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Research Forum

Specific Language Impairment, Nonverbal IQ, Attention-Deficit/Hyperactivity Disorder, Autism Spectrum Disorder, Cochlear Implants, Bilingualism, and Dialectal Variants: Defining the Boundaries, Clarifying Clinical Conditions, and Sorting Out Causes

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Purpose: The purpose of this research forum article is to provide an overview of a collection of invited articles on the topic "specific language impairment (SLI) in children with concomitant health conditions or nonmainstream language backgrounds." Topics include SLI, attention-deficit/hyperactivity disorder, autism spectrum disorder, cochlear implants, bilingualism, and dialectal language learning contexts.
Method: The topic is timely due to current debates about the diagnosis of SLI. An overarching comparative conceptual framework is provided for comparisons of SLI with other clinical conditions. Comparisons of SLI in children with low-normal or normal nonverbal IQ illustrate the unexpected outcomes of 2 × 2 comparison designs.
Results: Comparative studies reveal unexpected relationships among speech, language, cognitive, and social dimensions of children's development as well as precise ways to identify children with SLI who are bilingual or dialect speakers.
Conclusions: The diagnosis of SLI is essential for elucidating possible causal pathways of language impairments, risks for language impairments, assessments for identification of language impairments, linguistic dimensions of language impairments, and long-term outcomes. Although children's language acquisition is robust under high levels of risk, unexplained individual variations in language acquisition lead to persistent language impairments.

Although there is an extensive and robust research literature about children with specific language impairment (SLI; Leonard, 2014; National Institute on Deafness and Other Communication Disorders, 2011), there is more work to be done. The causes of SLI are not yet identified, clinical symptomology is not mapped in detail across the full life span, and there are recurrent debates about how SLI is to be characterized in comparison with other forms of language impairment in children or other conditions of language learning that could be confused with SLI. One potentially informative scientific approach is to compare children who meet the diagnostic standards of SLI with other groups of children with related developmental disorders (Rice, Warren, & Betz, 2005). Another approach is to compare children with SLI who do or do not speak dialectal variants of a conventional language or who are learning multiple languages. Such comparative studies have been relatively sparse and widely distributed in the literature, making it more difficult to appreciate how the comparative approach can yield valuable and unique insight into unexplained individual variations in language acquisition.

The purpose of this research forum article is to provide an overview of a collection of invited articles on the topic "SLI in children with concomitant health conditions or nonmainstream language backgrounds." The articles were first presented at the Research Forum at the Annual

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Convention of the American Speech-Language-Hearing Association in November 2014. The authors were invited to report on research under way in studies of children with attention-deficit/hyperactivity disorder (ADHD), autism spectrum disorder (ASD), cochlear implants (CI), bilingualism, and dialectal language learning contexts and to highlight comparisons with children with SLI.

To establish a broader context for the set of articles, this overview begins with a brief summary of current controversies about the SLI diagnosis relative to a more general diagnosis of language impairment. The overarching rationale has two interrelated themes: (a) that well-motivated group comparisons may contribute new insights about the nature of SLI and (b) that comparisons with SLI can inform a more general notion of language impairment. A conceptual schema is proposed for interpreting the research designs and outcomes of clinical group comparative studies, introduced by an example of how the schema plays out for consideration of the relationship of nonverbal intelligence and language impairments in children and followed by a summary of the group comparative outcomes reported in each of the articles in the forum as they relate to the overall interpretive schema. The conclusion is that such group comparisons provide valuable clarifications about diagnostic methods, potential causal pathways, and methods of sorting out interrelationships among linguistic, cognitive, social, and academic achievement in children's development. Overall, the comparative design reveals valuable information about each group that is difficult to obtain by studying just one group. The comparisons cumulatively highlight the clinical and research value for the diagnosis of SLI as a pathway for improved understanding of the nature of language impairments in children.

SLI and Language Impairment in the Wake of the *Diagnostic and Statistical Manual of Mental Disorders*

There is a long tradition of scientific debate about diagnostic labels for developmental clinical conditions. Language impairments of children are caught in the crosshairs of these debates because language impairments can be comorbid with other developmental disorders, may be the only clinically significant developmental disorder, or may be erroneously confused with other conditions of language learning, such as bilingualism. The interrelationships among children's language acquisition and their cognitive, social, and academic development are complex, and interactions among these developmental outcomes vary over childhood.

The recurring debate about the integrity of SLI as a diagnostic entity, and about language impairments in general, has recently flared up. The trigger for current debate was a new edition of *Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition* (*DSM-5*; American Psychiatric Association, 2013). The fifth edition has a general diagnostic category of Communication Disorders (CD). Under that overarching diagnosis, *language disorder* (LD) is defined as "persistent difficulties in the acquisition and use of language across modalities (i.e., spoken, written, sign language, or other) due to deficits in comprehension or production" and as language abilities that are "substantially and quantifiably" below age expectations (p. 42). This definition is applicable across a wide range of conditions in which LD can appear, including in children who are deaf or hard of hearing or who have ASD, ADHD, or other neurological conditions such as cerebral palsy or traumatic brain injury. Although these co-occurring conditions appear in children, the most common form of language impairment in children is SLI, the prevalence of which is greater than the estimated prevalence of ASD and ADHD combined (Redmond, 2016). The National Institute on Deafness and Other Communication Disorders (2011) defined SLI as "a language disorder that delays the mastery of language skills in children who have no hearing loss or other developmental delays …. [It] is also called developmental language disorder, language delay, or developmental dysphasia …. [It] is one of the most common childhood learning disabilities, affecting approximately 7–8 percent of children in kindergarten …. [The] impact persists into adulthood."

Several elements of *DSM-5* inspired follow-up debate. One involved a new definition of ASD that adjusted the diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* (*DSM-IV*; American Psychiatric Association, 1994) in several ways. In *DSM-IV*, spoken language impairment was included as a diagnostic criterion for ASD. In *DSM-5*, a diagnosis of LD appears in the section on CD and is independent of the ASD diagnosis. Instead, ASD diagnostic criteria include "persistent deficits in social communication and social interaction across multiple contexts," shortened to "social communication impairments." Nonverbal communications in social contexts are highlighted as central to diagnosis of ASD, whereas the definition of LD as a communication disorder stipulates deficits in vocabulary, grammar, and morphology as well as impairments in discourse. The section on social communication impairments in *DSM-5* also includes the diagnosis of Social (Pragmatic) Communication Disorder (S(P)CD), which excludes other medical or neurological conditions, and low abilities in the domains of word structure or grammar (i.e., LD) and ASD. Perhaps it is not surprising that there have been ensuing debates about how to differentiate LD (Paul, 2013), S(P)CD, and social communication impairments and discussions of how to bring the new diagnostic groupings into third-party payment systems (McCarty, 2013; Paul, 2013). In the interest of full disclosure, I served as an advisor to the neurodevelopmental disorders work group for *DSM-5*, as reported in the manual. In that capacity I worked on a panel charged with the development of the categories for communication disorders. Advisors signed confidentiality agreements as part of the process.

During the process of vetting potential changes in *DSM-5*, there was a public commentary period (June 2012) to inform the final decision-making process. A preliminary version of the LD section of *DSM-5* included the diagnosis of SLI as a specifier or possible subgroup within the

overarching LD category. After the commentary period, the category of SLI ultimately was not included in *DSM-5*, and there were no subgroups listed under the LD category, although one of the exclusionary criteria is "… are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay" (p. 42). The omission of SLI from *DSM-5* was one of the focal points of an ensuing debate about the value of the SLI diagnosis. This debate appeared in a special issue of a scientific journal, published in 2014, comprising a collection of two invited review articles, invited commentaries (including one by me), and a summary article (Bishop, 2014; Ebbels, 2014; Reilly, Bishop, & Tomblin, 2014; Reilly, Tomblin, et al., 2014).

Among the issues raised in the articles and commentaries was the extent to which language impairment arises in a "specific" way—that is, without other developmental delays or weaknesses. Intrinsic to this issue is a bit of a technical dispute having to do with the definition of where to draw the boundary of typical or sufficient nonverbal IQ for language acquisition for the purpose of an SLI diagnosis. The exclusionary criterion conventionally has been a nonverbal IQ of 85 or above for the SLI group in order to avoid confounds created by intellectual deficits as part of the causal pathway. The unresolved question is whether to expand the lower level to include children with levels of nonverbal IQ as low as 70 or below, thereby introducing greater variability within the group of children with language impairments. (Note that the range of nonverbal IQ in the affected group could be as large as 70–140 under this definition.) One conclusion is that there are no interesting language differences between groups defined according to the conventional criterion and the expanded criterion (Reilly, Tomblin, et al., 2014). This working conclusion is part of the support for a general term such as *language impairment* or *language disorders* (as in *DSM-5*), which would be applied to a very broad range of children. However, this conclusion overlooks important counterevidence, which is examined in more detail in the following section.

When viewed from the broader perspective of scientific logic, this research forum article and the articles to follow in the forum collection explore in more detail the outcomes of comparisons across four groups of children: those with and without SLI and those with and without other conditions that could affect language acquisition. The discussion in this research forum article begins with the comparison of children with and without SLI and children with and without low levels of nonverbal intelligence (although not in the lowest range of intellectual developmental disorder) as an example of how such comparisons can be informative when considering the full set of possible comparisons as a conceptual schema. This interpretive framework is extended to consideration of other group comparisons included in the collection of articles.

SLI and Nonverbal Intelligence

A distinction between verbal and nonverbal intelligence is ingrained in psychometric evaluation of human intelligence, with widespread use of verbal IQ and nonverbal IQ estimates (Wechsler, 1991). Although the distinction is commonly accepted, the existence of independent relationships is not as well understood when we consider children with language impairments. It is often assumed that language impairments in children are caused by low levels of general cognitive ability as shown in a study of kindergarten teachers, female adults of comparable educational backgrounds who are not educators, undergraduate students, and speech-language pathologists (Rice, Hadley, & Alexander, 1993). When listening to samples of children's speech, each group on average rated a child with language impairments as less intelligent than a child without language impairments even though the samples were from children with typical or above-typical levels of nonverbal intelligence. A follow-up study replicated the results (DeThorne & Watkins, 2001). This assumption, although widespread, is not always accurate. The scientific literature includes well-documented counterexamples of children with clinically low levels of nonverbal IQ who nevertheless have high levels of linguistic ability (Cromer, 2014; Smith & Tsimpli, 1995; Yamada, 1990), although it is generally assumed that such aberrations from expectations are rare.

In the context of current debates about SLI, the issue regarding nonverbal intelligence focuses on the exclusionary criteria used to rule out intellectual impairment in children diagnosed with SLI. The open debate is whether the general diagnosis of LD, as in *DSM-5*, regardless of levels of nonverbal intelligence, is preferred for clinical and research purposes (Reilly, Bishop, et al., 2014). One source of relevant scientific evidence compares two groups of children with language impairments (without other clinically significant developmental disabilities): those with nonverbal IQs of 71 to 84 (defined as borderline intellectual functioning in *DSM-IV*, p. 684) and those with nonverbal IQs of 85 and higher. The widely accepted empirical generalization is that children with lower levels of nonverbal IQ tend to score somewhat lower on standardized tests than children with nonverbal IQs of 85 and higher (Tomblin & Nippold, 2014); this tendency persists over childhood and across different dimensions of language. Although informative, this observation focuses only on the statistically significant (although not definitive) associative relationship between nonverbal intelligence and language impairments and overlooks other possible outcomes that are crucial parts of the full picture.

Consideration of the full range of developmental outcomes indicates a need to consider nonassociative, independent relationships between language acquisition and levels of nonverbal intelligence. Evidence from an epidemiologically ascertained study of children with SLI provides such a perspective (Tomblin, Smith, & Zhang, 1997). The study, commissioned by the National Institute on Deafness and Other Communication Disorders, assessed a sociodemographically diverse sample of 5-year-old kindergarteners in the United States. The collected data included direct assessments of language, speech, and nonverbal intelligence. The criterion for nonverbal IQ for children with SLI was

85 or above on the Block Design and Picture Completion subtests of the Wechsler Preschool and Primary Scale of Intelligence–Revised (Wechsler, 1989), known as the short form of the scale. Language impairment was defined by performance on selected subtests of the Test of Language Development–Primary: Second Edition (Newcomer & Hammill, 1988) and a narrative story task involving narrative comprehension and narrative production (Culatta, Page, & Ellis, 1983). The criterion of −1.25 *SD* on a multidimensional diagnostic system score was found to be similar to a unidimensional diagnostic system using a single composite language score (derived from the set of five marginal language measures), which yielded a cutoff point of −1.14 *SD*, or roughly between the 10th and 15th percentiles, or a standard score of approximately 80 (Tomblin, Records, & Zhang, 1996; Tomblin et al., 1997). Speech delay was defined as clinically low performance on the Word Articulation subtest of the Test of Language Development–Primary: Second Edition, validated to conversational speech samples (Shriberg, Tomblin, & McSweeny, 1999).

The results were reported as the proportion of children with typical or above-typical levels of performance versus those with low levels of performance on the two dimensions of development—language and nonverbal cognition—using 85 (standard score) as the cutoff point for nonverbal IQ and approximately 80 (standard score) as the cutoff point for language. The four cells are displayed in Figure 1. The children with typical development are in the upper left quadrant, with typical or higher levels of language acquisition and nonverbal IQ estimates. The lower left quadrant corresponds to the children with a conventional definition of SLI. The lower right quadrant includes a low language/low nonverbal IQ group labeled *nonspecific language impairment* (NLI). The upper right quadrant is for children with low nonverbal IQ and typical or higher levels of language acquisition, labeled *low cognition* (LC). The percentage of children per cell are reported as 75% with typical development, 8.1% SLI, 5% NLI, and, rather surprisingly, 11.9% LC (Rice, Tomblin, Hoffman, Richman, & Marquis, 2004; Shriberg et al., 1999). The prevalence of children who have what could be called *spared language*, despite a nonverbal IQ in the borderline range, is equivalent to or perhaps higher than the estimated prevalence of children with SLI.

Figure 1. Categories of language outcome cross-tabulated by nonverbal IQ and language levels. [1]Grammatical tense marking. [2]Speech. [3]Low cognition. [4]Speech delay. [5]Specific language impairment. [6]Nonspecific language impairment.

Language	Nonverbal IQ +	Nonverbal IQ −
+	(Typical & Above) 75% TNS[1] *M* = .90 SP[2] ok = 98.2%	(LC[3]) 11.9% TNS *M* = .86 SD[4] = 0.5%
−	(SLI[5]) 8.1% TNS *M* = .78 SD = 0.51%	(NLI[6]) 5.0% TNS *M* = .71 SD = 0.77%

The LC group, overlooked in the literature, deserves further consideration. These children can be difficult to identify because their low levels of nonverbal intelligence can be masked by their high verbal abilities, especially if no other neurodevelopmental disorders are apparent. They seldom appear in the scientific literature or in diagnostic systems. Without direct assessment of all children with and without language impairments, these children go undetected. Also note that when studies focus on children with language impairments, the designs involve the other three cells and leave out the relatively large group of children (11.9%) who fall into the LC quadrant. Thus, extensive discussions of the nature of language impairments and the relationship of nonverbal IQ to language acquisition and language impairments can overlook or fail to account for the existence of this group.

The LC group can be dropped from longitudinal follow-up assessments (and therefore do not appear in analyses of predictors of long-term outcomes) because their initial performance levels on language assessments are in the range of typical to above typical, yet their low nonverbal intelligence levels exclude them from the control sample of children with typical language. For example, in a follow-up longitudinal study of the acquisition of grammatical tense marking, this group was not included because their performance level at the first assessment was as high as that of the kindergarteners with typical development (Rice et al., 2004). By age 5 years, this group of children had mastered a property of grammar that was very difficult for the SLI group. The group-mean percentages correct for tense marking are reported in Figure 1. The means on the grammatical tense marker test for the typically developing control group and the LC group did not statistically differ. It is interesting to note that children in the LC group had nonverbal IQs as low as 64 and, similar to children in the control group, flawless performance on the grammar task. The score of the SLI group was statistically significantly higher than that of the NLI group, although there was a small effect size. This group difference played out in the subsequent longitudinal data that demonstrated that at a detailed level of linguistic measurement (evaluating how the children mastered irregular past-tense verb morphology) the two groups differed in their levels of performance over time, with lower performance by the NLI group. In addition to the quantitative differences, there were qualitative differences in the errors they made. The children in the NLI group persisted in an immature pattern of lower levels of performance in first, second, and third grades relative to the SLI group. When they were in first, second, or third grade, children in the NLI group made grammatical errors unlike those made by the children in the SLI group, indicating a more protracted learning of the morphophonological

requirements of past-tense irregular morphology. If the two groups had been collapsed into one LD group, this qualitative difference would have been obscured, as would the quantitative difference. Further, the exclusion of the LC group completely leaves out the real possibility that a group equivalent to the NLI group in nonverbal IQ would have performed at ceiling levels similar to the control group.

The group comparisons also clarify that children's grammar outcomes differed from the speech outcomes. Also reported in Figure 1 is the proportion of children with speech delay (Shriberg et al., 1999). (For the purpose of this presentation the data are collapsed across boys and girls, although there are clear sex differences.) The distribution of speech delay across the cells shows that at this age most children have age-appropriate speech production (98.2%) and that the comorbidity of speech delay with language impairment, collapsing across the SLI and NLI cells, is very low—1.3% (0.51% with SLI). Speech delay and language impairment outcomes are orthogonal, which is not at all apparent in speech pathology practitioners' caseloads, which are filled predominately with children who have speech impairments or comorbid speech and language impairments, perhaps because children with speech disorders with limited intelligibility are more likely to be identified and referred for services (Zhang & Tomblin, 2000).

Comparisons of the distributions across the four cells inform our understanding of possible causal relationships. Although the performance of the NLI group suggests that low levels of nonverbal intelligence share a causal pathway for SLI, this conclusion is undermined by the performance of the 12% of children in the LC group. Combined with the outcomes of the SLI group, the conclusion is that lower levels of nonverbal intelligence in this borderline range are neither necessary nor sufficient for language impairment and therefore not likely to share a core causal pathway. This does not rule out an apparent potential additive effect if both conditions are present. Further, the patterns of group distribution for the tense marking measure in kindergarten clearly show that children with low levels of nonverbal intelligence can nevertheless show unexpected typical development in this part of grammar, an asset that will make them appear more mature to their teachers and other adults compared with children with SLI. The outcomes collectively are not supportive of (a) a strong causal model positing low levels of nonverbal IQ as the driver for language impairments in children and (b) characterizations of no meaningful differences between the SLI and NLI groups. It is also clear that there is not a common causal pathway for speech and language impairments in children, an independence obscured by selection bias in clinical caseload (Zhang & Tomblin, 2000).

We are left with two related causal questions: (a) What factors cause language impairments in children, and (b) how do children with low levels of nonverbal intelligence nevertheless acquire formal properties of grammar (e.g., tense marking) as quickly as children with typical development without any special training? In effect, how do they avoid language impairments? A crucial test for any putative causal model will be how to answer both questions.

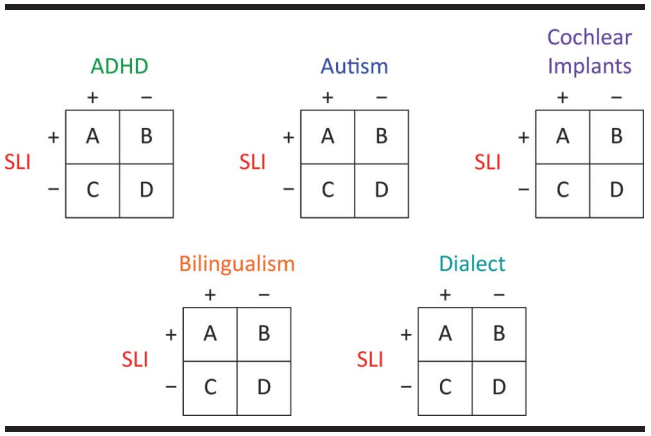
The logic of the comparisons illustrated in Figure 1 has motivated other investigations of potential causal pathways for language impairments, most notably in studies of possible memory impairments of children with language impairment. For example, a study of 400 school-age children reported that approximately equal numbers of children were identified with specific impairments in either language or working memory (Archibald & Joaanisse, 2009). The interpretation is that working memory impairments do not always cause SLI and vice versa, although there may be an additive effect such that the combination leads to lower levels of performance on assessments. In effect, the existence of the unexpected group—the children with impairments of working memory but without language impairments—is a key piece of evidence that can be missed when studies are limited to comparisons of children with typical development and children with language impairments. The authors concluded that the specificity of groupings suggests an additive rather than unidirectional causal pathway. This conclusion would not have been discovered if the group of children with working memory impairments but without language impairments had been excluded from the study.

To recap, the perspective provided by a 2×2 contingency table sheds light on an often overlooked outcome cell in investigations of children with SLI, suggesting a need to consider (a) independent causal pathways for linguistic and nonverbal IQ outcomes, particularly in the domain of grammar; (b) independent causal pathways for speech impairments versus language impairments; (c) independent causal pathways for working memory impairments versus language impairments; and (d) whether an LD category can obscure clinically significant differences for children in the "borderline IQ" group versus children in the normal and above-normal range of nonverbal intelligence.

SLI Compared With ADHD, ASD, CI, Bilingualism, and Bidialectalism

The contingency table framework of Figure 1 can serve as a template for an overview of the articles to follow in the forum, comparing SLI with other conditions of language acquisition, as depicted in Figure 2. The use of this framework does not imply that the group comparisons to follow are obtained from population-based studies such as the example in Figure 1. Instead, the research is more in line with the example of the SLI and working memory study above (Archibald & Joaanisse, 2009) in the form of experimental studies of selected groups of children. Recent research outcomes yield five comparison groups of interest: children with ADHD, children with ASD, children who receive CIs, children who are bilingual, and children who speak nonstandard dialects. The first two comparisons, SLI–ADHD and SLI–ASD, are examples of comorbid conditions that allow for examination of shared or nonshared symptoms and possible causal pathways. Comparison of children with SLI and children who receive CIs has not been highlighted in previous studies, but it is suggested here that

Figure 2. Overview of the group comparisons of interest in the forum. ADHD = attention-deficit/hyperactivity disorder; SLI = specific language impairment.



the outcomes of current investigations point toward possible differences in language acquisition abilities among children with CIs that could be consistent with the possibility that some of the children with CIs are similar to children with SLI. The final two comparisons, SLI–bilingualism and SLI–dialectal differences, are essential for the identification of appropriate forms of linguistic measurement in order to detect children with SLI who are bilingual or bidialectal as well as for the determination of whether bilingualism adds to the linguistic burdens of children with SLI.

For the purpose of this overview, the comparisons can be summarized as a series of 2 × 2 designs with four cells of interest (see Figure 2). Consider the cells identified as A, B, C, and D in terms of the possible scientific value of group comparisons. For example, children who have concurrent diagnostic categories (cell A) can be compared with children who do not have language impairments (cell C) to determine, for example, whether children with ADHD who also present with SLI are similar to children with ADHD but without SLI in their performance on tasks thought to be on the causal pathway for SLI. If A = C and A ≠ B, it would suggest that causal pathways contribute to ADHD but not SLI. Another example is from investigations of children who are dialect speakers, with a group with SLI (cell A) compared with a group without SLI (cell C). If there is no difference between the groups in the use of certain grammar features (A = C) and there is a difference between children with SLI with a dialect and children with SLI without a dialectal difference (A ≠ B), it would suggest that the dialectal variant is the common element and that this variant is not diagnostic of SLI. Investigation of children with SLI without ADHD, autism, CI, bilingualism, or dialect (cell B) makes it possible to identify language-specific symptoms without the possible confounding factors found in the more inclusive diagnostic grouping of "language disorders" across other diagnostic or linguistic categories. Another example is the case of children with CIs who can be compared with children in cell D (children with typical development) to determine whether the provision of a CI leads to typical language outcomes in young children. If some of the children with CIs are different from children in cell D, then a next step could be comparison with children in cell B to determine whether the children who do not achieve typical language outcomes share some linguistic features with children with SLI. As these examples suggest, there are multiple ways in which planned comparisons across groups of children (as illustrated in Figure 2) can be informative about characteristics of language impairment in children and possible shared features or characteristics that can be clinically informative as well as illuminating about causal pathways.

Together, the articles in the forum highlight the value of differentiating across clinical conditions and across language learning conditions. In particular, such comparisons uncover the distinctiveness of language, social, and cognitive dimensions of child development in patterns of relative strengths and weaknesses in groupings across the four possible cells. Here are brief previews of the articles that follow.

ADHD and SLI

Redmond (2016) summarizes his program of investigation comparing children with SLI and ADHD. His studies are conducted with monolingual 7- to 8-year-olds who have been screened to meet an exclusionary criterion of nonverbal IQs of 80 or above and who have normal hearing ability and speech ability to produce grammatical morphemes (Redmond, Thompson, & Goldstein, 2011). Redmond begins with the need to adjust for confounds in assessment by noting that conventional assessments of ADHD include language-associated items such as "does not seem to listen to what is being said to them." He also notes the need to adjust for situational effects, which could erroneously attribute a trait of ADHD to a child whose presumed ADHD symptoms are situational. *DSM-5* includes this new standard in the criteria for ADHD, ensuring that ADHD symptoms need to be present in nonacademic settings. With these standards for assessment of ADHD in place, Redmond reports on comparative studies following the design of Figure 2. Comparisons of linguistic dimensions of performance across the groups reveal that for grammatical tense marking, both the ADHD-only group (C) and the control group (D) were at ceiling levels of performance and that both were higher than the SLI-only group (B). On a sentence recall evaluation, the ADHD-only group (C) and the control group (D) were equivalent, whereas the SLI-only group (B) performed at lower levels; this pattern held for measures of nonword repetition and comprehension and production of narratives. In other words, the children in the SLI-only showed signs of language impairment only, and the ADHD-only group did not. There was no indication of possible additive effects of SLI and ADHD; that is, group B (SLI only) was equivalent to group A (SLI + ADHD) on language assessment, and on sentence recall there was even a possible protective effect (SLI only < ADHD + SLI).

Other comparisons offer insight into probable causal pathways by examining contingencies across groups for indices of possible processing breakdowns contributing to SLI. For measures of processing speed and temporal processing, the group with SLI only (group B) performed better than the group with ADHD only (group C), although the group with ADHD only performed higher on language assessments (Cardy, Tannock, Johnson, & Johnson, 2010). These outcomes are inconsistent with a model that posits limitations in processing speed and temporal processing as contributors to language impairment and instead suggests that such limitations are not sufficient for language impairment. It raises the possibility that attention rather than language was a factor in low performance on the assessments.

Other outcomes point to possible protective elements of ADHD (Sciberras et al., 2014). The group most likely to receive speech services was children with ADHD + SLI (group A), with a reduced likelihood for children with SLI only (group C). This could be because of the salience of the ADHD symptomology and the bias in referrals within service settings, particularly in the schools, and perhaps an echo of the earlier data showing that speech impairments were salient for clinical services. Further, the children with ADHD only (group C) had a lower risk for bullying by peers than did the children with SLI only (group B), who were at highest risk. Such outcomes highlight the risk that children with SLI go undetected for services and at the same time are identified by their peers as socially vulnerable and are likely to be bullied. Overall, this pattern of outcomes would not have been detectable without the full 2 × 2 contingency design.

ASD and SLI

Tager-Flusberg (2016) summarizes studies of infants who have older siblings with ASD, with a particular emphasis on risk factors associated with language impairments, and compares these outcomes with the literature on SLI. In these studies of the early developmental period (birth to 3 years) and the definition of ASD that includes possible comorbidity of intellectual impairments, exclusionary criteria for nonverbal IQ are not invoked. Although SLI symptoms can be present in children of this age range, SLI can be difficult to identify given the exclusionary criteria and the wide variation in language acquisition evident in children with typical development. In the framework of the 2 × 2 contingency table, this program of investigation can be regarded as ultimately identifying the risk for outcomes across the four cells in children old enough to be diagnosed. Toward that end, Tager-Flusberg notes that the risk factors for ASD only (theoretically, cell C) are also found in studies of risk for SLI (theoretically, cell B). These factors include sex (boys), a positive family history of delayed language onset or language impairments, delayed gesture or motor developments in infancy, and neural factors such as atypical brain lateralization for speech production. Tager-Flusberg also notes that more research is needed for the early preclinical identification stages of SLI during the infant and toddler periods of development. ASD is identified earlier than SLI.

Tager-Flusberg emphasizes the high risk for younger siblings to be subsequently diagnosed with ASD, reporting that 20% of high-risk infants (i.e., younger siblings of children with ASD) are subsequently diagnosed. In the SLI literature, it is reported in a population sample of 24-month-old children that 20% of children who were identified with late language emergence at 24 months were subsequently identified as having SLI at 7 years (Rice, Taylor, & Zubrick, 2008; Taylor, Zubrick, & Rice, 2013). In the SLI literature this level of risk can be regarded as equivocal. Some scholars argue for caution; they focus on the 80% who do not show SLI at later assessments and advocate a "wait and see" approach (Dollaghan, 2013), whereas in the ASD literature the 20% is considered a strong indicator of risk that warrants clinical attention. Why the 20% is considered of high diagnostic importance for the ASD research community and of low diagnostic importance for some scholars in the SLI research community is not clear. My inclination is to align with the interpretation of the ASD scholars.

The *DSM-5* changes will affect comparisons of SLI and ASD, although it does not rule them out. Under the new diagnostic system the diagnosis of LD is excluded if the LD is "better explained by intellectual disability," and intellectual disorder is neither an inclusionary nor exclusionary criterion for ASD. Intellectual impairments and language impairments are described as "associated features supporting diagnosis" for ASD. This suggests that studies following the design that Redmond (2016) used in comparing ADHD and SLI could be done for comparisons of ASD and SLI, although the samples would need to be selected in ways to avoid confounds with intellectual impairments and other possible assessment complications caused by severe speech problems or other associated features. These comparative studies could further explore potential causal pathways as well as linguistic markers in SLI, ASD, and SLI + ASD to determine whether the linguistic vulnerabilities are similar or different across conditions or whether the risk indicators are shared across conditions and linguistic dimensions (Rice et al., 2005). This approach is also possible for children with fragile X syndrome (Sterling, Rice, & Warren, 2012) or Down syndrome (Caselli, Monaco, Trasciani, & Vicari, 2008; Eadie, Fey, Douglas, & Parsons, 2002).

CI and SLI

The longitudinal language outcomes of young children with CIs reveal unexplained individual differences in outcomes that bring to mind longitudinal outcomes for children with SLI. The article included in this collection did not include explicit comparisons of children with CIs and children with SLI. Here I frame the results in the context of the 2 × 2 design framework to suggest possible advantages for pursuing the comparisons more formally.

Geers, Nicholas, Tobey, and Davidson (2016) report on a longitudinal study of children who received a CI at a young age. Candidate participants were excluded if

there was evidence of previously normal hearing or a progressive loss, below-average nonverbal learning abilities as tested in preschool, or language use other than English in the home. The longitudinal outcomes yielded three groups of children on the basis of test scores at 4.5 and 10.5 years: (a) those with normal language emergence (about 30% of the sample), (b) those with late language emergence (about 30%), and (c) those with persistent language delay (about 30%). Characteristics of the CI predicted outcomes. As expected, receiving a CI at a younger age increased the likelihood of normal language emergence following implant, although it did not predict whether a child with late language emergence showed a persistent language delay. Worse audibility for speech increased the likelihood of persistent versus resolving language delay. Bilateral CI use increased the likelihood of normal language emergence.

Here I highlight two very interesting questions: (a) By what means do children with early limited exposure to verbal language input catch up to age peers by 4 to 5 years, and (b) why do some children not benefit from CIs to the extent other children do when all related factors are similar? The first question points toward the robustness of language acquisition mechanisms when children are young. It is impressive that young children are able to overcome the challenges of significant degrades of auditory input early on and actually acquire language faster than the rate of hearing peers in order to catch up and then level off at the expected rate of acquisition following that period of rapid change. There is plasticity in language acquisition mechanisms as well as an overdrive capacity that enables this catch-up. It is as if the acquisition mechanisms are primed at the early period of development and able to accelerate to make up for lost time when input is provided. This is not to say that the quality of input is unimportant; Geers et al. (2016) report that children with persistent language development had less access to soft speech than those whose early language delay recovered over time. The point here is that all of the children with CI had an early period of very limited input compared with hearing children and that about two thirds of them caught up to hearing peers in their language acquisition. The catch-up phenomenon brings to mind the similar overdrive evident in toddlers with late language emergence, 80% of who overcome a delayed onset by 7 years (Rice et al., 2008). Yet it is also clear that the period in which the priming is available begins to fade relatively soon—well before 10 years, although precise documentation is yet to be determined.

The second question points toward unknown sources of individual variation across children during the priming period and after. Roughly one third of the children with CIs show persistent language impairment to age 10.5 years. One possibility is that there could be unexplained individual differences in language acquisition aptitude, similar to SLI, which could combine with early hearing impairment to create additive risk effects for language acquisition subsequent to a CI. If so, how could this be determined? At this early stage of investigation into CI effects on language acquisition of young children, the full range of possible designs in terms of the 2 × 2 contingency table has not yet been explored, but such an approach is likely to be informative. The available studies have examined children with CIs whose possible SLI status is unknown (i.e., potentially in cells A or C) compared with the age-benchmarked language milestones of children with normal hearing (cell D). Comparisons of children with SLI who do not have hearing impairments or a CI (cell B) could be a valuable design addition. As in the comparison of ASD and SLI, better means of early clinical identification of children with SLI in the toddler age period would facilitate the comparisons of children with CIs with and without SLI.

Bilingualism and SLI

Most of the world's children grow up speaking more than one language. In the context of clinical services for children with language impairments it can be difficult to differentiate between the effects of learning language as a second language and being late learning a native language, particularly if normative data are not available for the child's first language. Paradis (2016) addresses this issue in her review of studies of English language learners (ELLs) with and without language impairment, thereby addressing cells A and C—as well as cell D, occupied in this case by monolingual children with typical development. In the studies Paradis reviews, the participants are screened for nonverbal IQ levels to rule out intellectual impairments, yielding a broad range of nonverbal IQ scores across participants (73–136, as reported in Paradis, 2011). Paradis concludes that ELLs take longer than 3 years to converge on monolingual norms and approach monolingual norms asynchronously across linguistic subdomains. ELLs with language impairment acquire English more slowly than ELLs with typical development. Paradis further reveals other details of how ELLs and children with SLI follow distinctive developmental language trajectories. Linguistic subdomains yield important differences. Morphological and nonword repetition abilities differentiate them most. Within their morphosyntax, ELLs are prone to particular errors not documented in children with SLI. In contrast, ELLs have relative strengths in narrative uses of English: Their storytelling abilities benefit from their general conceptual development as well as their underlying native language skills. Children's native language similarities and differences relative to English also matter in the details of how they acquire English, a conclusion that holds across children with and without SLI. Paradis highlights the need for assessment measures that apply across different languages and reports that parent questionnaires on first language development and ELL norm referencing (e.g., the Alberta Language Development Questionnaire; Paradis, Emmerzael, & Sorenson Duncan, 2010) can result in accurate discrimination of ELLs with language impairment.

In addition to studies of ELLs and children with SLI following the general 2 × 2 design of Figure 2, Paradis reports on studies with elegant extensions of the basic 2 × 2 comparisons. In those studies, there is planned comparison of monolingual English- or French-speaking children

with and without SLI and simultaneous bilingual English- and French-speaking children with and without SLI. Thus, unlike the ELLs who are learning English after they have acquired their native language (summarized above), in these studies the participants are children who are either monolingual or learning English and French bilingually from the onset of language. This extension of the comparative study design demonstrated that there is no additive disadvantage for children learning two languages simultaneously from birth. Bilingual children with SLI show language skills that are similar to those of their monolingual peers with SLI. Paradis notes that other studies have reported similar findings for children with ASD and children with Down syndrome. She notes that developmental comparative studies of children with and without SLI who are simultaneous versus sequential learners of English are needed in order to investigate the long-term trajectories of bilingual effects.

Dialect and SLI

Just as a child's first language can affect acquisition of a later-introduced second language, a home dialectal variant of a language can affect a child's later acquisition of the mainstream dialect. Oetting, McDonald, Seidel, and Hegarty (2016) report on an investigation of possible group differences on sentence imitation tasks between 70 African American English (AAE) speakers with or without SLI and 36 Southern White English (SWE) speakers with or without SLI. Participants were screened to eliminate children with hearing impairments and to include children in the nonverbal IQ range of 82 to 125. The design is a somewhat extended version of the 2 × 2 design of Figure 2. One column is AAE dialect, a second column is SWE dialect, and a third implied column involves comparison with mainstream English–speaking children with or without SLI.

As with the studies of ADHD and bilingualism, it was important to develop suitable measurements. In this case, the researchers developed dialect-strategic scoring systems intended to evaluate linguistic markers that were sensitive to SLI without confounding by dialectal variants. Their sentence imitation task, developed with consideration of what is known about grammatical differences in mainstream English–speaking children with and without SLI and with scoring adjusted for known features of AAE and SWE, differentiated the children with SLI from the children without SLI across both dialects. That is, group A performed at lower levels of grammar development than group C, and group B performed lower than group D. Under these assessment conditions, children with SLI had lower levels of verbatim recall, more ungrammatical recalls when the recall was not exact, and higher levels of error on target grammar categories, especially those marking tense. The conclusion is that the assessments provided moderate to high levels of diagnostic accuracy for identifying SLI in speakers of nonmainstream dialects of English.

As with the other comparisons in Figure 2, the study of dialect-speaking children highlights that the linguistic details matter. As in the studies of ELLs, the features of the dialect that a child learns interact with the features of mainstream English in ways that require precise consideration in assessment in order to avoid confounding SLI with dialectal variants. Another similarity is the need for longitudinal follow-up to determine how the differentiating features persist or fade over time as children mature in their linguistic competencies.

SLI Comparisons Bring Clarification About the Nature of Language Impairments in Children, Possible Causal Pathways, and Clinical Implications

This forum of articles collectively illustrates the great value of the diagnosis of SLI as a subset of the much broader grouping of all children with LDs. Without the comparisons of Figure 1 and Figure 2, much less would be known about the unexpected. A truncated list of such findings includes the following. First, there is an unexpectedly large proportion of children with age-appropriate language, including formal grammatical properties, despite mild to moderately low levels of nonverbal IQ (12% of the population at kindergarten). Second, there is greater social risk for children with SLI than for children with ADHD. Third, a putative cause of SLI, memory impairments, is shared with children with ADHD, even when the children with ADHD do not have language impairments, thereby weakening the conclusion of memory impairments as a cause of language impairments. Fourth, there are possible shared risks for early language impairments in children with ASD and children with SLI, although the diagnosis of SLI excludes ASD. Fifth, there are generally positive language outcomes for children with hearing impairments who receive CIs at young ages with two caveats: (a) About one third of the children require an extended time to catch up to age-level expectations, and (b) for unknown reasons, about one third of the children do not catch up and instead demonstrate a pattern similar to the growth trajectories of children with SLI. Sixth, the language acquisition of children with SLI is not made more difficult by simultaneous bilingual language learning from birth. Seventh, young sequential-learning ELLs require 3 years to catch up to age peers and could be misidentified as having SLI. Last, SLI can be identified in bidialectal children by precise measurements of grammatical properties of spoken English.

The relatively simple designs of Figure 1 and Figure 2 reveal that language acquisition is remarkably robust across different profiles of nonverbal IQ, ADHD, ASD, bilingualism, and bidialectalism and that SLI can be differentiated from each of these concurrent conditions. The available evidence (with the exception of the new literature on children with CIs and a few longitudinal studies of children with SLI; Conti-Ramsden, St Clair, Pickles, & Durkin, 2012; Rice, 2013; Tomblin & Nippold, 2014) mostly consists of cross-sectional snapshots of groups of children within relatively narrow age ranges in order to make comparisons unconfounded with age-driven changes. This is related to

the great challenges in ascertaining samples of children that meet the design requirements, involving assessing numbers of children in order to identify the children that meet the inclusionary and exclusionary criteria, in groups that can be difficult to identify. Under these conditions, multiple age levels are usually prohibitively time consuming and the opportunity to follow up with the children over time is often not available. Yet these early investigations suggest the great need for longitudinal studies, beginning shortly after birth and continuing well into the elementary school years, in order to flesh out the apparently complex and unanticipated ways in which language, social, and cognitive dimensions of development unfold.

Causal models will need to be adjusted to account for the outcomes of comparative group studies. Models must account for the ways in which language acquisition is robust as well as vulnerable and selectively spared as well as shared with other clinical conditions. At an empirical and conceptual level, programs of investigation must recognize the dimensionality within the linguistic system, given that some parts of the system are more vulnerable to age-related aspects of language learning in unaffected children, as shown in the studies of ELLs. Such programs must also recognize that these parts of the linguistic system, particularly in certain parts of the grammar, are shown to be sensitive to the identification of children with SLI, even in the context of bilingual or bidialectal language acquisition.

There are risks for the generic diagnosis of LD as the basis of comparative research. It could lead to the composition of groups for comparison that would not differentiate, for example, between ASD + LD and LD without ASD, given that LD is a diagnosis that can include ASD or other conditions. The grouping criteria could specify language impairments without other conditions, in which case it would amount to the diagnosis of SLI. Further, if LD is confounded with other developmental impairments or with measurement error in bilingual or bidialectal children, the existence of SLI and NLI could go undetected in clinical caseloads and in research. Last, if LD is assumed to be expected in the context of other development impairments, it is even more likely that the sizeable proportion of children who would be expected to have language impairments but who do not will continue to be overlooked as a vital part of causal research.

For clinical purposes, the comparative studies reveal that children with SLI are likely to be overlooked for services unless they also have ADHD or speech impairments, although the children with SLI are more likely to be bullied and suffer negative social consequences than the children with ADHD without SLI. This is a compelling example of how causal assumptions can operate in deleterious ways for the identification of children at most risk for poor language outcomes. Clinical decisions for bilingual and bidialectal children also require careful comparative studies of children with SLI in order to recognize that bilingualism does not drive language levels lower in children with SLI in the context of simultaneous bilingual acquisition from birth but that sequential English language learning causes delays that should not be confused with SLI.

The studies included in this forum are part of the longstanding pattern of the few such studies, distributed intermittently and widely across the literature. Given the informative nature of this research design and the high relevance for clinical services, it is hoped that more such studies will follow. The diagnosis of SLI is needed not just for our understanding and treatment of persons with SLI but also for a better understanding of language acquisition in general, the causes of language impairment across all conditions, and improved clinical guidelines for identification and treatment of all persons with language impairment.

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References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Archibald, L. M. D., & Joaanisse, M. F. (2009). On the sensitivity and specificity of nonword repetition and sentence recall to language and memory impairments in children. *Journal of Speech, Language, and Hearing Research, 52,* 899–914.

Bishop, D. V. M. (2014). Ten questions about terminology for children with unexplained language problems. *International Journal of Language & Communication Disorders, 49,* 381–415.

Cardy, J. E. O., Tannock, R., Johnson, A., & Johnson, C. J. (2010). The contributions of processing impairments to SLI: Insights from attention-deficit/hyperactivity disorder. *Journal of Communication Disorders, 43,* 77–91.

Caselli, M. C., Monaco, L., Trasciani, M., & Vicari, S. (2008). Language in Italian children with Down syndrome and with specific language impairment. *Neuropsychology, 22*(1), 27–35.

Conti-Ramsden, G., St Clair, M. C., Pickles, A., & Durkin, K. (2012). Developmental trajectories of verbal and nonverbal skills in individuals with a history of specific language impairment: From childhood to adolescence. *Journal of Speech, Language, and Hearing Research, 55,* 1716–1735. doi:10.1044/1092-4388(2012/10-0182)

Cromer, R. (2014). A case study of dissociations between language and cognition. In H. Tager-Flusberg (Ed.), *Constraints on language acquisition: Studies of atypical children* (pp. 141–153). New York, NY: Psychology Press.

Culatta, B., Page, J. L., & Ellis, J. (1983). Story retelling as a communicative performance screening tool. *Language, Speech, and Hearing Services in Schools, 14,* 66–74.

DeThorne, L. S., & Watkins, R. V. (2001). Listeners' perceptions of language use in children. *Language, Speech, and Hearing Services in Schools, 32,* 142–148.

Dollaghan, C. (2013). Late talker as a clinical category: A critical evaluation. In L. A. Rescorla & P. S. Dale (Eds.), *Late talkers: Language development, interventions, and outcomes* (pp. 91–112). Baltimore, MD: Brookes.

Eadie, P. A., Fey, M. E., Douglas, J. M., & Parsons, C. L. (2002). Profiles of grammatical morphology and sentence imitation in

children with specific language impairment and Down syndrome. *Journal of Speech, Language, and Hearing Research, 45,* 720–732.

Ebbels, S. (2014). Introducing the SLI debate. *International Journal of Language & Communication Disorders, 49,* 377–380.

Geers, A. E., Nicholas, J., Tobey, E., & Davidson, L. (2016). Persistent language delay versus late language emergence in children with early cochlear implantation. *Journal of Speech, Language, and Hearing Research, 59,* 155–170.

Leonard, L. B. (2014). *Children with specific language impairment* (2nd ed.). Cambridge, MA: MIT Press.

McCarty, J. (2013). DSM-5 changes may cause billing headaches. *The ASHA Leader, August,* 55.

National Institute on Deafness and Other Communication Disorders. (2011). *Specific language impairment*. Retrieved from http://www.nidcd.nih.gov/health/voice/pages/specific-language-impairment.aspx

Newcomer, P. L., & Hammill, D. D. (1988). *Test of Language Development 2-Primary–Second Edition*. Austin, TX: Pro-Ed.

Oetting, J. B., McDonald, J. L., Seidel, C. M., & Hegarty, M. (2016). Sentence recall by children with SLI across two nonmainstream dialects of English. *Journal of Speech, Language, and Hearing Research, 59,* 183–194.

Paradis, J. (2011). Individual differences in child English second language acquisition: Comparing child-internal and child-external factors. *Linguistic Approaches to Bilingualism, 1,* 213–237.

Paradis, J. (2016). The development of English as a second language with and without specific language impairment: Clinical implications. *Journal of Speech, Language, and Hearing Research, 59,* 171–182.

Paradis, J., Emmerzael, K., & Sorenson Duncan, T. (2010). Assessment of English language learners: Using parent report on first language development. *Journal of Communication Disorders, 43,* 474–497.

Paul, D. (2013). A quick guide to DSM-5. *The ASHA Leader, August,* 52–54.

Redmond, S. M. (2016). Language impairment in the attention-deficit/hyperactivity disorder context. *Journal of Speech, Language, and Hearing Research, 59,* 133–142.

Redmond, S. M., Thompson, H. L., & Goldstein, S. (2011). Psycholinguistic profiling differentiates specific language impairment from typical development and from attention deficit/hyperactivity disorder. *Journal of Speech, Language, and Hearing Research, 41,* 688–700.

Reilly, S., Bishop, D. V. M., & Tomblin, B. (2014). Terminological debate over language impairment in children: Forward movement and sticking points. *International Journal of Language & Communication Disorders, 49,* 452–462.

Reilly, S., Tomblin, B., Law, J., McKean, C., Mensah, F. K., Morgan, A., … Wake, M. (2014). Specific language impairment: A convenient label for whom? *International Journal of Language & Communication Disorders, 49,* 416–451.

Rice, M. L. (2013). Language growth and genetics of specific language impairment. *International Journal of Speech-Language Pathology, 15,* 223–233.

Rice, M. L., Hadley, P. A., & Alexander, A. L. (1993). Social biases toward children with speech and language impairments: A correlative causal model of language limitations. *Applied Psycholinguistics, 14,* 445–471.

Rice, M. L., Taylor, C. L., & Zubrick, S. R. (2008). Language outcomes of 7-year-old children with or without a history of late language emergence at 24 months. *Journal of Speech, Language, and Hearing Research, 51,* 394–407.

Rice, M. L., Tomblin, J. B., Hoffman, L., Richman, W. A., & Marquis, J. (2004). Grammatical tense deficits in children with SLI and nonspecific language impairment: Relationships with nonverbal IQ over time. *Journal of Speech, Language, and Hearing Research, 47,* 816–834.

Rice, M. L., Warren, S. F., & Betz, S. K. (2005). Language symptoms of developmental language disorders: An overview of autism, Down syndrome, fragile X, specific language impairment, and Williams syndrome. *Applied Psycholinguistics, 26,* 7–27.

Sciberras, E., Mueller, K. L., Efron, D., Bisset, M., Anderson, V., Schilpzand, E. J., … Nicholson, J. M. (2014). Language problems in children with ADHD: A community-based study. *Pediatrics, 133*(5), 793–800.

Shriberg, L. D., Tomblin, J. B., & McSweeny, J. L. (1999). Prevalence of speech delay in 6-year-old children and comorbidity with language impairment. *Journal of Speech, Language, and Hearing Research, 42,* 1461–1481.

Smith, N., & Tsimpli, I.-M. (1995). *The mind of a savant: Language learning and modularity*. Oxford, United Kingdom: Blackwell.

Sterling, A. M., Rice, M. L., & Warren, S. F. (2012). Finiteness marking in boys with fragile X syndrome. *Journal of Speech, Language, and Hearing Research, 55,* 1704–1715.

Tager-Flusberg, H. (2016). Risk factors associated with language in autism spectrum disorder: Clues to underlying mechanisms. *Journal of Speech, Language, and Hearing Research, 59,* 143–154.

Taylor, C. L., Zubrick, S. R., & Rice, M. L. (2013). Population and public health perspectives on late language emergence at 24 months as a risk indicator for language impairment at 7 years. In L. A. Rescorla & P. S. Dale (Eds.), *Late talkers: Language development, interventions, and outcomes* (pp. 23–40). Baltimore, MD: Brookes.

Tomblin, J. B., & Nippold, M. A. (2014). Features of language impairment in the school years. In J. B. Tomblin & M. A. Nippold (Eds.), *Understanding individual differences in language development across the school years* (pp. 79–116). New York, NY: Psychology Press.

Tomblin, J. B., Records, N. L., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). The prevalence of specific language impairment in kindergarten children. *Journal of Speech and Hearing Research, 40,* 1245–1260.

Tomblin, J. B., Records, N. L., & Zhang, X. (1996). A system for the diagnosis of specific language impairment in kindergarten children. *Journal of Speech & Hearing Research, 39,* 1284–1294.

Tomblin, J. B., Smith, E., & Zhang, X. (1997). Epidemiology of specific language impairment: Prenatal and perinatal risk factors. *Journal of Communication Disorders, 30,* 325–344.

Wechsler, D. (1989). *Wechsler Preschool and Primary Scales of Intelligence*. New York, NY: Psychological Corporation.

Wechsler, D. (1991). *Wechsler Intelligence Scale for Children–Third Edition*. San Antonio, TX: Psychological Corporation.

Yamada, J. E. (1990). *Laura: A case for the modularity of language and cognition.* Cambridge, MA: MIT Press.

Zhang, X., & Tomblin, J. B. (2000). The association of intervention receipt with speech-language profiles and social-demographic variables. *American Journal of Speech-Language Pathology, 9,* 345–357.