!"
Repeat	The frequency with which the parent responded verbally to child acts of spoken communication by repeating all or part of the child's previous utterance.	Child: "Big ball." Parent: "Big ball." Child: "My hat." Parent: "Hat."
Expansion	The frequency with which the parent responded verbally to child acts of spoken communication by adding semantic or grammatical information to the child's previous utterance.	Child: "Ball." Parent: "Yellow ball." Child: "Up." Parent: "Car is going up." Child: "Eat." Parent: "Baby is eating."

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Table 3

Mean frequencies of child engagement, child communication acts, and parent responsiveness.

Variable	*M*	*SD*	*Range*
Engaged intervals	138.75	28.88	68–175
Unengaged intervals	30.25	26.60	2–107
Uncodable intervals	11.66	14.78	1–78
Parent follow-in comments	28.91	19.71	1–78
Parent follow-in directives	29.69	13.80	4–63
Parent other talking	31.84	12.89	2–59
Parent no talking	39.28	27.83	2–114
Child gestures	6.50	8.56	0–35
Child gesture + speech combinations	2.09	3.54	0–14
Child spoken utterances	16.68	19.54	0–71
Parent linguistic mapping	3.56	5.35	0–22
Parent repeats	9.34	10.88	0–44
Parent expansions	1.06	1.38	0–5

Table 4

Longitudinal correlations between Time 1 predictors or control variables with Time 2 spoken vocabulary.

Time 1 predictor	Time 2 spoken vocabulary
Parent verbal responsiveness to child focus of attention	
Follow-in comments	.47*
Follow-in directives	.44*
Parent verbal responsiveness to child communication acts	
Linguistic mapping	.17
Repeat	.62*
Expansion	.71*
Control variables	
Other talking	.07
No talking	−.28

* $p < .05$ after adjusting for multiple significance testing via multivariate permutation testing.

Table 5

Intercorrelations among the parent responsiveness and control variables.

Time 1 variable	1	2	3	4	5	6	7
Parent verbal responsiveness to child focus of attention							
1. Follow-in comments	—						
2. Follow-in directives	.42*	—					
Parent verbal responsiveness to child communication acts							
3. Linguistic mapping	.51**	.07	—				
4. Repeat	.27	.20	.05	—			
5. Expansion	.26	.29	−.04	.67**	—		
Control variables							
6. Other talking	.26	.31	.21	.14	−.09	—	
7. No talking	−.51**	−.67**	−.28	−.21	−.19	−.29	—

* $p < .05$, two-tailed.

** $p < .01$, two-tailed.