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Research Article

Parent Telegraphic Speech Use and Spoken Language in Preschoolers With ASD

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Purpose: There is considerable controversy regarding whether to use telegraphic or grammatical input when speaking to young children with language delays, including children with autism spectrum disorder (ASD). This study examined telegraphic speech use in parents of preschoolers with ASD and associations with children's spoken language 1 year later.
Method: Parent–child dyads (n = 55) participated when children were, on average, 3 (Time 1) and 4 years old (Time 2). The rate at which parents omitted obligatory determiners was derived from transcripts of parent–child play sessions; measures of children's spoken language were obtained from these same transcripts.
Results: Telegraphic speech use varied substantially across parents. Higher rates of parent determiner omissions at Time 1 were significantly associated with lower lexical diversity in children's spoken language at Time 2, even when controlling for children's baseline lexical diversity and nonverbal IQ. Findings from path analyses supported the directionality of effects assumed in our regression analyses, although these results should be interpreted with caution due to the limited sample size.
Conclusions: Telegraphic input may have a negative impact on language development in young children with ASD. Future experimental research is needed to directly investigate how telegraphic input affects children's language learning and processing.

Clinicians and researchers use the term *telegraphic speech* to describe the developmental stage during which young children produce primarily content words (e.g., *Ball go*, *Daddy jump, Want cup*) in their spontaneous spoken language (Brown, 1973). Because of its focus on content, telegraphic speech often omits adjectives, articles, and other grammatical morphemes—similar to the concise messages contained in telegrams decades ago (Van Kleeck, Schwarz, Fey, Kaiser, & Weitzman, 2010). Although telegraphic speech is a natural stage of child language acquisition, there is considerable controversy over whether parents and clinicians should speak telegraphically to young children, especially those with delayed language development, including children with autism spectrum disorder (ASD). Understanding how telegraphic input affects language development in children with ASD is particularly important because many autism intervention approaches explicitly incorporate the use of telegraphic speech for teaching language (e.g., Lovaas, 2003; Maurice, Green, & Luce, 1996).

In our experience, the topic of telegraphic speech can incite considerable debate; some clinicians strongly recommend its use, whereas others argue passionately against it. Even expert clinical researchers remain divided on this issue (van Kleeck et al., 2010). Proponents of telegraphic speech argue that it is beneficial because it simplifies language processing, facilitates verbal imitation, and focuses children's attention on the relationship between semantic elements (e.g., agent–action; van Kleeck et al., 2010; Wolfe & Heilmann, 2010). Others argue that telegraphic speech is detrimental because morphosyntactic features of language provide useful information about the structure of language and the meaning of words, and omitting these features may put children at a disadvantage (Bedore & Leonard, 1995; Bredin-Oja & Fey, 2014; Fey, 2008; Fey, Long, & Finestack, 2003; van Kleeck et al., 2010). Our study informs this debate by investigating telegraphic speech use by parents of preschoolers with ASD and the association with their children's spoken language development. To our knowledge, this is the first study to investigate this issue.

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Defining Telegraphic Versus Grammatical Simplified Speech

Adults naturally simplify their speech when interacting with young children—most often by shortening the length of their utterances. Because shortened utterances presumably ease processing demands, simplified input is a primary component of many child language interventions. The clinical controversy surrounding this issue, then, is not whether parents and clinicians should simplify their language when interacting with young children with language delay, but how it should be simplified. Language can be simplified in one of two ways—grammatically or telegraphically. Grammatical simplifications are shorter than typical adult utterances, but they do not violate grammatical rules (e.g., *Mommy goes*, *Put it in*, *The cup is full*). Telegraphic simplifications, on the other hand, break the grammatical rules of English. For example, without the information in brackets, the following utterances—*Mommy go[es]*, *Put [it] in*, and *[The] cup [is] full*—all contain clear grammatical errors (for further discussion, see Fey, 2008; van Kleeck et al., 2010).

Challenges to Making an Informed Decision About Telegraphic Speech

When faced with such a debate, how should clinicians and parents decide whether to speak telegraphically? Evidence-based practice guidelines state that research evidence should inform treatment decisions alongside clinical expertise and client/family preferences (Dollaghan, 2007). Research on telegraphic input is extremely limited, however, so there is little empirical data on which speech-language pathologists (SLPs) and other professionals can base their clinical decisions and recommendations for parents (and themselves). In 2010, van Kleeck et al. conducted a meta-analysis of intervention and processing studies examining the effects of telegraphic versus grammatical input. The three relevant intervention studies, which were conducted on children with moderate to severe intellectual disability (Fraser, 1972; Jones, 1978; Willer, 1974), found no impact of telegraphic versus grammatical input on children's comprehension; one study with a limited sample size (n = 10; Willer, 1974) found a positive effect of telegraphic input on language production in children with intellectual disability. The processing studies included in the meta-analysis (Fernald & Hurtado, 2006; Kedar, Casasola, & Lust, 2006; Lew-Williams & Fernald, 2007) suggested that grammatical input was generally more favorable than telegraphic input for typically developing children, but the quantity and quality of research on children with language impairment were extremely limited. Thus, van Kleeck et al. concluded, "Given the small amount of research designed to examine the effects of telegraphic versus grammatical input in clinical populations, the overall weakness of that research, and the lack of consistent findings favoring either type of input, we clearly cannot base the clinical use of [telegraphic input] with young children with language impairments on research findings to date" (van Kleeck et al., 2010, p. 14). Notably, the meta-analysis identified no relevant studies that included children with ASD.

Arguments for and Against Telegraphic Speech

Although empirical data are limited, there are several theoretical arguments to be made about the potential benefits or drawbacks of telegraphic speech. One argument made in support of telegraphic speech is that it may allow children to imitate adult models more easily (van Kleeck et al., 2010). For example, a child who says *car* may be more likely to imitate the simpler utterance, *Car drive*, than the more complex utterance, *The car drives.* The study by Willer (1974) supported this hypothesis, but more recent evidence has suggested that telegraphic input may have a negative impact on children's imitation. Using a single-case alternating treatment design, Bredin-Oja and Fey (2014) found that three of five participants with language delay imitated more grammatical morphemes when presented with grammatical models than with telegraphic models. The authors concluded that telegraphic prompts are not advantageous and may actually discourage the imitation of grammatically correct utterances in children who are developmentally ready to produce them. Contrary to the hypothesis that telegraphic input emphasizes the relationship between semantic elements of language (e.g., agent–action), the number of child responses containing semantic relationships did not significantly differ between the telegraphic and grammatical conditions.

Another argument made in favor of telegraphic speech is that presenting only the "most important" words in an utterance—content words—makes it easier for children to process spoken language and learn new words (Wolfe & Heilmann, 2010). In line with this hypothesis, Plunkett, Munakata, and Johnson (2006) found that presenting isolated words was beneficial for word recognition in 17-month-old infants (also see Trehub & Shenfield, 2007), and a case study by Wolfe and Heilmann (2010) showed a slight advantage for vocabulary learning in a telegraphic input condition. However, other research has shown that inclusion of determiners facilitates language processing in typically developing children by allowing them to anticipate upcoming content words (Fernald & Hurtado, 2006; Kedar et al., 2006; Lew-Williams & Fernald, 2007). For example, 18- and 24-month-old infants in one study (Kedar et al., 2006) heard four different types of sentences: grammatical (e.g., *Can you see the ball?*); nonsense (e.g., *Can you see el ball?*); other English function word (e.g., *Can you see and ball?*); and omitted determiner (e.g., *Can you see _ ball?*). Infants in both age groups were significantly faster to process nouns in the grammatical condition than in the other three conditions. The authors concluded that "although infants could presumably have processed the manipulation of a single determiner as only a trivial change in the sentence's overall structure and meaning, our results show that this manipulation was by no means trivial for infants in processing the linguistic input and in determining reference" (Kedar et al., 2006, p. 334).

In addition to its positive effects on verbal imitation and language processing, grammatical input may facilitate word learning. Grammatical structure (e.g., verb endings, plural markers, determiners) provides statistical and linguistic cues about language (Mintz, 2003; Mintz, Newport, & Bever, 2002), and children can use those cues to learn the meanings of new words—a process known as syntactic bootstrapping (Gleitman, 1990). A classic study by Brown (1957) illustrates this point: When asked to point to pictures of *sibbing*, *a sib*, or *some sib*, preschoolers reliably identified pictures of an action, an object, and a substance, respectively. The only way children could have identified the correct meaning was by using information from the morphosyntactic features: *-ing*, *a*, and *some.* Although most studies of syntactic bootstrapping have focused on typically developing children, recent work has shown that some children with ASD are also capable of learning new words through syntactic bootstrapping (Naigles, Kelty, Jaffery, & Fein, 2011; Shulman & Guberman, 2007). These findings indicate that, in some circumstances, children with ASD can take advantage of information contained in the grammatical structure of language. However, when grammatical information is removed—as in the case of telegraphic speech—the probabilistic and linguistic information it provides is also removed, so children can no longer take advantage of the potential benefits offered by grammatical input.

Telegraphic Speech and Autism Intervention

Understanding how ungrammatical input relates to language learning and processing in children with ASD is important because telegraphic speech is a component of many autism interventions delivered by clinicians and/or parents, suggesting that children with ASD may be exposed to telegraphic input more frequently than other children. For example, telegraphic speech is a common strategy in behavioral interventions such as the Lovaas approach, a discrete trial training (DTT) intervention based on applied behavior analysis (Lovaas, 1981, 2003; Maurice et al., 1996) that is often recommended for young children with ASD (Lord & Bishop, 2010). In fact, telegraphic speech is so strongly associated with behavioral treatment that this style of speaking has been called the "Lovaas accent" (Siegel, 2003). Although some contemporary DTT approaches may be less likely to incorporate telegraphic speech (Leaf & McEachin, 1999; Sundberg & Partington, 1998), many traditional DTT approaches focus primarily on content words, especially for young children with limited language skills. In a traditional DTT approach, children might be given commands such as *Put in*, *Throw ball*, *Touch nose*, or *Turn on light*, or they may be asked questions, such as *Where's bottle?* Similarly, children may be taught to comment or request by saying, *I see cookie* or *I want eat* (Lovaas, 1981, 2003; Maurice et al., 1996). Importantly, grammatical models may be introduced only after children have mastered content words: "The separate words *I*, *want*, *play*, and *to* can be expanded to the sentence *I want play* and later to *I want to play*" (Lovaas, 2003, p. 216). The result of this hierarchical progression is that children with ASD who have limited language skills may not be exposed to grammatical input in a clinical context until it is the direct focus of therapy. Although telegraphic speech is perhaps most prominent in traditional behavioral treatments, it has also been incorporated into other types of intervention approaches for children with ASD, including naturalistic behavioral approaches (e.g., enhanced milieu teaching; Hancock & Kaiser, 2006) and developmental/social–pragmatic, parent-mediated approaches (e.g., Hanen's *More Than Words*; Sussman, 1999; see Discussion).

The Current Study

Although many discussions of telegraphic speech center on the bound morphemes required for subject–verb agreement (e.g., third person singular *–s*), this study focused on determiners (e.g., articles, possessive pronouns) omitted from noun phrases in which they were obligatory—that is, required by the grammatical rules of English. We focused on determiner omissions because object nouns are some of the earliest words learned by young children, and the way that parents talk about objects is directly related to children's language development (Hani, Gonzalez-Barrero, & Nadig, 2012; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010).

Determiners may facilitate word learning by providing information about nouns as a lexical category (Lany & Saffran, 2010). In grammatical input, determiners often precede nouns; in fact, *the* is immediately followed by a noun up to 93% of the time in speech directed to typically developing young children (Thorpe & Fernald, 2006). When a child encounters a new word preceded by *the*, the new word is likely to be a noun, which places constraints on its meaning (e.g., it is not likely to be an action). The presence of a determiner can also signal the type of noun it precedes, which provides additional cues to word meaning. Children as young as 2 years of age can use the presence of articles to differentiate proper nouns from common nouns, which helps them to correctly generalize newly learned words (Gelman & Taylor, 1984; Katz, Baker, & Macnamara, 1974).

Following are examples of shortened utterances that are either telegraphic or grammatical, with obligatory determiners indicated in bold:

Telegraphic simplification	Grammatical simplification
Eat cookie	*Eat* ***the*** *cookie*
Truck drives	***My*** *truck drives*
See hat?	*See* ***this*** *hat?*

The utterances on the right are simplified in a manner consistent with the grammatical rules of English, whereas the utterances on the left are missing obligatory determiners. Differentiating telegraphic versus grammatical speech is not always this straightforward, however—particularly in the case of isolated nouns. Some clinical researchers have considered article omissions to be telegraphic (van Kleeck et al., 2010), whereas others have viewed isolated nouns as grammatical because they are merely pared down to their simplest form. The current study focused primarily on determiner omissions in phrases, because these omissions clearly produced telegraphic speech; however, isolated nouns were also identified, which allowed for separate analyses of these two types of parent input.

Parent omissions of determiners in noun phrases were examined when children were on average 3.5 years of age (Time 1) and 4.5 years of age (Time 2). Two different measures of children's spoken language abilities were examined: number of different words (NDW), a measure of lexical diversity, and mean length of utterance (MLU), a measure of grammatical complexity. The primary question we addressed was this: Does parent rate of determiner omissions relate to the lexical diversity or grammatical complexity of children's spoken language, either concurrently or longitudinally? We predicted that parents who used more determiner omissions would have children with lower spoken language abilities, both concurrently and 1 year later.

Method

Participants

Children with ASD who participated in the current study were part of larger longitudinal studies of children with ASD at two university sites: Boston University and the University of Wisconsin–Madison. In both studies, children were seen for annual evaluations that included language, cognitive, and social communication assessments, as well as naturalistic parent–child language samples. Evaluations took place in child-friendly testing spaces at the research centers.

Toddlers with suspected or confirmed ASD diagnoses were initially recruited from a variety of sources, including early intervention programs, physicians, clinics, and community resources. Children were excluded if they had known chromosomal abnormalities (e.g., Down syndrome, fragile X syndrome), cerebral palsy, seizure disorder, uncorrected hearing or vision impairments, physical disability, or frank neurological insult. Parents provided written consent for children's participation, and all study procedures were approved by the university institutional review boards at both sites. Participants in the current study were those who participated in parent–child play samples with the same parent at mean age 3.5 years (Time 1) and at mean age 4.5 years (Time 2; see Table 1). Twenty-four children did not produce enough language to derive MLU and NDW values (see "Parent-Child Language Samples"), resulting in a group of 55 children used in the analyses (n = 22 from Wisconsin and n = 33 from Boston). The sample included 51 boys and 4 girls.

Assessments

Best-estimate ASD diagnoses were determined by experienced clinicians who integrated clinical expertise with findings from the Autism Diagnostic Observation Schedule (Lord, Rutter, DiLavore, & Risi, 2002) or the Autism Diagnostic Observation Schedule-Toddler Module (ADOS-T; Luyster et al., 2009), and a toddler research version of the Autism Diagnostic Interview-Revised (Rutter, LeCouteur, & Lord, 2003). The toddler versions of these assessments were included because children were initially diagnosed at a mean age of 2.5 years in the Wisconsin sample; diagnoses were reconfirmed at subsequent visits.

Children completed the Mullen Scales of Early Learning (Mullen, 1995) at Time 1. Nonverbal ratio IQ (NVIQ) scores were derived by calculating the mean of each child's Visual Reception and Fine Motor age-equivalent scores, dividing the mean age-equivalent score by their age in months, and multiplying by 100 (Bishop, Guthrie, Coffing, & Lord, 2011; see Table 1 for mean NVIQ); there was no significant difference in mean NVIQ between the two sites, $t(52) = 0.18$, $p = .86$.

Parent–Child Language Samples

Parent–child dyads took part in naturalistic, play-based language samples at Time 1 and Time 2 using a standard set of toys at each site (e.g., a farm set, Mr. Potato

Table 1. Description of child variables.

Characteristic	*M* (*SD*)	Range
Time 1		
Age in months	42.09 (5.26)	31–53
NVIQ	92.48 (21.91)	52–169
NDW	5.35 (2.24)	1.82–11.13
MLU	2.27 (0.55)	1.17–3.75
Number of utterances	98.02 (46.05)	29–234
Number of utterances per minute	6.51 (2.98)	2.13–15.60
Time 2		
Age in months	54.22 (5.37)	43–66
NDW	8.36 (3.06)	1.89–19.02
MLU	3.11 (0.70)	1.29–5.19
Number of utterances	102.35 (38.28)	27–200
Number of utterances per minute	7.37 (2.53)	2.22–13.33

Note. NVIQ = nonverbal ratio IQ scores obtained from the Mullen Scales of Early Learning (Mullen, 1995). NDW = mean number of different word roots per minute. MLU = children's mean length of utterance.

Head set, play tea set). Parents were told to play with their child as they normally would at home. Samples were video-recorded and transcribed at a later time. On average, the play samples lasted 15.02 min at Time 1 (SD = 2.00 min) and 13.84 min at Time 2 (SD = 1.75 min). Trained research assistants transcribed all parent and child utterances from video using Systematic Analysis of Language Transcripts software (Miller, Andriacchi, & Nockerts, 2011). Utterances were segmented on the basis of falling/rising intonation and/or the presence of a pause. Transcription agreement for the broader study at the Wisconsin site was conducted on 10% of transcripts at each time point. Two aspects of interrater agreement were examined: morphological agreement (e.g., the number of morpheme additions, deletions, and changes) and utterance segmentation agreement (e.g., the number of changes in segmentation). At both Time 1 and Time 2 at the Wisconsin site, morpheme agreement was 94%, and segmentation agreement was 96%. Specific data on transcription reliability at the Boston site were not available due to the use of a consensus transcription approach. That is, all transcripts were prepared by one transcriber and independently checked by a second transcriber; the two transcribers then discussed and resolved any disagreements (see Condouris, Meyer, & Tager-Flusberg, 2003). As described later herein, coding agreement values for the dependent variables of interest within the transcripts are reported for both sites.

Because the full sample (n = 79) had included children with a wide range of expressive language abilities, it was necessary to specify the minimum number of utterances a child must have produced in order to calculate MLU and NDW. In general, the validity of these measures would be expected to increase with an increasing number of utterances, and previous studies of children with ASD examining spontaneous language samples have used or recommended a minimum of 100 utterances (Eigsti, Bennetto, & Dadlani, 2007; Tager-Flusberg et al., 2009). However, applying the 100-utterance criterion to the current study would have excluded over 70% of the participant sample at each time point, producing results that were generalizable only to the subgroup of children with ASD with relatively good language and communication skills. A recent study of typically developing children found good internal consistency for MLU across language samples lasting only 1, 3, and 7 min (Heilmann, Nockerts, & Miller, 2010), and a study of 3-year-old children with a range of language abilities found acceptable reliability for NDW and a measure of grammatical complexity for samples between 7 and 10 min (Guo & Eisenberg, 2015). In addition, recent research assessing spoken language in young children with ASD derived MLU from approximately 30 utterances (Kover, Davidson, Sindberg, & Ellis Weismer, 2014). Given these findings, we included children who produced at least two complete and intelligible utterances per minute at Time 1 and Time 2 (n = 55). The 55 children for whom MLU and NDW were calculated produced an average of 98.02 total utterances (SD = 46.05) at Time 1. At Time 2, children produced an average of 102.35 total utterances (SD = 38.28). Full descriptive information is provided in Table 1.

We derived two measures of child spoken language from the transcribed play samples: MLU and NDW. Utterances with unintelligible segments were excluded because inclusion of these utterances may have yielded artificially low MLU. In addition, the intelligibility of children's speech increases with age, which could result in a differential effect of intelligibility at Time 1 versus Time 2; avoiding this issue was important because we conducted analyses that included child spoken language variables at both time points. Following standard procedures, MLU was calculated by dividing the total number of morphemes children produced by their total number of utterances. Morphemes were defined as the smallest units of meaning; examples of single morphemes include single words (e.g., *boat*, *drive*); bound morphemes (e.g., third person singular *–s*, plural *–s*); and names and animal sounds (e.g., *Mr Potatohead*, *Cockadoodledoo*). NDW was calculated by deriving the total number of different word roots each child produced and dividing that number by the length of the play sample to account for slight differences in timing across participants. Table 1 presents information about children's MLU and NDW values at both time points.

Identifying Parent Determiner Omissions

A coding system was developed to identify omissions of determiners from noun phrases in all parent verbal utterances. Noun phrases were not coded if the part of the sentence directly preceding the noun was unintelligible, because, in these cases, it was not possible to tell whether a determiner was omitted. Because parents rarely omitted determiners when they talked about objects that were imaginary or absent from the room (for the full sample, parents presented on average 0.18 determiner omissions for absent/imaginary objects at Time 1, and 0.06 at Time 2), this study focused only on noun phrases that described objects in the room. Each object noun phrase was assigned a code on the basis of the presence or omission of a determiner in an obligatory context. Determiners included articles (*a*, *an*, *the*), possessive pronouns (e.g., *my*, *his*), deictic determiners (e.g., *this*, *that*), and quantifiers (e.g., *some*, *two*). Determiners were not considered obligatory for proper, mass, or plural nouns because the grammatical rules of English do not require them.

Five randomly selected transcripts (5% of the total participant sample) were independently coded by one trained coder from each site; the transcripts selected were spread across the period of time during which coding occurred. Conducting the coding agreement required the sites to switch transcripts, so the coders were necessarily aware of which transcripts were used for agreement. Transcripts were compared line-by-line, and any disagreements regarding the coding of determiner omissions were recorded. Agreement was 95.9% for identification of noun phrases and omissions. Kappa (a measure of intercoder agreement after accounting for chance; Cohen, 1960) for determiner omissions was

.81, which represents “almost perfect” agreement (Landis & Koch, 1977).

Next, the determiner omissions were categorized on the basis of whether they were isolated nouns without determiners or omissions within a longer phrase. Subdividing determiner omissions in this way allowed us to separately analyze isolated words and determiner omissions in phrases; we return to this issue in the Discussion. The total number of determiner omissions in phrases was summed and divided by the total number of utterances, yielding a proportion. The total number of isolated nouns was summed and divided by the total number of utterances produced by each parent. These variables accounted for parent talkativeness because they took into account the total number of utterances that parents produced; however, it is also possible to derive these variables on the basis of frequency by dividing the total numbers by sample length instead of number of utterances. Although additional research is needed to determine the difference between the relative number versus the absolute amount of determiner omissions, the two variables were highly correlated in this study ($r > .95$); only the results of the proportion variables are presented here.

The parent speech variables were positively skewed; however, the distributions remained highly skewed after the data were log-transformed. Raw data were used to facilitate interpretation. Using a criterion of more than 2 *SD* above the mean, eight cases were identified as potential outliers for word and/or phrase omissions at Time 1 and Time 2. Results of the correlation and regression analyses are presented both before and after these cases were removed.

Results

We first characterized how often parents omitted determiners from noun phrases. On average, parents omitted obligatory determiners once per 100 utterances at both time points (see Table 2). Parents produced isolated nouns on average once per 100 utterances at Time 1 and 0.20 times per 100 utterances at Time 2. The style of input varied considerably across parents; although many parents did not produce any instances of isolated nouns or determiner omissions in phrases, one parent produced four single words per 100 utterances and another produced 25 determiner omissions per 100 utterances.

We next addressed the question of whether parent determiner omissions were related to two measures of children’s spoken language: grammatical complexity (MLU) and lexical diversity (NDW). First, we calculated correlations among parent and child speech variables; second, we conducted regression analyses to test the prediction that parent telegraphic speech at Time 1 would predict child spoken language at Time 2, even when controlling for children’s baseline spoken language and nonverbal cognition; and finally, we conducted path analyses that entered both parent and child variables at each time point into a single model. The path analyses were conducted to lend support to the directionality of effects assumed in the regression analyses; because of the limited sample size, the results of these analyses should be interpreted cautiously.

Table 3 presents the correlations between parent omissions of determiners in phrases and children’s spoken language (MLU and NDW). Correlations are presented for the full group of children ($n = 55$), as well as for the group of children after outliers were removed ($n = 47$). The concurrent correlations between parent and child variables were significant (or marginally significant) for the full group, indicating that parents who used a higher rate of single words and determiner omissions in phrases had children with lower MLU or NDW at the same point in time. However, concurrent correlations were nonsignificant for the group of $n = 47$ children. Time 1 parent phrase omissions were significantly correlated with Time 2 NDW, and this correlation remained significant even after outliers were removed. Child MLU and NDW were significantly correlated both concurrently and longitudinally. Parent use of determiner omissions in phrases was not significantly correlated across the two time points. Table 4 presents the correlations between parent use of isolated nouns and child spoken language. Parent use of isolated nouns was significantly correlated with child MLU at Time 1 and at Time 2 for the full group of $n = 55$ children, but it was not significantly correlated with NDW; the longitudinal correlations

Table 2. Description of parent variables.

Characteristic	*M* (*SD*)	Range
Time 1		
Number of utterances	225.78 (69.82)	110–433
Number of determiner omissions in phrases per 100 utterances	1.20 (1.46)	0–7.12
Number of isolated nouns per 100 utterances	0.63 (0.85)	0–3.56
Time 2		
Number of utterances	206.38 (66.78)	99–365
Number of determiner omissions in phrases per 100 utterances	1.01 (3.44)	0–25
Number of isolated nouns per 100 utterances	0.20 (0.45)	0–2.70

Note. Determiner omissions were identified in object noun phrases in which a determiner was obligatory according to the grammatical rules of English. Isolated nouns were object nouns that did not have a determiner, but that would have required one in a longer phrase.

Table 3. Correlations between parent phrase omissions and child spoken language.

Variable	Time 1 parent phrase omissions	Time 2 parent phrase omissions	Time 1 child MLU	Time 1 child NDW	Time 2 child MLU
Time 2 parent phrase omissions	.14 *.13*				
Time 1 child MLU	−.26⁺ *−.21*	−.07 *−.03*			
Time 1 child NDW	−.26⁺ *−.23*	−.18 *−.17*	.71** *.69***		
Time 2 child MLU	−.18 *−.17*	−.42** *−.12*	.41** *.39***	.56** *.58***	
Time 2 child NDW	−.41** *−.41***	−.37** *−.23*	.37** *.31**	.58** *.53***	.72** *.65***

Note. The group of n = 55 children is presented on the top of each cell. The group of n = 47 is presented on the bottom of each cell in italics. Determiner omissions were identified in object noun phrases in which a determiner was obligatory according to the grammatical rules of English. MLU = children's mean length of utterance. NDW = mean number of different word roots per minute.

*p < .05; **p < .01; ⁺p < .10.

between Time 1 parent isolated nouns and Time 2 child MLU and NDW were nonsignificant.

Next, we conducted regression analyses to determine whether parent telegraphic speech at Time 1 predicted child language at Time 2 and whether this relationship would hold over and above the effects of children's baseline spoken language and developmental level. Based on our theoretical framework and the results of the correlational analyses, we focused only on parent phrase omissions and child NDW in these analyses. The independent variable was Time 1 parent determiner omissions in phrases, and the dependent variable was Time 2 child NDW. Linear regression was used because the dependent variable approximated a normal distribution. Time 1 parent omissions significantly and negatively predicted Time 2 child NDW (see Table 5 and Figure 1), indicating that parents who produced higher rates of telegraphic speech when children were 3.5 years old had children with lower NDW at age 4.5 years. Parent determiner omissions in phrases accounted for 16.2% of the variance in later child NDW. A one percentage point increase in parent determiner omissions at Time 1 was associated with approximately one fewer different word per minute produced by a child at Time 2. Importantly, Time 1 parent determiner omissions remained a significant unique predictor of Time 2 child NDW even after accounting for baseline child NDW and developmental level. Results of the regression analyses were unchanged for the subgroup of children with outliers removed (n = 47).

To support the directionality of effects represented in our regression models, we applied a series of path analyses using Mplus Version 7.3 (Muthén & Muthén, 2012). These analyses were run only with the full sample of children for whom NDW had been calculated (n = 55); there were problems with model convergence when analyses were conducted with the subgroup of children with outliers removed (n = 47). Two different models were tested (see Figure 2 and Figure 3). Model 1 included paths from parent determiner omissions to child NDW both concurrently and longitudinally. Paths from Time 1 to Time 2 child NDW, and from Time 1 to Time 2 parent phrase omissions were

Table 4. Correlations between parent isolated nouns and child spoken language.

Variable	Time 1 parent isolated nouns	Time 2 parent isolated nouns
Time 2 parent isolated nouns	−.07 *.03*	—
Time 1 child MLU	−.31* *−.10*	−.17 *−.13*
Time 1 child NDW	−.18 *−.07*	−.12 *−.04*
Time 2 child MLU	−.19 *−.08*	−.33* *−.09*
Time 2 child NDW	−.13 *.19*	−.18 *.03*

Note. The group of n = 55 children is presented at the top of each cell. The group of n = 47 is presented at the bottom of each cell in italics. MLU = children's mean length of utterance. NDW = mean number of different word roots per minute.

*p < .05.

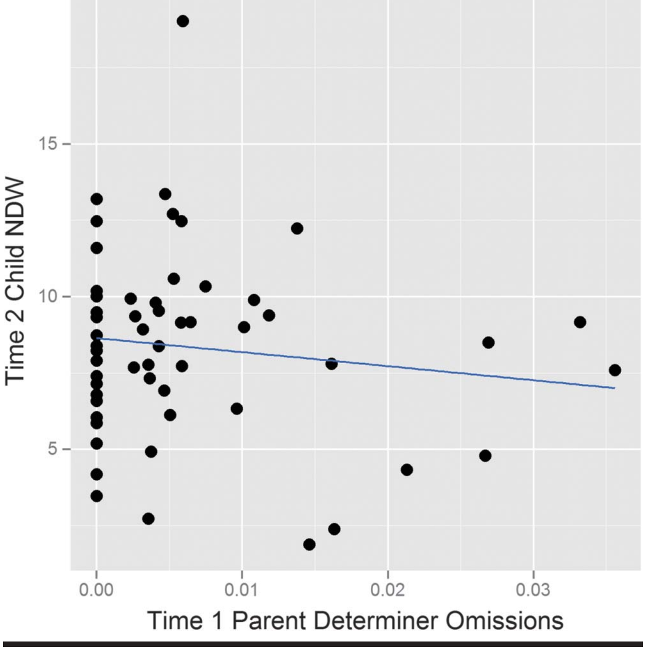
Table 5. Regression analyses.

Block	R^2	F	df	b	SE b	b*	p
Block 1	.16	10.28	1, 53				
Constant				9.37	0.50	−.40	< .001**
T1 parent determiner omissions				−84.32	26.30		.002**
Block 2	.40	17.55	2, 52				
Constant				5.32	0.98		< .001**
T1 parent determiner omissions				−56.28	23.24	−.27	.02*
T1 child NDW				0.70	0.15	.51	< .001**
Block 3	.42	11.81	3, 50				
Constant				4.49	1.59		.007**
T1 parent determiner omissions				−53.94	23.57	−.26	.03*
T1 child NDW				0.67	0.17	.49	< .001**
T1 child NVIQ				0.01	0.02	.08	.53

Note. Parent determiner omissions were calculated by dividing the total number of noun phrases with an omitted obligatory determiner by the total number of utterances that parents produced. Statistics: *df* = regression degrees of freedom, residual degrees of freedom; *b* = unstandardized beta coefficients; *SE b* = the standard error of unstandardized beta coefficients; *b** = standardized beta coefficients. NDW = mean number of different word roots per minute; NVIQ = nonverbal ratio IQ scores obtained from the Mullen Scales of Early Learning (Mullen, 1995). Results are presented for the group of *n* = 55 children; results were unchanged for the group of *n* = 47 children with outliers removed. T1 = Time 1.

$^*p < .05$; $^{**}p < .01$.

Figure 1. The relationship between Time 1 rate of parent determiner omissions in noun phrases and Time 2 child number of different words (NDW), a measure of lexical diversity. Parent determiner omissions were calculated by dividing the total number of noun phrases with an omitted obligatory determiner by the total number of utterances that parents produced. NDW represents mean number of different word roots per minute. Parents who produced a higher rate of determiner omissions when children were 3.5 years old (Time 1) had children with lower NDW at age 4.5 years old (Time 2). Parent determiner omissions accounted for 16% of the variance in later child NDW.



also included. Model 2 included paths from child NDW to parent determiner omissions both concurrently and longitudinally. Paths from Time 1 to Time 2 child NDW, and from Time 1 to Time 2 parent phrase omissions were also included. Thus, the primary difference between the models was that Model 1 included paths from parent to child, representing directional effects from parent language to child language, whereas Model 2 included paths from child to parent, representing directional effects from child language to parent language. We predicted that Model 1 would provide a better comparative fit to the data and that there would be a significant path from Time 1 parent

Figure 2. A visual depiction of the path model representing directional effects from parent language to child language (Model 1). Standardized estimates are presented for each path (* *p* < .05). Parent determiner omissions were calculated by dividing the total number of noun phrases with an omitted obligatory determiner by the total number of utterances that parents produced. NDW represents mean number of different word roots per minute.

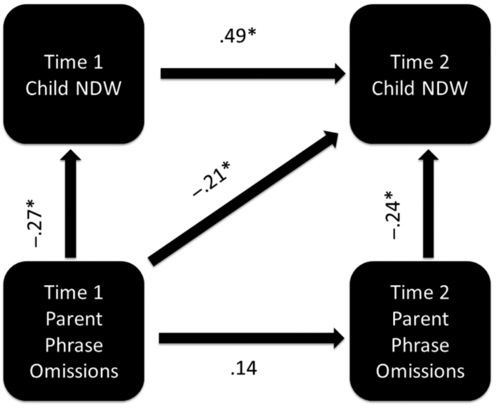
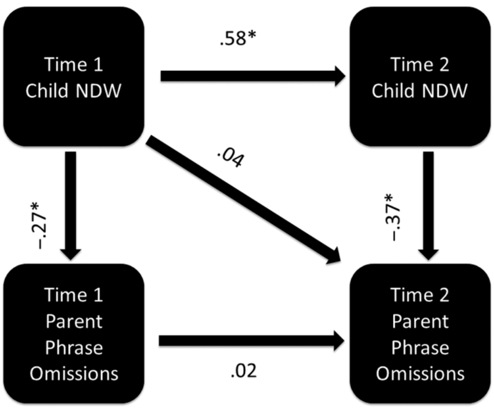


Figure 3. A visual depiction of the path model representing directional effects from child language to parent language (Model 2). Standardized estimates are presented for each path (* $p < .05$). Parent determiner omissions were calculated by dividing the total number of noun phrases with an omitted obligatory determiner by the total number of utterances that parents produced. NDW represents mean number of different word roots per minute.



phrase omissions to Time 2 child NDW. We predicted that Model 2 would not fit the data and that the path from Time 1 child language to Time 2 parent language would not be significant.

Consistent with these predictions, results indicated that Model 1 fit the data, χ^2 (1, n = 55) = 1.16, p = .28, root mean squared error of approximation (RMSEA) = 0.05, standardized root mean squared residual (SRMR) = 0.04, comparative fit index (CFI) = .995. Standardized path model estimates for Model 1 are presented in Table 6 and Figure 2. The concurrent paths from parent phrase omissions to child NDW were significant at both time points, as was the path from Time 1 to Time 2 child NDW. As predicted, there was a significant path from Time 1 parent phrase omissions to Time 2 child NDW. The longitudinal path from Time 1 to Time 2 parent phrase omissions was nonsignificant.

Model 2 provided a poor fit to the data, χ^2 (1, n = 55) = 4.41, p = .04, RMSEA = 0.25, SRMR = 0.06, CFI = .90. Standardized path model estimates for Model 2 are presented in Table 6 and Figure 3. The concurrent paths from child NDW to parent phrase omissions were significant at both time points, as was the path from Time 1 to Time 2 child NDW. There was not a significant path from Time 1 child NDW to Time 2 parent phrase omissions. As in Model 1, the path from Time 1 to Time 2 parent phrase omissions was nonsignificant.

Discussion

As a first step in understanding the relationship between telegraphic input and child language development, this study examined the extent to which parents of preschoolers with ASD omitted obligatory determiners from object noun phrases and the associations with children's spoken language concurrently and 1 year later. On average, parents omitted one determiner for every 100 utterances they produced, when children were both 3.5 (Time 1) and 4.5 years old (Time 2). Although some parents did not omit any obligatory determiners, other parents omitted many—in one case, 25 determiner omissions for every 100 utterances produced. Future work is needed to determine whether specific parent characteristics, such as age or educational level, are associated with greater use of telegraphic input. In addition to altering the presentation of each noun phrase individually, this variability produced marked differences in the overall structure of the linguistic input that children heard. In the span of 15 min, some children were exposed to determiner–object noun pairings with 100% consistency (i.e., every object noun that required a determiner was preceded by one), whereas others were exposed to noun phrases that were preceded by determiners much less consistently. Previous work has shown that young children are

Table 6. Standardized path model estimates, Models 1 and 2.

Model	Estimate	*SE*	Est/*SE*	*p*
Model 1				
T1 parent phrase omissions → T2 parent phrase omissions	0.14	0.13	1.09	.28
T1 child NDW → T2 child NDW	0.49	0.10	4.94	< .001**
T1 parent phrase omissions → T1 child NDW	−0.27	0.13	−2.19	.03*
T2 parent phrase omissions → T2 child NDW	−0.24	0.11	−2.31	.02*
T1 parent phrase omissions → T2 child NDW	−0.21	0.11	−2.03	.04*
Model 2				
T1 parent phrase omissions → T2 parent phrase omissions	0.02	0.14	0.11	.91
T1 child NDW → T2 child NDW	0.58	0.09	6.46	< .001**
T1 child NDW → T1 parent phrase omissions	−0.27	0.13	−2.19	.03*
T2 child NDW → T2 parent phrase omissions	−0.37	0.15	−2.44	.02*
T1 child NDW → T2 parent phrase omissions	0.04	0.16	0.28	.78

Note. Parent determiner omissions were calculated by dividing the total number of noun phrases with an omitted obligatory determiner by the total number of utterances that parents produced. T1 = Time 1; T2 = Time 2; NDW = mean number of different word roots per minute. Results are presented for the group of n = 55 children.

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

sensitive to linguistic co-occurrences (Evans, Saffran, & Robe-Torres, 2009; Mayo & Eigsti, 2012; Saffran, Newport, Aslin, Tunick, & Barrueco, 1997), suggesting that variation in the consistency with which noun phrases are preceded by determiners could affect children's language development.

Because determiners contain information that may help children to process language and learn new words, we hypothesized that parents who produced higher rates of determiner omissions would have children with lower language abilities 1 year later. Consistent with this prediction, regression analyses demonstrated that Time 1 rate of parent determiner omissions significantly predicted Time 2 child NDW, accounting for 16.2% of the variance. Importantly, Time 1 parent determiner omissions remained a significant, unique predictor of Time 2 child NDW even after controlling for children's NDW and nonverbal cognitive ability at Time 1. Findings from the path analyses supported the directionality of effects assumed in our regression analyses, although the results of these analyses should be interpreted cautiously due to our limited sample size. In the first model, the cross-lagged effect from Time 1 parent phrase omissions to Time 2 child NDW was significant, suggesting a directional effect between parent language and later child language. In the second model, the cross-lagged effect from Time 1 child NDW to Time 2 parent phrase omissions was not significant. The model containing paths from parent to child language fit the data well, but the model containing paths from child to parent language did not.

Although experimental work is needed to confirm the results of this observational study, our findings provide preliminary evidence that telegraphic speech may have a negative impact on language development in children with ASD. As discussed in the Introduction, there are several reasons why telegraphic speech may negatively affect language development. Telegraphic speech may slow language processing (Fernald & Hurtado, 2006; Kedar et al., 2006; Lew-Williams & Fernald, 2007), discourage imitation of grammatical utterances (Bredin-Oja & Fey, 2014), and prevent children from learning new words through syntactic bootstrapping (Bedore & Leonard, 1995), a word-learning strategy used by typically developing children and at least some children with ASD (Naigles et al., 2011; Shulman & Guberman, 2007). Longitudinal observational studies of typically developing children have shown that parents who use more complex syntactic constructions in their speech have children with higher language abilities later in life (Hoff & Naigles, 2002; Huttenlocher et al., 2002). Telegraphic speech limits children's exposure to these aspects of language by removing them entirely from certain utterances. In addition, many children with ASD exhibit immediate or delayed repetition of spoken language (i.e., echolalia). If children frequently hear telegraphic utterances, they may be more likely to repeat and learn utterances constructed in this manner. Telegraphic input may also elicit less spoken language from children than grammatical input (Wolfe & Heilmann, 2010), which would be detrimental for children with ASD.

Although this study focused primarily on the directional relationship from parent language to child language, it is important to recognize that parent language and child language are likely to exert mutual influences on one another. The correlational analyses demonstrated, for example, that parent phrase omissions were significantly and concurrently associated with child NDW at Time 2, but the results of this study did not speak directly to why this was the case. It is entirely possible that parent language influenced child language, as suggested by the longitudinal analyses, *and* that child language influenced parent language. This type of bidirectional relationship is consistent with a transactional account of language development, wherein parent and child factors have a reciprocal influence on one another (Sameroff, 2009). Just as children may have limited spoken language skills because they have been exposed to higher levels of telegraphic input, parents may use higher levels of telegraphic input *because* their children have limited spoken language skills. Parents (understandably) may gauge children's understanding at least in part on the basis of the amount of spoken language they produce. If children do not clearly signal comprehension through a verbal response, parents may reasonably assume that the child does not understand, and parents thus may be more likely to use telegraphic input. Children who produce less spoken language also provide adults with fewer opportunities for responding to and expanding children's language (Wolfe & Heilmann, 2010). Additional work is needed to determine the specific aspects of child behavior that influence parent behavior and vice versa, as well as the direction and strength of these effects at different ages and different points in development.

Because this study was observational, it is important to acknowledge the possibility of a third variable explanation. For example, parents who use higher levels of telegraphic speech may also exhibit other behaviors that negatively affect children's language learning (e.g., frequently redirecting children's attention, not providing temporally contingent responses); future research is needed to explore this possibility. Another unexplored area is how adult telegraphic speech use is affected by dynamic aspects of the adult–child interaction, something that the current study did not address. For example, parents or clinicians may be more likely to use telegraphic speech when a child says something unrelated to the current topic or does not respond at all. In this way, telegraphic input could be an attempt to scaffold the interaction and enhance the child's learning; however, we do not yet know whether this is effective, and, if so, for which children.

There are two interesting observations to be made regarding the child and parent variables that were most consistently related—parent determiner omissions in phrases and child NDW—and the variables that were less consistently related—parent isolated nouns and child MLU. The first observation is that parent determiner omissions in phrases seemed to play a different role than isolated, single words without a determiner. Children's language was more consistently related to determiner omissions in phrases than to isolated words, which could be in line with the view that single words are grammatical, but merely pared down to their simplest form (Fey, 2008). Second, regarding child language, we investigated both MLU and NDW because there were theoretical reasons to believe that either could be affected. However, the relationship with parent determiner omissions was less compelling for MLU than for NDW. There could be several potential explanations for this. Perhaps lower levels of telegraphic speech enhanced children's ability to learn the lexical categories and subsequently the meanings of more words, which was apparent in the variety of words that children produced. Differences in MLU may relate more closely to a different type of telegraphic input (e.g., omission of grammatical bound morphemes) or may be apparent only over a longer period of time. Although pilot data from this sample indicated that parents rarely produced grammatical omissions, some parents produced utterances that contained omissions of both determiners and grammatical morphemes, including *Boy go on bicycle* and *Say Daddy fix please*. This type of omission may be more common in some intervention contexts; experimental studies could also be designed to investigate omissions of grammatical morphemes.

Not surprisingly, when telegraphic speech is recommended, it is typically recommended for children at the prelinguistic, one-word or two-word stages of spoken language because typically developing children beyond this stage are less likely to produce telegraphic speech themselves (van Kleeck et al., 2010). Although this guideline may seem straightforward and intuitive, basing recommendations on spoken language in children with ASD is challenging because their social use of language is, by definition, impaired. Their interactions with unfamiliar people in unfamiliar situations (e.g., diagnostic assessments) may provide an inaccurate representation of their abilities, leading to the selection of inappropriate treatment strategies. In addition, approximately 30% of children with ASD may not develop meaningful spoken language by school age (Tager-Flusberg & Kasari, 2013); if clinical decisions are based on language production, these children may be exposed to telegraphic input in treatment for an extended period of time. This is concerning because some young children with ASD, like typically developing children, may be capable of understanding more complex aspects of language than they produce (Goodwin, Fein, & Naigles, 2012). Failing to consistently expose children to grammatical features of language presents the real possibility that they will not be learned, which may be particularly harmful for young children who already have trouble learning morphosyntactic features of language (Eigsti et al., 2007; Fey, 2008; McGregor et al., 2011).

Some might argue that investigating telegraphic speech is not a high priority because it is a common component of autism interventions, and these interventions have a positive effect on language development for many children. In other words, if an autism intervention "works," and it incorporates telegraphic speech, then telegraphic speech must also "work." We disagree with this stance because optimizing treatment outcomes requires investigating not only the broad effects of comprehensive treatments, but also the specific effects of the strategies that comprise them. Input style (i.e., telegraphic vs. grammatical speech) is not a static component of behavioral intervention approaches—it is a focused intervention strategy (Odom, Boyd, Hall, & Hume, 2010) deserving of empirical and clinical attention in its own right. This issue is well summarized in a clinical commentary by Ann Kaiser, who states that although enhanced milieu teaching has strong empirical support, the specific role of telegraphic input in enhanced milieu teaching is unclear because it has not been directly compared with grammatical input within the context of the broader treatment approach (van Kleeck et al., 2010). Identifying and understanding the role of potential active ingredients in intervention will shed light on the developmental mechanisms underlying treatment change—which, in turn, may help to individualize treatments, optimize outcomes, and develop new intervention strategies. For example, future work may reveal positive effects of telegraphic input for children with severe language and cognitive deficits but negative effects for children with higher level skills. The findings of this study cannot speak to this issue because children with the most limited spoken language were excluded from the analyses.

This study had a number of limitations that can be addressed in future studies. The same level of information was not available on intercoder transcription and coding agreement across both testing sites. Additionally, we did not have consistent information about intervention services across the two sites, and so we were unable to test potential treatment effects. As discussed, this study was based on observational data and focused solely on children's spoken language abilities. One way to address these limitations would be to design experimental studies that more directly investigate the effects of telegraphic input on children's language learning and processing. For example, eye-gaze methods of language comprehension (Venker, Eernisse, Saffran, & Ellis Weismer, 2013) may reveal effects of telegraphic input in real time, as spoken language is unfolding; this methodology has limited task demands and thus may also incorporate data from children with a wider range of skills.

Our findings suggest that telegraphic input may have a negative impact on language development in young children with ASD—results that are consistent with recent findings in children with language impairment (Bredin-Oja & Fey, 2014). If future studies continue to support these findings, it may be beneficial to reevaluate the most effective way for parents and clinicians to simplify their language when speaking to young children with language delays. In theory, it would be possible for parents and clinicians to use simplified grammatical input as a focused intervention strategy in intervention approaches that have previously recommended telegraphic input. Until quite recently, for example, Hanen's *More Than Words* training manual for parents of children with ASD provided examples of telegraphic speech (Sussman, 1999). Given the strength of the arguments against telegraphic speech, however, the *More Than Words* manual was updated in 2012 to reflect simplified but grammatical models (Elaine Weitzman, personal communication, January 31, 2012). Clinicians or parents using grammatical simplified speech would still have the option to stress certain aspects of the input (e.g., content words) by making them louder and longer while de-emphasizing other aspects (e.g., functor words) by making them softer and faster (Ellis Weismer, 2000; Siegel, 2003).

Conclusion

Using simplified language when speaking to young children is a nearly universal practice (van Kleeck et al., 2010), but the results of this and other studies have shown that not all simplified input is the same. Although some researchers have used the terms *simplified* and *telegraphic* interchangeably (Wolfe & Heilmann, 2010), we believe that there is great value in updating clinical terminology to reflect the fact that simplified language can be either grammatical or telegraphic. Accurately describing these two styles of speaking is a necessary step in encouraging clinicians to make a purposeful decision about which style to adopt. Consistent terminology will also facilitate interpretation of research findings, which will ensure that future studies continue to inform the best practices for improving language outcomes in children with ASD. Despite the controversy surrounding telegraphic versus grammatical input, it is important to remember that clinicians and researchers on both sides of the debate share the common goal of improving language outcomes in children with ASD.

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