Morpheme Use in Late Talkers at Age 5

Hannah L. Turner

Advisor: Leslie Rescorla

Haverford College
# Table of Contents

Abstract ................................................................................................................................. 3

Introduction .......................................................................................................................... 4

Early Language Acquisition ................................................................................................. 4

Specific Language Impairment ............................................................................................ 7
  Morphology Deficits in SLI ............................................................................................... 8
  Theoretical Explanations of SLI ....................................................................................... 10
  Cross-Linguistic Studies of SLI ......................................................................................... 13
  Delay or Deviance ............................................................................................................. 14

Late Talkers .......................................................................................................................... 15
  Characteristics of Late Talkers ......................................................................................... 16
  Short-term Outcomes for Late Talkers ............................................................................ 23
  Long-term Outcomes for Late Talkers ............................................................................ 27

Rationale and Hypotheses for the Current Study ................................................................. 30

Method ................................................................................................................................ 32
  Participants ......................................................................................................................... 32
  Procedure ............................................................................................................................ 33
  Morpheme Coding ............................................................................................................. 34
  Study Design and Data Analyses ....................................................................................... 35

Results .................................................................................................................................. 36
  Morpheme analysis ............................................................................................................ 36
  Two-group comparisons ..................................................................................................... 37
  Three-group comparisons ................................................................................................. 40

Discussion ............................................................................................................................ 42
  Overview of Findings ......................................................................................................... 42
  Limitations .......................................................................................................................... 48
  Clinical Implications ......................................................................................................... 50

References ............................................................................................................................ 51

Tables .................................................................................................................................. 59

Figures .................................................................................................................................. 64

Appendices ............................................................................................................................ 65
Abstract

It has been widely observed that some children struggle to acquire language. Of particular interest to the current study is the subset of children who, although developmentally typical in every other domain, fail to begin talking at the expected age and are slow to acquire words. These children, termed “late talkers” (Rescorla, 2000), were previously thought to ‘catch up’ to their non-delayed peers. However, more recent evidence suggests that late talkers show mild but consistent language weakness through late adolescence, long after they have acquired vocabulary and grammar. The present study fills a gap in the literature on these late talkers’ developmental trajectory by examining morphological development at age 5 in a group of late talkers identified at 24 to 31 months of age. We found that late talkers and typically developing children showed no significant differences in morphological mastery at age 5, despite highly significant differences in MLU and IPSyn performance. This suggests that late talkers’ language difficulties at age 5 may specifically concern issues of sentence structure and complex language use, which continue to manifest in higher-order language differences through adolescence. These findings are discussed within Rescorla’s larger body of research, and suggestions for future research and clinical intervention are provided.


Introduction

Early Language Acquisition

Child language development has been studied for over 200 years. Although most of the early work focused on individual cases, particularly children of linguistic researchers in different countries, these case studies revealed much about the complex process of language acquisition. Research has since investigated cognitive, environmental, and biological factors that all play crucial roles in language acquisition.

Language skills emerge even before formal language in the form of prelinguistic communication. Shared attention, babbling, and gesturing (e.g., pointing, tugging, and waving) are among the prelinguistic communicative skills that many young children display. Verbally, children begin to develop language through babbling, which proceeds in stages such as reduplicated consonant-vowel sequences (e.g., dadada) followed by variegated syllable strings (e.g., baduga). Babbling allows children to practice and master phonology (Carroll, 2008). Around the time of their first birthdays, most children have spoken their first words. This is concurrent with the child’s realization that objects have names, which may explain why many early words are nouns (Carroll, 2008). Not all naming is phonetically precise, and not all named objects are identified accurately, but early naming starts the child on the path of vocabulary development, which continues for decades.

Most children’s early vocabularies are comprised primarily of general nouns (e.g., ball, milk, girl), but also include proper nouns (names), action words (e.g., eat, kiss), modifiers (e.g., big, mine), personal-social words (e.g., no, byebye), and function words (e.g., what) (James, 1990). By age 2, children should be using at least 50 distinct words. This one-word phase gradually transitions into a telegraphic speech phase, during which children combine two or
three words into phrases, producing pseudo-sentences (Brown, 1973; James, 1990). Producing these small sentences is a crucial developmental milestone because it indicates the onset of syntax (James, 1990). The words used during this phase, which occurs from 18 to 30 months in typically developing children, are primarily content words, with few grammatical morphemes (i.e., the portions of words that themselves carry meaning, such as -ing to indicate present progressive tense) (James, 1990). However, by 30 months, typically developing children have productive command of some grammatical morphemes (Wagner, Swensen, & Naigles, 2009).

Brown (1973) outlined the order of morpheme acquisition in his classic observational study of morphological development. He identified the early morphemes (progressive -ing, prepositions in and on, plural -s, and possessive -’s), the middle morphemes (irregular past tense verb endings, contractible copula be, articles, regular past tense -ed, and regular third person present tense -s), and the later morphemes (irregular third person present tense, uncontractible auxiliary be, uncontractible copula be, and contractible auxiliary be) that are acquired by typically developing children (Brown, 1973; Rescorla & Roberts, 2002) (see Table 1). Although Brown’s study included data from only three children, his results have subsequently been confirmed in several studies (e.g, de Villiers & de Villiers, 1978; Lahey, Liebergott, Chesnick, & Menyuk, 1992). However, there is variability in the age at which children begin the process of morpheme acquisition (Brown, 1973) and, to some extent, the order in which they acquire morphemes. By age 5, typically developing children have mastered most of the morphology of their native language (Paul & Alforde, 1993; Rescorla & Roberts, 2002).

Children apply morphemes in novel and productive ways, even with pseudo-words such as two wugs (Berko, 1958) and in irregular contexts (i.e., She runned). With age, these morpheme overextensions disappear in favor of correct use. Children transition from telegraphic speech to
longer sentences with more word types during the preschool period’s language ‘explosion’ (James, 1990). By age 5, most children are speaking with adult-like proficiency and grammar.

Brown’s (1973) methods are still being used to determine a child’s progress in morphological development. Brown used Mean Length of Utterance (MLU) (Appendix A) to measure a child’s sentence length and grammatical complexity. MLU counts the number of morphemes used in a sample (so cats would be two morphemes—one for cat and one for –s) and divides it by the total number of utterances expressed. Another measure of morpheme development is the percentage suppliance of a given morpheme (Appendix A). Suppliance is measured by dividing the number of times a child uses a particular morpheme by the number of obligatory contexts in which that morpheme should have appeared (James, 1990). Obligatory contexts are linguistic environments deemed ungrammatical without the inclusion of a particular morpheme (i.e., two dogs is an obligatory context for plural -s). Other examples of obligatory contexts involve responses to present progressive questions (i.e., What is the doggy doing?) with the present progressive –ing, and declarative actions using the auxiliary to be (i.e., I am painting; She is drawing).

Brown (1973) used MLU to define five stages of language development characterized by the appearance of new morphemes and sentence types (James, 1990). During stage I (1.1-2.0 MLU), children primarily use one- and two-word sentences to express semantic roles and relations. Children begin to use grammatical morphemes during stage II (2.0-2.5 MLU) in order to modulate meanings in simple sentences. The morphemes typically present during stage II are –ing, plural –s, and the preposition in (Miller, 1981). Sentences involving negatives, questions, and imperatives appear during stage III (2.5-3.5 MLU). Stage III morphemes are the preposition on and possessive –’s (Miller, 1981). Grammar becomes quite complex during stage IV (3.5-4.0
MLU), and includes the morphemes regular past tense –ed, irregular past tense, regular third person singular –s, articles a and the, and the contractible copula be (Miller, 1981). The final stage, V (4.0+ MLU), is when children begin conjoining two or more simple sentences (James, 1990). The contractible auxiliary be, uncontractible copula be, uncontractible auxiliary be, and irregular third person singular verbal morphemes emerge during stage V (Miller, 1981). Brown (1973) found that, despite variations in chronological ages, children reached similar linguistic milestones at similar MLUs. Thus, MLU serves as a good measure of language development and is widely used to compare children’s language development progress.

Cross-linguistic data generally show that the trajectory of language acquisition from phonology through multi-word utterances is consistent across languages. Furthermore, specific parts of speech may be acquired in the same order, reflecting a universal commonality in children’s developing cognitive skills (Carroll, 2008). For example, the acquisition order of the prepositions in, on, under, beside, between, front, and back is quite similar in English, Italian, Serbo-Croatian, and Turkish (Johnston & Slobin, 1979). This consistency indicates a developing complexity in children’s understanding of spatial relations (Carroll, 2008). In addition, the acquisition of many grammatical features is consistent cross-linguistically, supporting Chomsky’s notion of a universal grammar (Chomsky, 2006).

Specific Language Impairment

The previous discussion primarily concerns typical language development. From this point forward the focus of this review will be those children who fail to acquire their own native language proficiently within the typical time course. Developmental language deficits vary broadly in clinical markers and associated cognitive factors. A language deficit may be primary, or it may be secondary to another developmental disorder (e.g., Down’s Syndrome or an Autism
Spectrum Disorder) or to a physical condition (e.g., hearing loss). It may affect receptive and/or expressive language. Expressive language delay is one of the most common reasons for referring a young child for clinical evaluation (Lee & Rescorla, 2000).

Defined by Leonard (1998) in his foundational text, children with Specific Language Impairment (SLI) are characterized by their “significant limitation in language ability, yet the factors usually accompanying language learning problems—such as hearing impairment, low nonverbal intelligence test scores, and neurological damage—are not evident” (pp. 3). SLI occurs in about 7% of the general population (Tomblin, Zhang, Buckwalter, & O’Brien, 2003), but affected individuals’ profiles are quite heterogeneous (1998). SLI is more commonly seen in males than in females and among children whose immediate family members have a history of language learning difficulties (Leonard, 1998). Tomblin et al. (2003) followed children diagnosed with SLI in kindergarten and found that poor kindergarten language abilities were likely to persist through elementary school (Tomblin et al., 2003). Treatment does improve language abilities in children with SLI, but their relative deficits often remain until adulthood (Leonard, 1998).

Morphology deficits in SLI. Although children with SLI manifest a variety of deficits, morphology skills appear to be their most striking weakness. Further, this weakness in morphology persists through age 5, beyond when children with SLI achieve average levels of lexical diversity (Goffman & Leonard, 2000). Additionally, morphological deficits in children with SLI are even greater than their MLUs would typically predict (Hansson, 1997; Leonard, Davis, & Deevy, 2007; Maillart & Parisse, 2006).

Specific weaknesses within SLI verb morphology have been identified, namely the underuse of the past tense –ed morpheme (Leonard et al., 2007), tense markers auxiliary was and
were in conjunction with progressive \textit{-ing} suffixes (Leonard, Deevy, Miller, Charest, & Kurtz, 2003), and inconsistent use of third person \textit{-s}. Together these findings suggest that children with SLI may have an underlying difficulty mastering the verb inflection system of English (Leonard et al., 2003). Additionally, children with SLI are more likely than typically developing peers to omit the nonfinite particle \textit{to}, arguments in finite clauses, and the optional complementizer \textit{that} (Owen & Leonard, 2006). Although these children’s lower MLUs indicate less overall morpheme use, Owen and Leonard (2006) excluded MLU restrictions as an explanatory factor in their observed differences because late talkers show less mastery of inflections than typically developing children with the same MLUs.

Children with SLI show such marked morphology deficits that some have proposed them as a clinical marker for the impairment (Rice, Wexler, & Hershberger, 1998). Discriminant function analysis, which statistically determines whether a set of variables predicts group membership, accurately grouped children with SLI and their typically developing peers based on morphological measures alone (Bedore & Leonard, 1998). This finding suggests that morphological deficits may help identify children with SLI into school age (Bedore & Leonard, 1998). Still, others have argued that tense marking inflections may even more accurately identify SLI than morphology in general (Rice & Wexler, 1996). When Rice and Wexler (1996) compared children with SLI to age- and MLU-matched typically developing peers, they found that children with SLI showed less accurate use of tense marking morphemes than either comparison group. Further, the children with SLI were still performing at low levels of accuracy while their age-matched peers used tense morphemes at essentially adult levels (Rice & Wexler, 1996).
Thordardottir and Ellis Weismer (2002) studied children ages 5-10 with SLI and age-matched comparison children and found that the children with SLI used significantly fewer argument types, argument structure types, and verb alternations than age-matched typically developing children. Additionally, children with SLI were significantly less likely to use three-place argument structures than MLU-matched peers (Thordardottir & Ellis Weismer, 2002). By school age, children with SLI used mostly correct verb argument structure, but their usage was less sophisticated than either age- or MLU-matched typically developing peers (Thordardottir & Ellis Weismer, 2002). These data suggest that children with SLI have morphological weaknesses that go beyond tense marking.

By ages 10-12, children with SLI showed high accuracy on spoken noun and verb morphology, but still struggled to use morphemes in a significant percentage of obligatory contexts in their writing (Windsor, Scott, & Street, 2000). Children with SLI whose deficits had not resolved by age 5.5 continued to show weakness in all areas of spoken and written language at age 15-16 when compared to age-matched peers, whereas children with SLI whose deficits resolved by 5.5 performed at the same level as peers on vocabulary and language comprehension measures at age 15-16 (Stothard, Snowling, Bishop, Chipchase, & Kaplan, 1998). Even so, these children showed weaker phonological processing and literacy at age 15-16 than typically developing peers (Stothard et al., 1998).

**Theoretical explanations of SLI.** Many theories have been proposed in order to explain SLI. The Extended Optional Infinitive (EOI) theory of SLI, put forward by Rice, Wexler, and Hershberger (1998), posits that children with SLI experience an extended period of immature grammar (the OI period) that is present in typical language acquisition. According to this theory, the OI period occurs because linguistic tense features are incompletely represented in the child’s
mental grammar (Rice et al., 1998). During this OI period, children display a tendency to drop tense marking morphemes: third person singular –s, regular past tense –ed, and copular and auxiliary be (Wexler, 1994, 1996). While typically developing children use tense marking morphemes accurately by age 5, children with SLI showed an extended OI period through age 7-8, years after younger MLU-matched children had mastered the relevant morphemes (Rice et al., 1998).

Tense and agreement deficits in SLI have also been identified outside of language production. When compared to typically developing peers, children with language impairment showed a non-typical pattern of response in reading target words that were immediately preceded by a word missing its tense or agreement morpheme (Leonard, Miller, & Finneran, 2009). Specifically, typically developing children showed slower reading when the target word was preceded by any grammatical error, but the children with language impairment did not show slowed performance when the target word was preceded by a tense or agreement error (Leonard et al., 2009). Because children with SLI did not show impaired performance in response to omitted tense or agreement morphemes, these data suggest that they did not register the omissions as incorrect at all. This conclusion is consistent with the EOI theory’s notion that children with SLI see tense and agreement marking as optional beyond the point when their peers recognize it as obligatory, and that this underuse indicates an incomplete representation of tense/agreement in the child’s mental grammar (Rice et al., 1998).

Others argue that the basis of SLI is a processing deficit. According to this account, children with SLI have weaker auditory perceptual skills, and therefore have more difficulty analyzing, phonologically coding, and retrieving speech. The processing account posits that children with SLI have less complete processing of the speech they hear than typically
developing children, especially when input is rapid, lengthy, or complex. Charest and Johnston (2011) emphasized that total costs of a conversational interaction can exceed a speaker’s processing resources, language operations can vary in their processing costs, and processing costs in one language domain can affect performance in another. If children with SLI have fewer processing resources, some conversational interactions are likely to exceed their total resources. Leonard and colleagues (2000) found that when priming was provided to lighten the processing load, children with SLI showed significant improvements in morpheme production (Leonard, Miller, Grela, Holland, Gerber, & Petucci, 2000). Therefore, the observed morphology deficits characteristic of SLI may, according to this account, be manifestations of the child’s exceeded processing resources. Additionally, it has been found that SLI-like performance can be induced in non-impaired children by introducing cognitive stress factors into a grammaticality judgment task, therein simulating increased processing demands (Hayiou-Thomas, Bishop, & Plunkett, 2004).

These proposed processing deficits in SLI are related to the surface hypothesis proposed by Leonard and Bortolini (1998), namely that morphemes that are brief in duration and in unstressed sentence positions (i.e., have low phonetic substance) will decay first or not be registered at all by the child with SLI when his/her weak processing capacities are overtaxed (Grela, Collisson, & Arthur, 2011). When Montgomery and Leonard (1998) examined sensitivity to morphemes of low versus high phonetic substance, they found that children with SLI had weaker sensitivity to morphemes of low phonetic substance. These authors additionally found that increasing the duration, and thus the phonetic substance, of the morpheme increased the children’s sensitivity to it (2006). These findings further support the theory that a phonological processing deficit is a central cause of the language weaknesses seen in SLI. These phonological
processing deficits help explain the difficulties with working memory and with learning linguistic generalizations that are characteristic of SLI (Joanisse & Seidenberg, 1998).

**Cross-linguistic studies of SLI.** Some cross-linguistic data support the EOI account of SLI, and some support the notion of an underlying processing deficit in SLI. Data from Swedish-speaking children with SLI showed continued morpheme omission beyond what their MLUs would predict, even though their morpheme use did improve as they matured (Hansson, 1997). This finding supports a morphological account of SLI similar to the EOI theory, in that the deficit affects correct morphology for a time beyond that found for typically developing children. However, a study finding that Spanish-Catalan bilingual children showed difficulty with verb inflections linked these observations to processing deficits dependent on each language’s typology, rather than an EOI period (Sanz-Torrent et al., 2008). Data from children speaking French, Hebrew, Italian, Catalan, and Greek support the idea that SLI results from a processing deficit associated with a weak phonemic inventory and phonological impairment (Maillart & Parisse, 2006; Mastropavlou, 2010).

Other data have shown that grammatical manifestations of SLI vary between languages, which may indicate that children’s SLI-related deficits do not necessarily reflect underlying weaknesses in grammatical representation or processing, but rather difficulties mastering the particular grammar of that language (Lindner & Johnston, 1992). For example, Spanish-speaking children with SLI show high levels of accuracy when using present and past tense verb inflections, but display significant weakness in their use of articles and direct object clitics (unstressed function words) when compared to age- and MLU-matched typically developing peers (Bedore & Leonard, 2005). These children’s grammatical weaknesses do not seem to involve tense or agreement at all, indicating that such deficits may be unique to English.
Delay or deviance. Some argue that children with SLI are merely delayed in language development, but not deviant in the process by which they acquire language. Leonard (1991; 1998) himself argued that SLI represents the low end of a broad spectrum of language ability, much like spectra of athleticism or musical skills. Rescorla (2000, 2002) has espoused a similar account, arguing for a language endowment spectrum. Dollaghan (2004), who analyzed distributions of language scores from children at ages 3 and 4, found that their scores were distributed dimensionally at both ages, contradicting the idea that SLI represents a qualitatively distinct category.

Other data indicate that the SLI profile does represent an actual deviance from the typical language acquisition trajectory. Even when compared to MLU-matched peers, children with SLI manifest unique difficulties with syntax and propositions, despite otherwise similar language abilities (Johnston & Kahmi, 1984). Children with SLI have also been observed to use different strategies than either age- or MLU-matched comparison children in extending verbal morphemes to novel verb roots (Carr & Johnston, 2001). A possible explanation for this observation is that older children with SLI have longer short-term memory than their language-matched typically developing peers. Therefore, they are able to use more words per sentence without using more suffixed morphemes, increasing their MLUs but not their morpheme performance. For this reason, cross-age MLU-matching may not produce valid ‘language matched’ groups, which casts doubt on the use of these comparisons as strong evidence for deviance rather than delay in SLI.

In sum, children with SLI show particular difficulties with morphology, a pattern that has been found across different languages. Many theories have been developed to explain SLI, emphasizing different aspects of language acquisition ranging from morphology to processing
demands. It remains unclear whether children with SLI represent a qualitatively distinct group, or simply the low end of a language development spectrum.

Late Talkers

There is notable overlap in the language deficits seen in SLI and those seen in “late talkers”, defined as children in the age range of about 2 to 4 years who have delayed vocabulary acquisition, onset of word combinations, and use of grammatical inflections (Rescorla, 2009). Rescorla (2000; 2002; 2005; 2009; 2013), who studied a cohort of late talkers longitudinally from ages 2 to 17, argued that late talkers are perhaps a subset of SLI, and that both diagnoses represent a lower range on a language endowment spectrum. Ellis Weismer (2007) corroborated that late talkers share similarities with children previously diagnosed with SLI, and that late talkers share patterns and mechanisms of language development with typically developing peers. This again supports the notion of a language endowment spectrum suggested by Rescorla (2002).

It has been reported that approximately 15% of 2-year-olds are categorized as late talkers, This group shows delayed vocabulary acquisition but no signs of any underlying pathology, such as neurological, sensory, or cognitive deficits (Desmarais, Sylvestre, Meyer, Bairati, & Rouleau, 2008). It is recognized that some late talkers have expressive language delay only, whereas others have delayed receptive language as well (Desmarais et al., 2008). Many factors have been found to influence the occurrence of late talking, including language-related and family-related factors (Desmarais et al., 2008).

Late talkers were previously thought to ‘catch up’ to their non-delayed peers, but evidence accumulated over the past two decades suggests that late talkers as a whole show mild but consistent language weakness through late adolescence relative to their typically developing peers, long after they’ve acquired age-adequate vocabulary and grammar (Ellis Weismer, 2007;
Paul & Alforde, 1993; Rescorla, 2000; 2002; 2005; 2009; 2012; Thal, Tobias, & Morrison, 1991). Additional outcomes of late talkers will be reviewed below. Although some of these children, termed “late bloomers”, do seem to achieve the same language abilities as their typically developing peers, groups of late talkers identified at age 2 lag significantly behind comparison peers for many years (Paul & Alforde, 1993; Rescorla & Roberts, 2002; Thal et al., 1991).

**Characteristics of late talkers.** Delayed vocabulary acquisition is the most obvious marker of a late talker, but these children also show delays in phonology and syntax, as is described below. Much of the research on these children has been conducted as a part of the Pennsylvania Late Talkers Study by Rescorla and colleagues, a longitudinal study following late talkers and SES-matched typically developing peers from ages 2 to 17. Findings from this large study will be summarized, in addition to findings from several other studies of late talkers.

Arguably the basis of spoken language is phonology, as it provides the sound system for language comprehension and production. Not surprisingly, therefore, phonological skills are generally delayed in late talkers. Specifically, late talkers in several studies have been found to use less phonetic complexity (i.e., less complex vocalization patterns and syllable structures, and fewer consonants) than typically developing peers (Cecyle, Klee, Carson, & Hime, 2003; Fasolo, Majorano, & D’Orico, 2008; Mac-Roy Higgins, 2009; Mirak & Rescorla, 1998; Paul, Murray, Clancy, & Andrews, 1997; Pharr, Ratner, & Rescorla, 2000; Rescorla & Ratner, 1996; Roberts, Rescorla, Giroux, & Stevens, 1998). Late talkers tend to rely only on the consonants most frequently used in typically developing children’s speech, implying that these are the easiest consonants to acquire and use (Mirak & Rescorla, 1998). Furthermore, Fasolo et al. (2008) reported delayed consonant use, simpler syllable structure, and less phonetic variation in future
late talkers’ babbling at 20 months, before the age at which they are typically identified. Not only can phonological differences distinguish late talkers from typically developing peers, but they have also been used to help predict which late talkers will ‘bloom’ and which will show continued delay (Williams & Elbert, 2003). When Williams and Elbert (2003) compared late talkers with continuing delay to those who ‘bloomed’ by age 4, those with continuing delay showed a limited phonetic inventory, a lower percentage of correct consonants, more sound errors, atypical error patterns, greater sound variability, and a slower rate of resolution.

Typically developing children rely on phonological foundations to facilitate new word learning (MacRoy-Higgins, 2009). A better understanding of the sounds present in one’s native language enables a child to more efficiently learn new words. MacRoy-Higgins (2009) taught late talkers and typically developing children nonwords of varying phonotactic probability (i.e., frequency of sound sequences in the language). She found that the late talkers, unlike comparison children, showed no preference for nonwords with higher phonotactic probability. MacRoy-Higgins (2009) suggested that late talkers’ deficits with language, and specifically with lexical acquisition, might be due to an underlying inefficiency in phonological organization skills. That is, these children may simply have a poor grasp of the sound patterns in their native language, so phonotactically probable sequences do not aid late talkers’ learning as much as they aid typically developing children. Other studies have also suggested that late talkers may rely on atypical mechanisms in their vocabulary building processes, accounting for some of their observed lexical delay (Desmarais et al., 2008; Rescorla, Mirak, & Singh, 2000).

Among late talkers, some show a vocabulary spurt between 24 and 30 months, whereas other late talkers’ vocabularies do not grow until closer to age 3. Rescorla and colleagues (2000) studied vocabulary growth in late talkers using the Language Development Survey (LDS;
Rescorla, 1989) (Appendix A), completed at 2-month intervals beginning at age 2.2. When first identified as late talkers at 24-26 months, these children had vocabularies of about 20 words. By 30 months, 11 of the 28 late talkers had ‘spurted,’ rapidly acquiring 150 words (Rescorla et al., 2000). However, the other 17 late talkers had changed little by 30 months, only reaching that 150-word milestone by age 3. Given that the mean LDS vocabulary of typically developing children is in the range of 150 words, 11 of the late talkers showed a 6-month lag in vocabulary growth, while 17 showed a 12-month lag (Rescorla et al., 2000). Importantly, high $Q$ correlations—a measure used to determine consistency in rank ordering across groups (Appendix A)—indicated that both groups of late talkers were acquiring the same words as their peers, just at a delayed rate (Rescorla, Alley, & Christine, 2001).

Lexical and grammatical development are highly correlated, perhaps helping to explain the later language deficits of late talkers with lexical weakness at age 2. Vocabulary size and sentence length have been found to correlate highly on both the LDS and the MacArthur-Bates Communicative Development Inventory (CDI; Fenson et al., 1993), a 680-word checklist widely used to study early language development (Appendix A). Typically developing children begin to combine words into short sentences when their vocabulary grows to contain about 50 words (Rescorla, 1989; Rescorla & Alley, 2001). Further, lexical development is closely linked to grammatical development (Armstrong, 2007; Mirak & Rescorla, 1998; Moyle, Ellis Weismer, Evans, & Lindstrom, 2007; Rescorla et al., 2000). When Moyle et al. (2007) examined longitudinal relationships between lexical and grammatical development from ages 2-5.5, they found that both domains were strongly related. In a study of early talking 2-year-olds, grammatical development was found to be more closely associated with the size of the lexicon than with the child’s age (McGregor, Sheng, & Smith, 2005). One study suggested a shared
biological influence on vocabulary and grammar (Dionne, Dale, Biovin, & Plomin, 2003). Some have suggested that it may not be simply a relation between lexical and grammatical development, but rather a dependence of grammatical development on lexical development.

Once they begin to acquire vocabulary, late talkers are subsequently delayed in syntactic development. Unlike their typically developing peers, they rarely use any word combinations by age 2 (Manhardt & Rescorla, 2002; Mirak & Rescorla, 1998; Rescorla, Bascome, Lampard, & Feeny, 2001; Rescorla, Dahlsgaard, & Roberts, 2000; Rescorla, Roberts, & Dahlsgaard, 1997). Rescorla et al. (1997) examined late talkers at age 3 and found that they were still more than 1.5 standard deviations below age expectations on MLU and the Index of Productive Syntax (IPSyn; Scarborough, 1990) (Appendix A), despite reaching the average range on measures of vocabulary and expressive language. The IPSyn is a measure of language development assessing the development of noun phrases, verb phrases, questions/negations, and complex syntax (Scarborough, 1990). Rescorla et al. (1997) further found that the late talkers’ progress in lexical development was more rapid than their syntactic and morphological development from ages 2 to 3. In Moyle et al.’s (2007) study, these authors additionally found that syntactic growth facilitated lexical growth less in late talkers than it did in typically developing children.

Beyond vocabulary, phonology, and syntax deficits, there are other factors also associated with late talking, such as use of gesturing—a common prelinguistic communicative strategy. When late talkers were compared to typically developing peers in gesture production, late talkers produced fewer pointing gestures referring to an external event, but used more pointing in situations with great communicative pressure, associative pointing, and visual checking towards their mothers (Assanelli, D’Odorico, Franco, & Salerni, 2005). These findings may reflect late talkers’ attempts to compensate for their weak verbal skills in shared communication. Thal and
Tobias (1992) also found that, as a whole, late talkers aged 18-28 months seemed to use more communicative gestures than typically developing children (Thal & Tobias, 1992). However, when separated based on their language outcomes 1 year later, the data showed that only the late talking children who later ‘bloomed’ were using more communicative gestures 1 year prior (Thal & Tobias, 1992). These late bloomers were further found to have age-equivalent language comprehension at intake (Thal et al., 1991). Thus it seems that, in Thal et al.’s (1991) study, gesturing within young late talkers was a predictor of later verbal outcomes.

Maternal gesturing has also been found to correlate with a child’s language productivity (Girolametto, Bonifacio, Visini, Weitzman, Zocconi, & Pearce, 2002). Among German-speaking mothers, the mothers of late talking children were observed to use more gestures and to hold these gestures throughout a complete utterance more than mothers of typically developing children, reinforcing their communicated message for their rarely-speaking child (Grimminger, Rohlfing, & Stenneken, 2010). This finding has been interpreted as an indication that mothers adjust their communication to accommodate their child’s learning processes (Girolametto et al., 2002).

Maternal speech, too, may be influential in children’s early language development. Studies of Italian-speaking mothers suggest that mothers of late talkers may speak in a way that does not optimally promote their children’s language skills. During a play session with their child, the mothers of late talkers used lower pitch peaks on nouns and a flatter pitch contour more often (D’Orico & Jacob, 2006) and spoke faster (Girolametto et al., 2002) than mothers of typically developing children. However, other studies have shown few differences between maternal input provided by mothers of late talkers and mothers of typically developing children (Paul & Elwood, 1991), finding that the only significant difference was the frequency with which they
used expansion and extension in talking with their child. However, the proportion of these maternal contingency devices relative to the number of child utterances was equivalent (Paul & Elwood, 1991). Mothers of late talkers also did not differ in degree of synchrony or use of social cues with their children when compared to mothers of typically developing children (Rescorla & Fechnay, 1996). These data suggest that early maternal linguistic input has a minor role in a child’s late talking, at least for children from middle-to-upper SES families, and that maternal input is generally appropriate for the child’s language level.

Independent symbolic play—as shown in the use of play schemes with dolls, sequential play, and use of a neutral object to carry out pretend play—has also been found in some studies to correlate with language comprehension and production among late talkers (Lyytinen, Poikkeus, & Laasko, 1997; Rescorla & Goosens, 1992). Although a total play score was not strongly associated with language measures, associations were higher between play and language comprehension than between play and language production (Lyytinen et al., 1997). However, other studies have shown no difference between late talkers and typically developing children on measures of play synchrony, compliance, or overall communicativeness (Rescorla & Fechnay, 1996). When Rescorla and Goosens (1992) observed play behaviors in children 24-to-31 months, they found that late talkers showed relative weakness in complex play skills (i.e., de-centered play, sequential play, symbolic play transformations), but not in simpler skills.

Some conversational behaviors have also been found to correlate with late talking. In a mother-child play-based study, intentional communication was measured among late talking and typically developing children at 24-34 months (Paul & Shiffer, 1991). Late talkers used significantly fewer joint attentional intentions. Additionally, while the typically developing children were using primarily word combinations to communicate at this stage, the late talkers
were still relying most heavily on vocalized sounds (Paul & Shiffer, 1991). In a study by Rescorla et al. (2001), late talking children did not differ from typically developing children at age 3 on number of utterances, topic initiation, topic synchrony, use of commands, reactions to commands, or conversational fillers. The late talkers did, however, make significantly fewer declarative statements, elaborated on their own topics less, asked significantly fewer questions, and responded to maternal questions less than typically developing children (Rescorla et al., 2001). Additionally, none of these conversational measures differentiated late talkers with continuing delay from late bloomers (Rescorla et al., 2001). Rescorla and Merrin (1998) compared late talkers and typically developing children age 24-30 months on measures of communicative intent (i.e., verbal communication, joint attention, and initiation of communication), and found that both groups were equally likely to initiate, respond to, and maintain joint attention. Again, the late talkers in this study primarily used nonword vocalizations and gesturing while their typically developing peers were using words and word combinations (Rescorla & Merrin, 1998). Interestingly, the only predictor of age 3 MLU among these late talkers was interest in initiating communication and sustaining joint attention. Paradoxically, those late talkers who showed more interest in joint communication had worse outcomes than the late talkers with a weaker conversational drive. This finding suggests that late talkers who show more interest in joint communication may actually be trying to compensate for an especially weak underlying language endowment, which will lead to poorer outcome (Rescorla & Merrin, 1998).

Another factor contributing to late talking besides maternal input, conversational skills, and gesturing is language processing. One study drew robust links between processing efficiency and vocabulary growth from age 18-30 months in typically developing and late talking children
Late talkers with more efficient word recognition, as measured by the looking-while-listening task, were more likely to ‘bloom’ with accelerated vocabulary growth during the following year (Fernald & Marchman, 2012). Another study found that even as a word’s presentation was unfolding during a looking-while-listening task, late talkers were significantly less accurate (Eernisse, 2011). The late talkers in this study were also much slower to recognize familiar words (Eernisse, 2011). These data support the hypothesis that processing efficiency and word recognition may contribute to toddlers’ language acquisition, consistent with the processing account of SLI discussed above. A mismatch negativity neuroscientific study found that late talkers at ages 4 and 7 showed a reduced duration of auditory sensory memory, also consistent with a processing deficit account. However, this finding alone was not enough to account for the children’s persistent language difficulties (Grossheinrich, Kademann, Bruder, Bartling, & von Suchodoletz, 2010).

Family history may also play a role in a child’s language status. Some data have shown that late talking children are more likely to have family members with language difficulties than typically developing children (Rescorla & Schwartz 1990; Paul 1991), suggesting a potential genetic component to language abilities.

**Short-term outcomes for late talkers.** Most of the past research has focused on the language outcomes of late talkers until school age (approximately age 5). These studies have contradicted the earlier belief that late talkers do not experience later language weaknesses. In Paul’s (1993) longitudinal study, she tracked language skills in late talkers and typically developing children throughout the preschool period. Despite significant improvement in speech and language skills, most of the late talkers continued to score below the average range in expressive syntax or articulation at age 3 (Paul, 1993). However, most of the late talkers in this
study reached normal language and speech levels by kindergarten, and were within the normal range for reading readiness at that point (Paul, 1993). This study also found that half of the late talkers showed impaired social skills at age 3 independent of their communication difficulties (Paul, 1993). Thus, the effects of late talking may extend beyond toddlerhood, and may affect domains beyond lexical and grammatical development.

Studies have shown late talkers’ weaknesses in grammatical development throughout the preschool period. One early study found that among children identified with slow expressive language acquisition at 18-24 months, nearly half remained delayed in expressive communication at age 3, and one-third remained delayed in receptive language (Paul, Looney, & Dahm, 1991). When Rescorla, Dahlsgaard, and Roberts (2000) studied late talkers and typically developing peers at ages 3 and 4, they found that although late talkers made greater gains than age-matched peers between ages 3 and 4 on both MLU and IPSyn scores, they still lagged by about 2.5 standard deviations at both ages (Rescorla et al., 2000). This research also showed no differences in the predictive relationship between MLU and IPSyn for each group, suggesting that late talkers are delayed but not deviant in their grammatical development (Rescorla et al., 2000).

As with SLI, morphological development is quite impaired among late talkers during early childhood. When Paul and Alforde (1993) looked at the age 4 morphological outcomes of late talkers identified at age 2, they found significant weaknesses relative to the morphological development of their age-matched peers. Late bloomers did not differ from comparison children in MLU at age 4, but had acquired fewer grammatical morphemes than their typically developing peers (Paul & Alforde, 1993). When evaluating morphological development of late talkers and typically developing peers at ages 3 and 4, Rescorla and Roberts (2002) found that late talkers
had lower suppliance levels than typically developing peers on several morphemes at both ages. Further, most of the unmastered morphemes were verbal, not nominal, in nature (Rescorla & Roberts, 2002). However, this pattern was also true of typically developing children, indicating late talkers’ delayed but not deviant language acquisition processes (Rescorla & Roberts, 2002). Corroborating this notion, late talkers performed quite similarly to typically developing cross-age MLU-matched peers (Rescorla & Roberts, 2002). At both ages 3 and 4, the late talkers had significantly fewer scoreable morphemes, indicating that their utterances were simpler and that the late talkers were less frequently supplying morphemes in obligatory contexts than their age-matched peers (Rescorla & Roberts, 2002). Late bloomers at age 4 did not differ from typically developing peers of the same age on any morphemes (Rescorla & Roberts, 2002). However, the age 4 late talkers, as a group, had not “closed the gap” with the typically developing children (Rescorla & Roberts, 2002).

Other work has focused on late talkers’ specific lexical content. Lee and Rescorla (2008) compared late talkers and typically developing age-matched peers in their use of psychological state words (physiological, emotional, desire, and cognitive) at ages 3, 4, and 5. They found that the late talkers used significantly more psychological state words overall at ages 3 and 4, but that the groups did not differ at age 5. However, the late talkers used significantly fewer cognitive words at each age. This is important because cognitive state words are the most complex psychological state terms, as they typically require complex sentence frames (i.e., He thinks it is a house but it is really a garage.). Interestingly, the mothers of late talkers also made significantly fewer references to cognitive states than the mothers of comparison children (Lee & Rescorla, 2008). This delay in the use of cognitive state words may affect other aspects of the late talkers’ social and cognitive development (Lee & Rescorla, 2008). A follow-up study
showed that not only did age 5 late talkers use cognitive state words half as often as their age-matched comparison peers, but a smaller percentage of the late talkers used cognitive words at all (Rescorla & Lee, 2009). The late talkers’ percentage of cognitive state utterances was one-third that of their typically developing peers (Rescorla & Lee, 2009). This finding suggests that late talkers’ delayed vocabulary acquisition may later be deficient in complex content. There were no significant differences found between age 5 late talkers and MLU-matched age 3 typically developing children in the use of any psychological state words (Lee & Rescorla, 2008), suggesting delay rather than deviant acquisition of cognitive state words.

Of particular interest to the current study are Lee and Rescorla’s (2008) findings about patterns of MLU measures among late talking and comparison children across ages 3-5. The authors found significant main effects of both group and time on MLU, such that at each age the late talkers had significantly lower MLU scores than the comparison children (Lee & Rescorla, 2008). Importantly they also found a group x time interaction, showing that the gap between groups narrowed over time. By age 5, 53% of the late talkers scored within 1 standard deviation of the typically developing children’s mean age 5 MLU (Lee & Rescorla, 2008). Interestingly though, the late talkers’ age 5 MLU scores were still lower than even the age 3 MLU scores of their typically developing peers (Lee & Rescorla, 2008). The age 5 late talkers did not, however, differ significantly from the comparison children on the total number of words present in their vocabulary (Lee & Rescorla, 2008). Together these findings indicate that, despite notable lexical gains since age 2, late talkers at age 5 had weaker and delayed grammatical abilities compared to their age- and language-matched typically developing peers.

Some findings indicate that late talkers have remaining weaknesses in a number of higher level language areas, despite having ‘caught up’ to typically developing peers in expressive
grammar and vocabulary at age 5 (Girolametto et al., 2001). These higher-level language areas include facility with teacher-child discourse, use of pragmatic cues for resolving ambiguous sentences, and narrative tasks (Girolametto et al., 2001). However, it is important to note that late talking in itself is not longitudinally associated with behavioral or emotional disturbances (Whitehouse, Robinson, & Zubrick, 2011).

**Long-term outcomes for late talkers.** Several studies have followed late talkers identified at a young age through childhood, relating their language abilities to early language status. Early school age language skills appear to be significantly affected by age 2 language status. When Ellis Weismer (2007) investigated age 5.5 outcomes for late talkers identified at age 2, she found that late talkers showed significantly weaker listening and speaking skills than typically developing peers, especially in measures of sentence imitation. Adding the children’s performance on a fast mapping task (learning lexical associations for new words) at age 2.2 and preschool cognitive and language measures as predictors explained 65% of the variance in age 5.5 MLUs (Ellis Weismer, 2007). Ellis and Thal (2008) studied 577 children who had been classified at 16 months as typically developing, delayed in expressive language, or delayed in expressive and receptive language. They found that a small percentage of children from each of these initial groups met the criteria for SLI at age 6 (Ellis & Thal, 2008). Most of the children who had SLI at age 6 had typical language histories, but children who had shown an early receptive delay were at greater risk for developing SLI than children who showed expressive delay only (Ellis & Thal, 2008). Rice, Taylor, & Zubrick (2008) looked at age 7 language scores and found that late talkers showed significant weaknesses when compared to typically developing peers. The authors also determined that syntactic and morphosyntactic skills—especially tense marking—were more vulnerable to long-term impairment than semantic skills.
(Rice et al., 2008). Nonverbal intelligence was found to be unaffected by early language delay (Rice et al., 2008).

Few outcome studies of late talkers beyond age 7 have been conducted, but the series of follow-ups conducted by Rescorla (i.e., 2000, 2002, 2005, 2009) and colleagues continued to age 17. By age 5, Rescorla found that 85% of her late talkers reached the average range on a sentence-repetition test of expressive grammar skills (1993). However, the late talkers’ mean score was significantly lower than that of their typically developing peers. Continuing language weaknesses relative to peers were found at later ages on other measures of grammar, as well as on measures of vocabulary and verbal memory. When compared to typically developing peers at age 6, the late talkers had significantly weaker vocabulary, grammar, and phonology skills (Rescorla, 2002). Vocabulary measures also distinguished the two groups at age 7, and vocabulary, grammar, listening comprehension, and reading revealed significant differences at age 8 (Rescorla, 2002). At age 9, late talkers had significantly weaker reading skills than their typically developing peers (Rescorla, 2002). On a story-telling task completed at age 9, the late talkers included less evaluative information than their typically developing peers and showed significantly weaker syntax and story grammar (setting, event or problem initiation, characters’ internal responses to that problem, goal-directed actions, consequences, resolution, and ending) (Manhardt & Rescorla, 2002). This observed weakness in story grammar in late talkers at age 9 was not solely determined by their generally weaker language skills, but was instead interpreted as suggesting a specific narrative weakness (Manhardt & Rescorla, 2002), perhaps a manifestation of their weak underlying language endowment. This narrative weakness may also reflect a difficulty internalizing the narrative structure as a way to conceptualize, understand, and remember events (Manhardt & Rescorla, 2002).
Another study investigated the relations between rate of recovery from late talking and language-related skills from early through middle childhood (Armstrong, 2007). These data again showed weak language-related skills in fifth grade relative to typically developing peers, despite language scores in the normal range from age 5 forward (Armstrong, 2007). Unlike other work, this study found no long-term differences between the late talkers who bloomed by age 3 and those who bloomed between ages 3 and 4 (Armstrong, 2007). It may be that earlier measures of language skills (i.e., Rescorla & Roberts, 2002) are particularly sensitive to recovery rate differences, but that these differences do not have long-term effects. However, this study did find that late talkers who failed to bloom prior to beginning school (presumably around age 5) did score significantly lower than other groups on fifth grade language measures (Armstrong, 2007).

These data point to a variation in asymptotic language performance among late talkers (Rescorla, 2002).

At age 13, Rescorla’s late talkers scored within the average range but significantly lower than their typically developing peers on measures of vocabulary, grammar, verbal memory, and reading comprehension (Rescorla, 2005). Age 2 vocabulary scores on the LDS significantly predicted these age 13 results (Rescorla, 2005). Both groups performed similarly on reading mechanics and aggregate writing skills at age 13 (Rescorla, 2005). Further, measures of phonology, vocabulary, grammar, verbal memory, reading mechanics, and reading recorded at ages 6 and 8 significantly predicted age 13 outcomes (Rescorla, 2005).

Although the late talkers performed within the normal range on all language and reading tasks at age 17, their performance was weaker than that of SES-matched typically developing peers on vocabulary/grammar and verbal memory measures (Rescorla, 2009). These measures strongly correlated with age 17 reading/writing factors, which were strongly predicted by
comparable factors measured at age 13 (Rescorla, 2009). However, only the age 13 vocabulary score was a significant predictor of age 17 verbal memory, and only the age 13 reading score was a significant predictor of age 17 reading (Rescorla, 2009). Together, these findings indicate a pervasive language deficit that manifests across ages. Age 2 scores on the LDS vocabulary measure explained 17% of the variance in vocabulary/grammar and verbal memory scores at age 17 (Rescorla, 2009).

In summary, these data suggest that late talkers have a cognitive/linguistic weakness compared to SES-matched peers that manifests throughout development, and that a more severe weakness may lead to relatively weaker language performance at older ages (Rescorla, 2000; 2002; 2005; 2009; 2013). Many have argued that these findings support the notion of a language endowment spectrum, with late talkers occupying a place on the lower end (Armstrong, 2007; Ellis Weismer, 2007; Ellis & Thal, 2008; Rescorla, 2013). This group is now known to show significant and broad-reaching language weaknesses relative to their age-matched peers far beyond their age 2 language delays, providing a crucial window into the interrelations between early language acquisition processes and sophisticated language domains. It is important to emphasize that these late talkers are not delayed or below average in any normative way past early development. It is only when compared to their above average SES-matched peers that the late talkers’ differences emerge.

Rationale and Hypotheses for the Current Study

Rescorla and Roberts (2002) reported that morphological development in late talkers was delayed at ages 3 and 4 relative to that of SES- and age-matched typically developing peers, but very little is known about late talkers’ mastery of grammatical morphemes at age 5, the age by which typically developing children generally show virtually complete mastery. Thus, the
primary goals of the current study were to determine differences in morphological mastery between (a) age 5 late talkers and age-matched typically developing children; (b) age 5 late bloomers, children with continuing delay, and age 5 typically developing peers; and (c) age 5 late talkers and age 3 MLU-matched comparison peers. For each of these group constellations, differences were tested in number of morphemes with sufficient obligatory contexts to be scored, percent suppliance in obligatory contexts for each scored morpheme, and percent of the group with >90% suppliance. The purpose of these analyses was to assess the degree to which late talkers’ language development had caught up to typically developing peers by age 5, and in what ways late talkers still showed marked differences.

The current study draws from research on school-age language development. When compared to age-based norms, late talkers generally achieve average language abilities by age 5. However, they continue to lag behind SES-matched peers through adolescence. Both late talkers and children with SLI seem to show selective difficulty with verbal/tense marking morphemes, mastering them later than typically developing peers. Thus, improved understanding of the language deficits present in age 5 late talkers may also enhance our understanding of delays in acquisition of adult-like grammar, complex language, and advanced grammar, reading, and writing skills. Consistent with this hypothesis, data from both late talkers and children with SLI suggest that deficits in morphology are associated with later weaknesses in other language domains. The current study aims to situate itself within this literature, filling critical gaps in our understanding of morphological development in late talkers at age 5.

The current study was designed to further elucidate the similarities and differences between age 5 late talkers and age- and language-matched typically developing peers. Previous research (Rescorla, 2009; Rescorla & Roberts, 2002) has shown that the late talkers in this cohort
manifested significantly impaired morphology at ages 3 and 4, as well as significantly weaker complex language skills than SES-matched peers through adolescence. Based on these findings, we hypothesized that the age 5 late talkers would continue to display more impaired morphology, particularly verbal morphology, than SES-matched, age-matched typically developing peers. However, we also hypothesized that more late talkers would supply each morpheme at age 5 than at ages 3 and 4, helping to explain why these children were thought to have ‘caught up.’ Still, we hypothesized that late talkers’ rates of suppliance would lag behind those of age-matched typically developing peers. In determining group similarities, we hypothesized that age 5 late talkers would not be significantly different from age 3 typically developing peers on any morpheme suppliance measures, that age 5 late bloomers would show morpheme performance on par with age-matched typically developing peers, and that the order of morpheme acquisition would be consistent across all groups.

Method

Participants

The current study used data from 34 late talkers and 20 typically developing comparison children. The data used for this study were part of a larger data set collected in the Pennsylvania Late Talkers Study (see Rescorla 2000, 2002, 2005, 2009, 2012). This longitudinal study followed groups of late talkers and comparison children from age 2 to age 17, evaluating language abilities at various points. Late talkers were recruited through advertisements in newspapers, pediatricians’ offices, and a local infant lab. All participants were Caucasian and from middle/upper-SES families, and the groups did not differ in nonverbal IQ scores at intake (Rescorla, 2012). Intake occurred between 24 and 31 months of age, and the late talkers exhibited an expressive language delay only, without receptive deficits (Rescorla, 2013). All
children in both groups had a Bayley Mental Development Index (MDI; Bayley, 1969) score of 85 or greater and a Reynell Receptive Language (Reynell, 1977) (Appendix A) score within 3 months of chronological age (one was 4 months delayed) (Lee & Rescorla, 2008), although the group means on this receptive language measure were found to be significantly different (Lee & Rescorla, 2008). The children in the typically developing group had to score within 3 months of chronological age on the Reynell Expressive Language scale as well (one was within 4 months), whereas the late talkers were all at least 6 months below chronological age on this measure. The late talkers had significant delays in expressive speech at intake, as documented in naturalistic observation and parental reports (Lee & Rescorla, 2008). Mean vocabulary size, as measured by Rescorla’s LDS, was significantly different at intake between the late talkers and typically developing children. The late talkers had a mean vocabulary of 19 words, while the typically developing children had a mean vocabulary of 233 words at the same age.

**Procedure**

Speech samples from the Pennsylvania Late Talkers Study were obtained from 30-minute recordings of mother-child free play sessions using the Fisher Price play village. This toy contains many environments and pieces of equipment (people, animals, furniture, vehicles, etc.) conducive to pretend play. The play sessions were videotaped and audiotaped, while a speech-language pathologist present during the play session took notes of all utterances. The play sessions were transcribed using the conventions established by the Children’s Data Exchange System (CHILDES) consortium (MacWhinney, 1991) (Appendix A). The transcripts were coded in a way that identifies morphemes independently of the words to which they are attached (cat-s is transcribed in place of cats). Morpheme coding was done for the first 100 utterances in each transcript, which were also used to compute each child’s MLU. Immediate self-repetitions and
imitation were excluded from the MLU corpora (Lee & Rescorla 2008). Language transcripts for this study were available for 54 children (34 late talkers and 20 typically developing comparison children). MLU and IPSyn, two measures of early syntax, had already been scored for each transcript prior to this study.

For the current study, we coded each transcript for the percentage of suppliance in obligatory contexts for each morpheme (percentage morpheme suppliance). We also recorded what percentage of each group was using each morpheme in enough contexts to be analyzed (percentage of participants analyzed) (Appendix A). We subsequently split the late talker group into 8 late bloomers whose MLUs were indistinguishable from typically developing children at age 5 and 21 late talkers with continuing delay to see if any significant differences between those two subgroups emerged. Analyses were conducted in two-group (late talkers vs. typically developing children) and three-group (late talkers with continuing delay vs. late bloomers vs. typically developing children) comparisons.

**Morpheme Coding**

Every utterance in each transcript was inspected for the presence or absence in obligatory contexts for the following grammatical morphemes: progressive –*ing*, personal pronouns, possessive personal pronouns, plural –*s*, preposition in, preposition on, possessive –*’s*, regular past tense –*ed*, irregular past tense, regular third person –*s*, irregular third person, articles, contractible copula *be*, uncontractible copula *be*, contractible auxiliary *be*, uncontractible auxiliary *be*, modal verbs, derivational morphemes (un-, -ly), irregular plurals, auxiliary *do*, auxiliary *have*, adjectival verb suffixes (-*ed*, -*ing*), and negation (-*’nt*). (Age 4 late talkers showed mastery of plural –*s*, articles, nominative pronouns, preposition *in*, other prepositions, progressive –*ing*, and modal verbs (Rescorla & Roberts, 2002).) The selection of these
morphemes was guided by Brown (1973) and Bedore and Leonard (1998). The specific morphemes were identified in each utterance, and the coding was checked for accuracy. The primary researcher coded 50 of 54 transcripts. A research assistant independently coded the other 4 transcripts. Interrater reliability was 71%.

Morphemes were classified as correctly supplied in an obligatory context, omitted in an obligatory context, substituted for another morpheme in an obligatory context, or oversupplied where unnecessary. Percentage suppliance for each morpheme for each child was calculated by dividing the number of overtly marked morphemes by the total number of obligatory contexts in which that morpheme should have appeared. Group means of these suppliance percentages served as the basis for cross-group comparisons. Additionally, according to Rescorla and Roberts’ (2002) guidelines, a morpheme was considered scoreable for a given child if he/she had at least 4 obligatory contexts. A morpheme was considered analyzable if at least 8 children in each group had enough obligatory contexts to be scoreable. Thus, the percentage of children in each group considered scoreable on a given morpheme constituted the percentage of participants analyzed for that morpheme for that group. A child reaching 90% suppliance on a particular morpheme was considered to have mastered that morpheme, in accordance with Brown (1973) and subsequent work.

**Study Design and Data Analyses**

This study primarily utilized a two-group design comparing late talkers to typically developing children of the same age and SES. Subsequent analyses divided the late talkers into late bloomers and late talkers with continuing delay and compared these groups to the age-matched peers, producing a three-group design. We hypothesized that the morphemes scored in this study would reveal significant differences between the late talkers, age-matched peers, and
MLU-matched peers, in addition to potentially distinguishing late bloomers from late talkers with continuing delay.

We used *t*-tests to examine group differences in percentage of morpheme suppliance and percentage of participants analyzed between age 5 late talkers and typically developing children. Then, the age 5 late talkers were divided into two groups, late bloomers and late talkers with continuing delay, and compared to age 5 typically developing children using one-way ANOVAs. We initially intended to compare age 5 late talkers and MLU-matched age 3 typically developing children as the final step in our analyses, but results of the earlier steps indicated that this was not necessary and therefore this final analysis was not carried out. Effect sizes were calculated using Cohen’s $d$ (1988). We analyzed percentage suppliance and percentage of participants analyzed for each morpheme for each group. Lastly, we used *Q* correlations to test consistency in morpheme acquisition order across the various groups.

**Results**

**Morpheme Analysis**

Before comparing group morpheme suppliance, the data were examined to eliminate morpheme scores from children who were not scoreable on a given morpheme. In accordance with Rescorla’s and Roberts (2002), we considered a child who supplied a given morpheme in at least 4 obligatory contexts (OCs) to be scoreable on that morpheme. If there were at least 8 children in each group who were scoreable on a given morpheme, then that morpheme was analyzed using only the data from the children who supplied the morpheme in at least 4 OCs. Of the 23 morphemes that were coded, 14 were analyzeable. In many of these 14 morphemes, the percentage of the group that was scoreable was similar for both late talkers and typically developing children, although the percentage of late talkers scoreable was slightly lower than the
comparison group. Figure 1 reports the percentages of each group that was scoreable for each coded morpheme.

Two-group Comparisons

Independent samples t-tests were used to compare the percentages of correct suppliance, omission, and substitution of each analyzeable morpheme in obligatory contexts. For each morpheme, the scoreable late talkers (OC≥4) were compared to the scoreable typically developing children (Table 3).

All previously mastered morphemes from Rescorla and Roberts (2002) showed similar mastery at age 5, as hypothesized. Both late talkers and comparison children demonstrated solid mastery of the progressing -ing morpheme (99% and 97%, respectively), which is to be expected, as this is one of the earliest acquired morphemes according to Brown (1973). Personal pronouns were also mastered at age 5, as at age 4, in both late talkers (96%) and comparison children (98%). Prepositional in, another of Brown’s (1973) early-acquired morphemes, was again used with mastery by late talkers (99%) and comparison children (100%). Modal verbs, such as could, would, and might, had also been mastered by both groups of children (97% and 94%, respectively) at age 5.

Several morphemes that had not been mastered by the age 4 late talkers and typically developing comparison children were used with over 90% accuracy by both cohorts at age 5. Plural –s (99% and 92%, LT and TD) and irregular past tense verbs (94% and 98%, LT and TD), two of Brown’s (1973) earlier-acquired morphemes, were mastered at 5 for the first time. Articles were also newly-mastered by both age 5 groups, with 94% (LT) and 96% (TD) correct usage. Irregular third person verbs were used with 100% and 96% accuracy by late talkers and typically developing children, respectively. Contractible copula and contractible auxiliary forms
of *to be*, which Brown (1973) considered the last morphemes to be acquired, were both used frequently and proficiently by late talkers and typically developing children alike, with 99% of both groups showing mastery of contractible copulas and 100% of both groups having mastered contractible auxiliaries. Although it wasn’t measured in previous studies, we recorded accurate uses of the morpheme –‘nt, marking negation (i.e., *can’t, shouldn’t, don’t*). Both late talkers and comparison children had mastered this morpheme, with 100% and 99% accuracy, respectively.

A few analyzable morphemes (i.e., more than 8 children in each group supplied it in at least 4 obligatory contexts) had not yet been mastered by both groups of children. Uncontractible copulas had been mastered by typically developing children (92%) but not late talkers, who only showed 86% mastery. Late talkers (*M*=13%, *SD*=17%) omitted the uncontractible copula significantly more than their typically developing peers (*M*=5%, *SD*=9%), t(46.3)=2.20, *p*=0.03, *d*=0.59. The difference in percentage of obligatory contexts in which the uncontractible copula was omitted was the only significant difference found in our analyses. However, if Bonferonni correction is used (0.05/14==0.0036), then even this morpheme was not significant. Use of the auxiliary *do* showed the opposite [and unexpected pattern]: late talkers seem to have mastered the morpheme (95%), but typically developing children in our data sample had not yet mastered auxiliary *do*—as a group, they only used it correctly in 88% of obligatory contexts, and omitted it in 12% of obligatory contexts. Neither late talkers nor comparison children showed 90% mastery of the regular third person –s, using it with 82% and 89% accuracy respectively. The effect sizes for all of the analyzed morphemes can be found in Table 4. The majority of the Cohen’s *ds* (1988) are medium in size, although some are small or negligible and some are rather large (0.50-0.76).
Some of the morphemes within Brown’s (1973) acquisitional ordering were not analyzeable in our sample because they were not provided in enough obligatory contexts by enough children in each group. These morphemes included possessive –’s, regular past tense –ed, the uncontractible auxiliary be, and the preposition on. On is perhaps the most perplexing morpheme, because it was reported to be mastered at age 4 by the children in the Pennsylvania Late Talkers study (Rescorla & Roberts, 2002). The percentage suppliance of these morphemes was similarly low across both groups; it was not only the late talkers who failed to provide them in enough obligatory contexts to be analyzed.

A correlation was calculated between the mean correct suppliance percentages for each analyzeable morpheme for late talkers and typically developing children to determine the consistency in acquisition order between the groups. A moderate correlation ($r=0.63$) was found, indicating that the order of morpheme acquisition between the two groups was somewhat, though not entirely, consistent. This was lower than the $r$ of 0.82 at age 4 reported by Rescorla and Roberts (2002), which was probably due to the restricted range of correct morpheme suppliance at age 5 (82%-100%, with the majority of percentages falling between 94% and 100%) (Table 3).

Data from Lee and Rescorla (2008) provided MLU and IPSyn measures for our sample of 5-year-old late talkers and typically developing children. MLU was significantly different at age 5, with late talkers’ MLUs ($M=4.01, SD=0.56$) measuring lower than comparison children’s MLUs ($M=4.52, SD=0.59$), $t(41)=-2.76$, $p<0.01$, $d=-0.89$. Despite MLU differences between groups, all groups were clearly within (and beyond) Brown’s (1973) fourth stage of language development, where it is expected that they use complex grammar and morphology.

Late talkers not only had lower MLUs than comparison children, they also had significantly lower IPSyn scores at age 5 ($M=41.00, SD=8.21$) than typically developing children
Further, when looking at the subscores of the IPSyn measure, it became clear that the underlying group differences in linguistic syntax resided primarily in uses of Question/Negation and Sentence Structure. There were no significant differences in the Noun Phrase or Verb Phrase subscores, which is where most morphemes are found. Late talkers \((M=6.00, SD=2.48)\) employed question and negation sentence structures significantly less frequently than typically developing children \((M=7.94, SD=3.37)\), \(t(49)=-2.36, p=0.023, d=-0.66\). Late talkers \((M=11.64, SD=4.17)\) also used significantly simpler sentence structures, as measured by the IPSyn, than comparison children \((M=14.83, SD=4.82)\), \(t(49)=-2.48, p=0.017, d=-.071\).

**Three-group Comparisons**

Subsequent to the set of two-group comparisons between late talkers and typically developing comparison children, the late talkers’ group was subdivided into late talkers with continuing delay \((N=21)\) and late bloomers \((N=8)\), those late talkers whose MLUs are not significantly different from comparison peers at age 5.

One-way between-subjects ANOVAs were conducted to compare the late talkers with continuing delay, late bloomers, and typically developing children on suppliance of analyzeable morphemes. The same 14 analyzeable morphemes were used as in the two-group comparisons. Even after subdividing the late talkers group into late talkers with continuing delay and late bloomers, few significant differences emerged. All three groups showed mastery \(\text{(correct suppliance greater than 90\%)}\) of the morphemes progressive \(-\text{ing}\), pronouns, plural \(-s\), prepositional \(\text{in}\), irregular past tense, irregular third person, articles, contractible copula \(\text{be}\), contractible auxiliary \(\text{be}\), modal verbs, and negation \(-\text{nt}\).
Of note are morphemes where one of the three groups did not show mastery but the others did. The expected pattern of results was seen in use of the uncontractible copula *be*: the typically developing children’s and late bloomers’ percentage of correct suppliance were identical (92%), while the late talkers with continuing delay had a markedly lower percentage (85%).

A different pattern was found when analyzing use of auxiliary *do*. Each of the three groups were markedly different in their percentage of correct suppliance of the morpheme, but the typically developing children actually had the lowest percentage (88%), followed by late talkers with continuing delay (93%). The largest margin of difference was actually between the typically developing group and the late bloomers (97%).

As was seen in the two-group comparisons, none of the groups had mastered the regular third person -s morpheme, although within these results, the late bloomers’ percentage of correct suppliance (82%) was intermediate between the late talkers’ with continuing delay (80%) and the typically developing children’s (89%).

Oversuppliance of morphemes in non-obligatory contexts was also coded for, but very few instances were observed. Percentage of oversuppliance within all of the instances of any given morpheme mostly ranged from 2.9%-11.8%, with one outlier of 20.6% for contractible copulas.

As would be expected, the late talkers with continuing delay were significantly different from their typically developing peers on MLU measures: the late talkers with continuing delay had MLUs ($M=3.91, SD=0.54$) that were significantly lower than those of typically developing children ($M=4.52, SD=0.59$), but the late bloomers alone ($M=4.29, SD=0.54$) were not significantly different from any other group. Although the two-group comparison of age 5 MLU was highly significant, the late talkers’ mean used in that comparison was attenuated by the late
bloomers; the late talkers with continuing delay, when taken alone, had an even lower mean MLU than the combined late talker group (late talkers with continuing delay and late bloomers).

The same pattern found for the MLU measures held true for three-group comparisons of late talkers with continuing delay, late bloomers, and typically developing peers on overall IPSyn scores and sentence structure. The late talkers with continuing delay ($M=39.2$, $SD=7.39$) had total IPSyn scores that were significantly lower than those of typically developing peers ($M=48.3$, $SD=8.49$). However, the late bloomers’ total IPSyn scores ($M=44.5$, $SD=10.3$) were not significantly different from either late talkers’ or comparison children’s. The same was true of the Sentence Structure IPSyn subscores: the late talkers with continuing delay ($M=11.0$, $SD=3.77$) scored significantly lower than typically developing children ($M=14.8$, $SD=4.82$), though neither group was significantly different from the late bloomers ($M=12.9$, $SD=5.62$). The late bloomers’ sentence structure abilities were intermediate to the other groups, but the sample was so small so there was very little statistical power. The group differences in Question/Negation subscores were no longer significant when late talkers with continuing delay and late bloomers were separated, although the mean scores indicated that late bloomers’ scores fell between scores of late talkers with continuing delay and comparison children. Lack of significance may have been due to reduced power for a three-group comparison.

**Discussion**

**Overview of Findings**

As Paul and Alforde (1993) found, by age 5 children have mastered most of the morphology of their language. Interestingly, though, this appears to be no different for late talkers. Our results indicate that late talkers and their SES-matched typically developing peers have comparable morphological development at age 5, despite the fact that these same children
showed significant differences in morpheme use at ages 3 and 4. Slight and systematic differences were observed in the percentage of each group that was using the morphemes enough to be considered scoreable, such that the late talkers were supplying the morphemes slightly less frequently than the comparison group. Of the analyzed morphemes, only third person -s had not yet been mastered by either typically developing children or late talkers. Given the morphemes we were able to analyze, the children in our sample groups displayed comparable morphological abilities, with both groups having mastered the majority of the morphemes. For this reason, cross-age comparisons of age 5 late talkers to age 3 typically developing children were deemed superfluous.

Contrary to our hypotheses, no significant differences emerged in the percentage of correct, omitted, or substituted suppliance of analyzeable morphemes. When evaluating morphological measures alone, our findings are consistent with Paul’s (1993) conclusions that most late talkers have reached normal language and speech levels by kindergarten, approximately age 5. Although there were no group differences in morpheme suppliance, the late talkers had significantly weaker language skills at age 5 as measured by MLU and the IPSyn, even when late bloomers were included in the group of late talkers. These persistent and significant MLU and IPSyn differences cast doubt upon the conclusion that the late talkers had normal language levels by age 5, as will be discussed later.

No further group differences emerged in our three-group comparisons, when the late talker group was subdivided into late bloomers and late talkers with continuing delay. If the late bloomers had attenuated the larger late talker group’s results in any way, these subsequent analyses would have revealed subtle group differences. However, even in the three-group comparisons, very few significant differences emerged. Our hypothesized pattern of results
largely did not accurately predict the patterns between the three groups, and any group differences were mostly likely not systematic in nature. When the number of analyses run is taken into account, even the few significant findings should probably be considered Type I errors (i.e., due to chance).

The morphemes that were not analyzeable in our sample did not correspond to Brown’s (1973) ordering, but likely were a manifestation of the limiting conversational context in which the data were collected. For example, it is unusual that the 5-year-olds in our sample rarely used the regular past tense morpheme –ed, but this is probably because the children were engaged in pretend play. The analyzeability of the irregular past tense came primarily from uses of did in expressing the auxiliary do (i.e., he did sit, but now he’s going to get mail).

Although our Q correlation of 0.63 indicated that the groups were acquiring morphemes in a slightly different order, the restricted range of suppliance percentages (i.e., so many falling in the 90%-100% range) probably attenuated the level of this correlation. Additionally, the ordering produced by the current study likely does not accurately reflect the order in which each group of children acquired the morphemes. Taking into consideration the patterns found in vocabulary acquisition (see Rescorla, 2013), it is likely that the late talkers acquired the morphemes somewhat later than typically developing peers, but not in a distinctly different order.

Further analysis of our results in conjunction with the significant differences on IPSyn subscores sheds light on what differences remain between age 5 late talkers and children with typical language histories, and what picture this paints for the rest of their language development. At ages 3 and 4, IPSyn scores and morphology were both significantly weaker in late talkers than in typically developing peers. Age 5, however, is the first age at which these two measures do not correlate; suddenly late talkers’ morphological abilities seem to have recovered, and yet
syntactic abilities are still lacking, breaking *morphosyntax* into its independent components. The late talkers’ morphological recovery is reflected in their Noun Phrase and Verb Phrase subscores of the IPSyn, under which many of our coded morphemes are subsumed. The Question/Negation and Sentence Structure subscores, on the other hand, measure the more complex features of language (e.g., yes/no question with inverted copula, tag questions, propositional complement, relative clauses, bitransitive predicate, passive constructions, etc.), and are still significantly weaker in age 5 late-talkers than their comparison peers.

Like many other language measures, MLU and IPSyn scores progressively improve for both groups between ages 3 and 5, and likely plateau at a later age. Other research by Rescorla and colleagues (see Rescorla, 2013 for review) has evaluated various complex language measures for the age 5 group, and found that the following skills are comparatively weaker in late talkers than comparison children at age 5: use of cognitive state terms, propositional complement syntax, defining words, and describing concepts. Although their grammar was average relative to age-based norms, the late talkers still scored about 1 SD lower than the comparison group on a sentence repetition test tapping various grammatical structures (Rescorla, 2013). Thus we can see that complex language skills are still weak in late talkers at age 5, despite their much-improved morphology. Though these skills gradually improve, weak underlying language abilities manifest in diverse higher-order skills throughout development. Rescorla’s longitudinal findings (see 2013) show that the same late talkers we studied were significantly weaker than their typically developing peers in many complex language measures through age 17 (e.g., verbal memory, reading comprehension, listening comprehension, narrative tasks and story grammar, complex syntax, grammatical judgment, and logical memory). Furthermore, vocabulary size at age 2 (as measured by the LDS) proved to be a robust predictor of later
language measures, accounting for a significant amount of the variance in age 13 and age 17 language measures (Rescorla, 2013).

Overall, children in both groups in the current study showed age-appropriate morpheme development and mastery. Unlike at age 4, it seems that morphology is not a particularly useful group marker at age 5. It may also be that morphological deficits, like MLU deficits (Lee & Rescorla 2008), diminish during the period between ages 3 and 5. Unlike MLU though, these morphological deficits have mostly disappeared by age 5, and late talkers at that age are morphologically on par with their typically developing peers.

There were no significant differences in the current study in the suppliance, omission, oversuppliance, or substitution of any morphemes between late talkers and comparison children, or between late talkers with continuing delay, late bloomers, and comparison children. Our findings suggest that children with atypical language histories (late talkers, including late bloomers) have recovered most morphological skills by age 5, and perform at the same level as SES-matched typically developing peers. It may be that late talkers were experiencing an Extended Optional Infinitive (EOI) period similar to that which Rice, Wexler, and Hershberger (1998) posited of children with SLI at age 4. The EOI theory (Rice, Wexler, & Hershberger, 1998) hypothesizes that this extended period of immature grammar continues through age 7-8 in children with SLI, but perhaps in late talkers, the period is somewhat less extended. Late talkers did seem to lag behind their typically developing peers in morphology through age 4, but the group difference was gone by age 5. This again lends support to the notion that late talkers may be a more mildly impaired subset within children previously diagnosed as having SLI.

When we consider our findings in the context of the larger profile of Rescorla’s late talkers, it seems that the recovery of morphological abilities between ages 4 and 5 is illusory, and does
not imply a recovery of all underlying language abilities. Rather, as Rescorla suggested (2013), early morphological weakness is likely a partial manifestation of an underlying language endowment that is weak relative to typically developing peers’. Rescorla (2013) further proposed that late talkers and children with SLI both represent low, and possibly overlapping, areas on a spectrum of language endowment. High SES children with typical language histories probably comprise the high end of this spectrum.

Taken in the longitudinal context of Rescorla’s work on late talkers, our results are rather perplexing. How is it that these children, who show such pronounced differences from typically developing peers at young ages and such complex differences through age 17, show no morphological differences at 5? Developmentally, it may be that morphological weakness is something that diminishes over time, regardless of language endowment or speech-language intervention. All children experience periods when their morphology is immature, (i.e., overextending morphemes to irregular words, such as *she runned*). Again, it may be that this immature period extends longer in late talkers, but that their development is delayed rather than deviant. Consistent with Rescorla’s other work, then, is the conclusion that this current (and past) research on late talkers supports the notion of a language endowment spectrum in which some individuals are relatively weaker and some are relatively stronger. Perhaps late talkers’ weaker endowment causes their optional infinitive period to be extended, but not as dramatically extended as the broad group of children with SLI. It seems likely that the late talkers’ relative language weakness may also be attributable to this weaker endowment, which manifests differently through the course of development (e.g., first as small vocabulary, later in weaker higher-order comprehension skills). On the spectrum of language endowment, late talkers are just one of many clusters of children actively acquiring language in diverse and complex ways.
Limitations

Although the present study involved morphological analysis of the largest sample of age 5 late talkers studied to date, there are several limitations of our study that must be acknowledged in interpreting our results. First, logistics precluded establishing fully adequate interrater reliability. Lack of time meant that the supplemental rater was only able to code four transcripts and training was insufficient to reach a high level of reliability with the main coder. Second, some of the morphemes that were not analyzable in our sample (possessive –‘s, regular past tense –ed, the uncontractible auxiliary be, and the preposition on) have likely been mastered by children at age 5, perhaps including late talkers. However, due to the research paradigm of naturalistic pretend play, it may be the case that the speech sample context did not elicit these morphemes. The children’s speech was centered around activities and pretend play, and this context may have excluded many uses of morphemes such as past tense ed and third person –s that may have occurred at this age in other environments. The apparent lack of past tense –ed in our sample’s speech may also be consistent with Leonard et al.’s (2007) profile of children with SLI, but our participants do not fit the profile of the pervasive morphological deficits in SLI (Thordardottir & Ellis Weismer, 2002; Johnston & Kahmi, 1984). The question remains as to whether late talkers and children with SLI are one and the same, but our findings seem to generally suggest that late talkers are a somewhat distinct group, perhaps residing within or overlapping but not synonymous with SLI.

In the future, a paradigm involving story telling or describing past and future routines or activities might elicit a fuller range of morphemes. Manhardt and Rescorla (2002) found differences between late talkers and comparison peers in complex syntax at ages 8 and 9 through a narrative paradigm, and it might be that such a design is appropriate for the age 5 cohort as
well. It also may be true that there exist subtler differences in the mastery of particular morphemes than could be detected in our methodology. The paradigm we used resulted in ceiling effects for nearly all of the analyzeable morphemes in that both groups showed sufficient mastery of the same morphemes. Within an experimental design, however, one might be able to create challenging [and externally-imposed] grammatical contexts that require complex understandings of which morphemes are obligatory. This type of challenging paradigm may reveal subtle differences in late talkers’ morpheme mastery at age 5 that were not visible in this naturalistic study. This may also help to explain why prior to the Pennsylvania Late Talkers study, late talkers were thought to have ‘caught up’ to typically developing peers by age 5 (see Rescorla, 2013). Perhaps age 5 is also the point at which the naturalistic paradigm can cease to be conducted with the child’s mother as an active participant, and instead must position the child as the primary and independent participant.

An additional limitation in this work is that all of the included late talkers had normal receptive language at intake. In many cases of developmental language impairment (SLI or otherwise), the profile of expressive and receptive impairments is mixed. In addition, the children in this sample were all Caucasian and from middle- to upper-middle-class SES backgrounds. Thus, our results have only limited generalizability to more diverse samples of children from different racial and socioeconomic backgrounds. Our sample sizes were comparable to others in the literature, but were not large, and issues of statistical power must also be considered when evaluating our findings.

Further research may supplement our findings by investigating age 5 late talkers’ morphological and higher-order language abilities through varying paradigms (e.g., narrative, experimental). Although we did not find significant differences in morphology at age 5 between
late talkers and typically developing peers, these results are not generalizable to larger populations. Thus, further research may also investigate the interactions between socioeconomic factors (e.g., race, education, and SES) and language endowment. It may be that the combinations of these factors counteract or accentuate each other. Since the field of research on late talkers is still young, most research has focused on Caucasian children of middle- to high-SES and adequate educational resources. The ways in which other factors influence late talkers’ language abilities are still unknown.

**Clinical Implications**

Speech-language pathologists and other clinical professionals working with age 5 late talkers and typically developing children can expect mastery of most grammatical morphemes. Based on our results, comparatively more difficulty may be observed with the uncontractible copula, auxiliary do, regular third person -s, possessive – ’s, regular past tense –ed, and the uncontractible auxiliary be. Morphological difficulties observed in late talkers at ages 3 and 4 should largely diminish by age 5, although relative weakness in sentence structure complexity and mean utterance length may be manifested. Speech-language pathologists may find that the trajectory and rate of progress in morphological development for late talkers may be different from the pattern observed in typically developing children, but the end result is quite comparable. While targeting morphological and grammatical difficulties in earlier years, clinicians should be careful not to neglect other complex and fundamental aspects of sophisticated language such as the complex syntax required for narrative and expository discourse, which has been shown be weaker in late talkers than comparison peers into adolescence.
References


Table 1

*Brown’s (1973) order of morpheme acquisition*

<table>
<thead>
<tr>
<th>Order</th>
<th>Morpheme</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Present progressive</td>
<td>-ing, <em>I driving</em></td>
</tr>
<tr>
<td>2-3</td>
<td>Prepositions</td>
<td>in, on</td>
</tr>
<tr>
<td>4</td>
<td>Plural</td>
<td>-s, <em>cups</em> (sometimes overextended, i.e., <em>tooths</em>)</td>
</tr>
<tr>
<td>5</td>
<td>Irregular past tense</td>
<td><em>Broke, fell, threw</em></td>
</tr>
<tr>
<td>6</td>
<td>Possessive</td>
<td><em>Mommy’s hat</em></td>
</tr>
<tr>
<td>7</td>
<td>Uncontractible copula</td>
<td><em>This is hot</em></td>
</tr>
<tr>
<td>8</td>
<td>Articles</td>
<td><em>a, an, the</em></td>
</tr>
<tr>
<td>9</td>
<td>Regular past tense</td>
<td>-ed, <em>walked, cooked, talked</em> (overgeneralized)</td>
</tr>
<tr>
<td>10</td>
<td>3rd person present tense, regular</td>
<td>-s, <em>eats, makes</em></td>
</tr>
<tr>
<td>11</td>
<td>3rd person present tense, irregular</td>
<td><em>does, has, says</em></td>
</tr>
<tr>
<td>12</td>
<td>Uncontractible auxiliary</td>
<td><em>The horse is winning</em></td>
</tr>
<tr>
<td>13</td>
<td>Contractible copula</td>
<td><em>He’s a clown (noun)</em></td>
</tr>
<tr>
<td>14</td>
<td>Contractible auxiliary</td>
<td><em>She’s running (verb)</em></td>
</tr>
</tbody>
</table>
Table 2

*Number (%) of Children Per Group Scoreable on Each Morpheme*

<table>
<thead>
<tr>
<th>Morpheme</th>
<th>Late Talkers scoreable (%)</th>
<th>Typically Developing children scoreable (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Progressive –ing</td>
<td>21 (62%)</td>
<td>13 (65%)</td>
</tr>
<tr>
<td>*Personal Pronouns</td>
<td>34 (100%)</td>
<td>20 (100%)</td>
</tr>
<tr>
<td>Possessive Personal Pronouns</td>
<td>9 (26%)</td>
<td>6 (30%)</td>
</tr>
<tr>
<td>*Plural –s</td>
<td>21 (62%)</td>
<td>16 (80%)</td>
</tr>
<tr>
<td>*Preposition in</td>
<td>22 (65%)</td>
<td>16 (80%)</td>
</tr>
<tr>
<td>Preposition on</td>
<td>4 (12%)</td>
<td>3 (15%)</td>
</tr>
<tr>
<td>Possessive –’s</td>
<td>1 (3%)</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>Past tense –ed</td>
<td>4 (12%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>*Irregular past tense</td>
<td>16 (47%)</td>
<td>9 (45%)</td>
</tr>
<tr>
<td>*Regular third person -s</td>
<td>20 (59%)</td>
<td>14 (70%)</td>
</tr>
<tr>
<td>*Irregular third person</td>
<td>8 (24%)</td>
<td>8 (40%)</td>
</tr>
<tr>
<td>*Article</td>
<td>34 (100%)</td>
<td>20 (100%)</td>
</tr>
<tr>
<td>*Contractible copula be</td>
<td>30 (88%)</td>
<td>19 (95%)</td>
</tr>
<tr>
<td>*Uncontractible Copula be</td>
<td>31 (91%)</td>
<td>20 (100%)</td>
</tr>
<tr>
<td>*Contractible Auxiliary be</td>
<td>22 (65%)</td>
<td>8 (40%)</td>
</tr>
<tr>
<td>Uncontractible Auxiliary be</td>
<td>2 (6%)</td>
<td>4 (20%)</td>
</tr>
<tr>
<td>*Modal</td>
<td>28 (82%)</td>
<td>19 (95%)</td>
</tr>
<tr>
<td>Derivational</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Irregular Plural</td>
<td>5 (15%)</td>
<td>2 (10%)</td>
</tr>
<tr>
<td>*Auxiliary do</td>
<td>18 (53%)</td>
<td>12 (60%)</td>
</tr>
<tr>
<td>Auxiliary have</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Adjectival</td>
<td>4 (12%)</td>
<td>1 (5%)</td>
</tr>
<tr>
<td>*Negation</td>
<td>22 (65%)</td>
<td>13 (65%)</td>
</tr>
</tbody>
</table>

*Note. Scoreable defined as supplied in 4 or more obligatory contexts. Morphemes considered analyzeable if scoreable in at least 8 children in each group. Analyzeable morphemes marked with an asterisk.*
## Table 3

**Two-group comparison of analyzable morpheme supply**

<table>
<thead>
<tr>
<th>morpheme type</th>
<th>percent correct</th>
<th>percent omitted</th>
<th>percent substituted</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROGRESSIVE -ING</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>99% (4%), 97% (7%), t(32) = -1.01, p = 0.29</td>
<td>1% (4%), 3% (7%), t(32) = -0.89, p = 0.38</td>
<td>0% (0%), 0% (1%), t(12) = -1.00, p = 0.34</td>
</tr>
<tr>
<td><strong>PERSONAL PRONOUNS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>96% (5%), 98% (2%), t(52) = -1.35, p = 0.18</td>
<td>3% (3%), 2% (2%), t(52) = 1.13, p = 0.27</td>
<td>1% (3%), 0% (0%), t(52) = 0.97, p = 0.37</td>
</tr>
<tr>
<td><strong>PREPOSITION in</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>99% (5%), 100% (0%), t(36) = -0.85, p = 0.40</td>
<td>1% (5%), 0% (0%), t(36) = 0.85, p = 0.40</td>
<td>0% (0%), 0% (0%)</td>
</tr>
<tr>
<td><strong>MODAL VERBS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>97% (8%), 94% (23%), t(45) = 0.69, p = 0.49</td>
<td>3% (8%), 1% (2%), t(45) = 1.00, p = 0.32</td>
<td>0% (0%), 0% (0%)</td>
</tr>
<tr>
<td><strong>PLURAL -s</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>99% (4%), 92% (25%), t(15.7) = 1.02, p = 0.33</td>
<td>1% (4%), 2% (4%), t(35) = 0.11, p = 0.91</td>
<td>0% (0%), 0% (0%)</td>
</tr>
<tr>
<td><strong>IRREGULAR PAST TENSE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>94% (12%), 98% (7%), t(23) = -0.87, p = 0.40</td>
<td>3% (10%), 0% (0%), t(23) = 0.74, p = 0.47</td>
<td>3% (8%), 2% (7%), t(23) = 0.40, p = 0.70</td>
</tr>
<tr>
<td><strong>ARTICLES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>94% (7%), 96% (4%), t(52) = -0.64, p = 0.52</td>
<td>5% (6%), 3% (3%), t(40.5) = -1.69, p = 0.10</td>
<td>1% (2%), 1% (2%), t(40.5) = -0.20, p = 0.84</td>
</tr>
<tr>
<td><strong>IRREGULAR 3RD PERSON</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>100% (0%), 96% (8%), t(7) = 1.53, p = 0.17</td>
<td>0% (0%), 2% (6%), t(7) = -1.00, p = 0.35</td>
<td>0% (0%), 4% (8%), t(7) = -1.53, p = 0.17</td>
</tr>
<tr>
<td><strong>CONTRACTIBLE COPULA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>99% (4%), 99% (4%), t(47) = 0.13, p = 0.89</td>
<td>0% (0%), 1% (3%), t(18) = -1.00, p = 0.33</td>
<td>1% (4%), 1% (3%), t(47) = -0.61, p = 0.54</td>
</tr>
<tr>
<td><strong>CONTRACTIBLE AUXILIARY</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>100% (0%), 100% (0%)</td>
<td>0% (0%), 0% (0%)</td>
<td>0% (0%), 0% (0%)</td>
</tr>
<tr>
<td><strong>NEGATION -'NT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>100% (0%), 99% (4%), t(12) = 1.00, p = 0.34</td>
<td>0% (0%), 1% (4%), t(12) = -1.00, p = 0.34</td>
<td>0% (0%), 0% (0%)</td>
</tr>
<tr>
<td><strong>UNCONTRACTIBLE COPULA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>86% (17%), 92% (10%), t(49) = -1.45, p = 0.15</td>
<td>13% (17%), 5% (9%), t(46.3) = 2.20, p = 0.03</td>
<td>1% (3%), 3% (7%), t(22) = -1.25, p = 0.23</td>
</tr>
<tr>
<td><strong>AUXILIARY DO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>95% (10%), 88% (16%), t(28) = 1.47, p = 0.15</td>
<td>5% (9%), 12% (16%), t(16) = -1.46, p = 0.16</td>
<td>0.4% (2%), 0% (0%), t(28) = 0.81, p = 0.42</td>
</tr>
<tr>
<td><strong>REGULAR 3RD PERSON</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LT, TD, t-test</td>
<td>82% (22%), 89% (27%), t(32) = -0.81, p = 0.43</td>
<td>17% (23%), 4% (8%), t(32) = 1.99, p = 0.06</td>
<td>1% (6%), 0% (0%), t(32) = 0.83, p = 0.41</td>
</tr>
</tbody>
</table>
Table 4

*Cohen’s d (1988) effect sizes for two-group comparison of analyzeable morpheme suppliance*

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent correct effect size (d)</th>
<th>Percent omitted effect size (d)</th>
<th>Percent substituted effect size (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROGRESSIVE -ING</td>
<td>0.35</td>
<td>-0.37</td>
<td>0</td>
</tr>
<tr>
<td>PERSONAL PRONOUNS</td>
<td>-0.53</td>
<td>0.39</td>
<td>0.47</td>
</tr>
<tr>
<td>PREPOSITION IN</td>
<td>-0.28</td>
<td>0.28</td>
<td>0</td>
</tr>
<tr>
<td>MODAL VERBS</td>
<td>0.17</td>
<td>0.34</td>
<td>0</td>
</tr>
<tr>
<td>PLURAL -S</td>
<td>0.39</td>
<td>-0.25</td>
<td>0</td>
</tr>
<tr>
<td>IRREGULAR PAST TENSE</td>
<td>-0.41</td>
<td>0.42</td>
<td>0.13</td>
</tr>
<tr>
<td>ARTICLES</td>
<td>-0.35</td>
<td>0.42</td>
<td>0</td>
</tr>
<tr>
<td>IRREGULAR 3RD PERSON</td>
<td>0.70</td>
<td>-0.47</td>
<td>-0.70</td>
</tr>
<tr>
<td>CONTRACTIBLE COPULA</td>
<td>0</td>
<td>-0.47</td>
<td>0</td>
</tr>
<tr>
<td>CONTRACTIBLE AUXILIARY</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NEGATION –‘NT</td>
<td>0.35</td>
<td>-0.35</td>
<td>0</td>
</tr>
<tr>
<td>UNCONTRACTIBLE COPULA</td>
<td>-0.43</td>
<td>0.59</td>
<td>-0.37</td>
</tr>
<tr>
<td>AUXILIARY DO</td>
<td>0.53</td>
<td>-0.54</td>
<td>0.28</td>
</tr>
<tr>
<td>REGULAR 3RD PERSON</td>
<td>-0.28</td>
<td>0.76</td>
<td>0.24</td>
</tr>
</tbody>
</table>
Table 5

Morpheme acquisition order in Late Talkers and Comparison Children at age 5

<table>
<thead>
<tr>
<th>Morpheme acquisition order</th>
<th>Late Talkers</th>
<th>Typically Developing Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Irregular 3\textsuperscript{rd} person, Contractible Auxiliary be, Negation – ‘nt</td>
<td>Contractible Auxiliary be, Preposition \textit{in}</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Contractible copula be, Negation – ‘nt</td>
</tr>
<tr>
<td>4</td>
<td>Progressive –\textit{ing}, Preposition \textit{in}, plural –\textit{s}, contractible copula be</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Modal verbs</td>
<td>Pronouns, irregular past tense</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>Progressive –\textit{ing}</td>
</tr>
<tr>
<td>8</td>
<td>Modal verbs</td>
<td>Articles, irregular 3\textsuperscript{rd} person</td>
</tr>
<tr>
<td>9</td>
<td>Pronouns</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Auxiliary \textit{do}</td>
<td>Modal verbs</td>
</tr>
<tr>
<td>11</td>
<td>Irregular past tense, articles</td>
<td>Plural –\textit{s}, uncontractible copula be</td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Uncontractible copula be</td>
<td>Regular 3\textsuperscript{rd} person</td>
</tr>
<tr>
<td>14</td>
<td>Regular 3\textsuperscript{rd} person</td>
<td>Auxiliary \textit{do}</td>
</tr>
</tbody>
</table>
Figure 1

Percentage of Children Per Group Scoreable on Each Morpheme
### Appendices

#### Appendix A

<table>
<thead>
<tr>
<th>Measure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbreviation</td>
<td></td>
</tr>
<tr>
<td>CDI</td>
<td>MacArthur-Bates Communicative Development Inventory (Fenson et al., 1993)</td>
</tr>
<tr>
<td>CHILDES</td>
<td>Children’s Data Exchange System (MacWhinney, 1991)</td>
</tr>
<tr>
<td>IPSyn</td>
<td>Index of Productive Syntax (Scarborough, 1991)</td>
</tr>
<tr>
<td>LDS</td>
<td>Language Development Survey (Rescorla, 1989)</td>
</tr>
<tr>
<td>MDI</td>
<td>Mental Development Index (Bayley, 1969)</td>
</tr>
<tr>
<td>MLU</td>
<td>Mean Length of Utterance (Brown, 1973)</td>
</tr>
<tr>
<td>Percentage Suppliance</td>
<td>N/A</td>
</tr>
<tr>
<td>Percentage of participants</td>
<td>N/A</td>
</tr>
<tr>
<td>analyzed</td>
<td></td>
</tr>
<tr>
<td>Q correlation</td>
<td>N/A</td>
</tr>
<tr>
<td>Reynell</td>
<td>Reynell Language Test (Reynell, 1977)</td>
</tr>
</tbody>
</table>