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Assessment of Language and Literacy

A Process of Hypothesis Testing for Individual Differences

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Purpose: Older school-aged children and adolescents with persistent language and literacy impairments vary in their individual profiles of linguistic strengths and weaknesses. Given the multidimensional nature and complexity of language, designing an assessment protocol capable of uncovering linguistic variation is challenging. A process of clinical reasoning characterized as hypothesis testing is described to assist in language and literacy assessment. In-depth and explanatory assessment can contribute to establishing a common language across professionals and disciplines concerned with these impairments. **Methods:** Hypothesis testing relies on (a) review of research on language impairment variations found in the school-aged population and (b) careful analysis of content and form of commonly used assessment tools. A case study illustrates application of this material with a 10-year-old child. **Results:** Major sources of language variation include language and reading profiles, linguistic components and levels (word, sentence, text), gatekeeping factors, and explanations of language and literacy impairments. Three hypotheses and assessment tools that would be useful in attempts to confirm each hypothesis are described. **Conclusions:** Uncovering the "core" features of a persistent language and/or literacy impairment is difficult. Casting the process as one of testing hypotheses derived from research and analysis of testing tools has the potential to (a) assist language clinicians in determining best assessment practices and (b) improve communication among professionals. **Key words:** *assessment*, *language comprehension*, *language impairments*, *language tests*, *reading disorders*, *school-aged children and adolescents with language impairment*, *specific language impairment*

CHILDREN and adolescents with persistent oral and written language impairments have often seen several different professionals for purposes of assessment and/or intervention. Because their basic language impairments can impact such critical domains as literacy, academic achievement, and social relationships, it is not uncommon to find that these children have "made the rounds" among several professionals from disciplines such as psychology, neuropsychology, pediatric psychiatry, developmental behavioral pediatrics, special education/learning disabilities, speech-language pathology (SLP), school psychology, and audiology. Their parents, with a sense of urgency, arrive at each new appointment with an expanding portfolio of professional reports and individualized educational plans. Frequently, they are frustrated, having heard several labels for their child's problem (e.g., auditory processing disorder, dyslexia, learning disability, language impairment) and several (sometimes conflicting) recommendations for treatment. Although the individualized educational planning process requires different professionals to endorse a plan of treatment, evidence of true collaboration across disciplines is sometimes hard to discern in the record. When consultation outside the school setting is sought, parents

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are often on their own to integrate findings from several professionals. Sometimes the only constant in this journey is that the academic gaps between their child and the child's peers continue unabated (Catts, Bridges, Little, & Tomblin, 2008).

Like the other authors in this issue of *Topics in Language Disorders*, I am concerned about this scenario. To use the allegory of the blind man and the elephant, it seems that different professionals sometimes "see" only their part of the elephant. Would it not be better if there was consensus on (a) how the elephant works (see Foorman, Arndt, & Crawford, 2011), (b) what we call the parts of the elephant, and (c) how different professionals can make complementary contributions to a more successful elephant. In this article, I describe a clinical model for assessing language and literacy impairments in older children and adolescents as one type of contribution that has the potential to improve communication about, and understanding of, language impairments across disciplines. The model addresses multiple levels, domains, and modalities of language and, importantly, draws on research that helps explain connections between them. The goal is to uncover individual profiles of language and literacy impairment at a level of explicit detail and integration that can support cross-disciplinary communication. The desired outcome for the child is a more targeted intervention that all professionals can endorse and reinforce.

The model that I will describe is not specific to one work setting, but it has grown out of my work as a SLP working with older children and adolescents* with language and literacy impairments. Because I work in an urban academic medical center, many of the children who I see are referred by pediatricians, some in general practice, but more commonly specialists, including psychiatry and developmental behavioral pediatrics. Although the children differ on many dimensions (e.g., presence/absence of comorbid conditions such as attention-deficit hyperactivity disorder), the common denominator for those referred is academic struggle. Some have been "in the system" since they qualified for early intervention as a late talker, then continued into a preschool early childhood education program, and eventually met eligibility criteria for special education services in school in one or more categories (usually speech language impairment and/or specific learning disability). Others have a shorter history in special education, and some have never received services even though it seems clear that they could have benefited. The questions that these physicians raise when referring to us are (a) whether and how a language disorder is impacting school achievement, and (b) if so, what can be done about it.

The assessment model, characterized as a hypothesis-testing process, is covered in three sections. First is an overview of several types of oral and written language impairment variations found in the school-aged population. Awareness of these variations informs the hypothesis-testing process. The second section codifies this variation as several clinical hypotheses and presents a plan for obtaining the information necessary to confirm (or not confirm) each hypothesis. Finally, a case study is presented that illustrates the hypothesis-testing nature of language assessment.

VARIATION IN LANGUAGE IMPAIRMENT

Although heterogeneity is often asserted in literature on language impairments, there are fewer discussions about how assessment can be structured to reveal individual differences. A careful assessment that captures this variation would seem to be a first step in bridging the gap (or chasm) that often exists between (a) the actual language knowledge and skills required to function in a classroom and (b) common language assessment and

*Older children and adolescents between the ages of approximately 9 and 14 years with oral and written language impairments constitute the group of interest in this article. Use of the term *child* or *children* assumes this age range.

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intervention practices (as described recently by Wallach, 2010). The process of uncovering a unique language profile is one of starting with one or more hypotheses about the nature of oral and/or written language impairments and their variations and planning an assessment protocol that allows for confirmation. An internal conversation about how a child's oral and written language problems interact might go something like the following:

> Everything I know about this child points to a specific comprehension deficit that impacts both listening and reading. I don't think the classic dyslexic profile of word reading inaccuracy explains her problems. One way I can test this is to present comparable listening and reading comprehension tasks. I wouldn't expect listening performance to be better than reading. However, I anticipate that word reading accuracy will be within normal limits.

Language impairment categories and profiles

Perhaps the most basic question about language impairment is whether it stands alone as a child's only problem or, on the contrary, there are additional problems—a distinction captured in the literature as primary or secondary (Law, Garret, & Nye, 2004; Nelson, 2010). Children with primary language impairments are otherwise typical in cognitive, sensory, medical/neurological, and social–emotional domains. Secondary language impairments are those in which a language difficulty exists alongside problems in these other domains. Use of the term *secondary* is unfortunate because it seems to imply that the language impairment is of secondary importance to the other condition, for example autism, when in fact the language impairment is often one of the most problematic features of a child's entire profile. Nevertheless, the distinction is important because it channels our attention immediately to a body of research that addresses distinguishing linguistic features of children in particular groups. For example, children with Down syndrome are known to have syntactic difficulties that exceed predictions based on mental age (Abbeduto & Chapman, 2005) whereas lexical (vocabulary) skills are relatively higher (Laws & Bishop, 2003)—a pattern that differs for children with Fragile X syndrome (Abbeduto, Brady, & Kover, 2007). In studies involving children with autism who are verbal but language impaired, Kjelgaard and Tager-Flusberg (2001) report profiles resembling children with specific language impairment (SLI). Both groups are especially poor on grammatical tasks and have difficulty repeating long sentences and nonwords correctly.

Grammatical impairment, in particular tense marking, has long been considered as a clinical marker of children with the primary condition known as *specific language impairment* (Leonard, 1998; Rice, 2007)—one that "surfaces" again when these children are asked to write, even though their speech is practically error free (Windsor, Scott, & Street, 2000). A large body of research on the linguistic features of SLI and an emerging literature on language characteristics of children with known syndromes provide a starting point in the hypothesis-testing process by pointing to patterns of relative strength and weakness that could be encountered. Refinements are expected as researchers continue to make progress defining the phenotypic linguistic behaviors associated with genetic findings in various groups (e.g., Hayiou-Thomas, Harlaar, Dale, & Plomin, 2010; Rice, Smith, & Gayán, 2009).

One of the most helpful tools in the process of testing hypotheses about the language profile of any one child is to ask whether history and evidence point to a particular subtype of language or reading impairment. The search for subtypes of impairments has a long history (Aram & Nation, 1975; Conti-Ramsden, Crutchley, & Botting, 1997; van Daal, Verhoeven, & van Balkom, 2004). However, to date, the empirical evidence that would validate one or another system as distinct subtypes with clinical utility is lacking and use of the term *subtype* does not seem warranted. The only system to reach the level of official diagnostic coding thus far is the distinction between expressive language disorder and mixed receptive–expressive

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language disorder, as outlined in the current *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition, text revision; American Psychiatric Association, 2000).

Indeed, this distinction is ingrained in the structure of most comprehensive language tests that combine subtest scores into separate expressive and receptive quotients. However, this system is currently under review in the upcoming fifth edition. Further, on the basis of empirical evidence (Tomblin & Zhang, 2006) and critical analysis (Leonard, 2009), the validity of this distinction is questionable. Leonard (2009) argues that these categories could be an artifact of the way language is tested; certain structures that are easily tested in expressive tasks are less accessible in comprehension tasks. He also reviews evidence that language knowledge is "graded" rather than all or none and this graded level of knowledge may prove very difficult to measure given current methods of testing in which a response to any receptive test item is either correct or incorrect (p. 117). Sometimes production tasks require greater knowledge of a particular structure than a comprehension task where context and familiarity might assist.

For assessment planning, the obvious application is that comprehension and production should be thoroughly tested in all children with confirmed or suspected language impairments, and it should be tested beyond the level of single-word receptive vocabulary (i.e., in sentence- and text-level tasks). It is also important to carefully analyze both the content and the task format of language tests/subtests. A particular subtest of a comprehensive language test may be relegated to the expressive group mainly because the task format requires a spoken response when the task clearly requires linguistic knowledge that is used in *both* comprehending and producing language (sentence repetition tests are good examples). The importance of carrying out careful content and task analyses on norm-referenced tests and criterion-referenced tasks is a point explored in greater detail in the following section.

Another example of profiling is the well-known model of reading impairments based on word recognition and linguistic comprehension, the two components of the simple view of reading popularized by Gough and Tunmer (1986). In this model, how well one reads (where *reading* is defined as comprehending what is read) depends on word recognition accuracy and *general* linguistic comprehension ability. The emphasis is on general comprehension (listening comprehension). A child with poor word recognition and adequate general comprehension would meet the classic definition of dyslexia (Catts & Kamhi, 2005). The opposite, a condition where a child has poor general comprehension but adequate word-reading ability, has been variously termed: specific comprehension deficit (Catts & Kamhi, 2005), poor comprehender (Cain & Oakhill, 2006), and hyperlexia (Aram, 1997). The child whose reading (and writing) skills are limited by poor general comprehension is an example of the importance of forming hypotheses about how listening and reading comprehension interact. A third possibility is the child with both problems—poor word recognition and poor general comprehension. This model of reading impairment has had a substantial impact on the way I conduct a language assessment and is one of the hypotheses that I often explore.

One profile of SLI advanced over a number of years is a form where the impairment is quite specific to select grammatical systems, namely, those that require complex mapping and dependency relations. Two major syntactic groups have emerged. In one account, the problem lies at the intersection of morphology and syntax within the verb system, blocking proper assignment of verb tense and agreement (Rice, 2002). Usually, the child omits the tense or agreement markers, resulting in sentences like "he bite him" (when telling a story about something happening in the past) or "he love his dog" (describing a general state of affairs). In another grammatical account of SLI, the focus is on structures described by long distance

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dependency relations found in structures such as passive voice, relative clauses, and WH questions (van der Lely, 2005; van der Lely, Rosen, & McClelland, 1998). To illustrate, in the following sentence there is a dependency relationship between *bill* and the "trace" that it leaves as a grammatical object in the embedded relative clause (shown at the point of the arrow) that must be represented before the sentence as a whole is comprehensible:

> The bill that the House passed ↑ recently is unlikely to make it through the Senate in the same form.

Both of these specific, grammatically based varieties (morphosyntax and dependency relations) are the phenotypic outcomes of a domain-specific linguistic representational deficit. This deficit, in turn, is most likely genetically determined and resides in specialized cognitive processes that serve grammar (Silliman & Scott, 2006, p. 3). Even though the theoretical significance of these grammatical varieties of SLI is not universally accepted (Bishop, Adams, & Rosen, 2006), no one doubts that children with SLI find these specific structures to be problematic. Whether one adheres to a representational account or a domain-general cognitive-processing account (e.g., limited capacity processing) as the explanation of SLI, there would appear to be clinical utility in assessing these structures in comprehension and production tasks.

Linguistic components, levels, and modalities

Another source of variation in oral and written language impairments is the matter of where, in the vast language domain, problems are found. It is not very helpful to say that a child has a language problem and leave it at that. Because of the complexity of language, SLPs are accustomed to breaking the topic into more manageable subcomponents. One system is to categorize language according a typology of linguistic knowledge—phonology (sound knowledge), semantics (word and word relations), syntax (grammar), and pragmatics (function and use). Another system is to speak of the level of language—word, sentence, or discourse/text. Some overlap between components and levels is evident; for example, syntax plays out at the sentence level. Semantics, however, is seen at multiple levels including: word meaning (the lexicon), sentence meaning (propositions conveyed by a simple sentences and meaning relationships between clauses in complex sentences), and text meaning (organization of a text, and overall gist or core meaning, as conveyed by a succinct summary). Children and adolescents with language impairments can show various patterns of strengths and weaknesses across these levels. A common area of difficulty is at the sentence level—producing and understanding complex sentences that involve main and subordinate clauses characteristic of higher level language (Scott, 2009a; Silliman & Scott, 2009).

Children with sentence-level problems might post scores within normal limits on word-level (vocabulary) tests and could also show reasonable abilities in conveying an organized narrative. Sometimes the amount of contextualization in a task impacts performance at any one level. For example, a child could do poorly on a decontextualized sentence task but produce longer, complex sentences when the task is under his/her control, as when generating a story. Language tasks at the text level can either help or hurt language performance. Some children show improved performance on reading comprehension tasks when the broader context of the text or background knowledge boosts comprehension, but falter when filling in a missing word in a sentence or short text on a different type of comprehension task. Conversely, a child could perform within normal limits on sentence-level tasks or tests, but find the prospect of organizing a text, particularly an informational text, totally beyond his or her capability (Nippold & Scott, 2010). At any one level, modality (whether spoken or written language is required) can also impact performance. In this scenario, the usual pattern would be that a child might perform

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better in oral tasks compared with written tasks, but again, the opposite can occur, as it did in the case discussed later in this article. For this child, reading comprehension was superior to listening comprehension; this child seemed to benefit from having a permanent visual representation of information rather than the fleeting input of auditory-only stimuli.

Linguistic gatekeepers

Another perspective on language impairments that feeds directly to testing hypotheses is the matter of uncovering linguistic "gatekeepers." When one language domain is severely impaired, it can serve as a gatekeeper, limiting the development of another language skill. An obvious example is spelling. To illustrate, the developmental spelling level of a 10-year-old child evaluated in our clinic resembled that of a beginning speller. This child had some knowledge of initial and final singleton consonants and short vowels in consonant-vowel-consonant words but very little knowledge beyond that (e.g., long vowels, consonant blends and digraphs, and syllable juncture patterns were misspelled). This child could *tell* a story with basic text structure and content, but spelling was so difficult that his attempt to write the same material quickly deteriorated into a few simple sentences and he was unwilling to persevere. Another example of gatekeeping is the interaction between lexical and sentence/text knowledge. The child whose lexical options for describing character emotions in a story are limited to *happy, mad*, and *sad* is likely to express these in simple sentences (e.g., *he was mad* vs. *he was jealous because he wanted to be the only pet*).

Explaining language impairments

As is the case for children with broader developmental delays (C. Ochoa, personal communication, October 19, 2009), succinct explanations (medical, cognitive, and/or genetic) for developmental language impairments are often elusive. Nevertheless, there are hypotheses to pursue that can contribute to explaining language profiles. I find it helpful to think about explanations of language impairments using an analogy of peeling away the layers of an onion. At the outermost level are the observable language behaviors that we capture in our measures, for example, reduced utterance length, an absence of higher level vocabulary and sentence structure, inability to tell a well-organized narrative, poor single-word receptive vocabulary, and so forth. At the next layer into the onion are the cognitive processes that account for such language behaviors. As noted above, grammatical accounts of SLI posit that a domain-specific (but nevertheless brain-based) representational difference underlies the language difficulties. For more domain-general accounts of the problem, the processing of auditory information is of particular interest, with recent focus on the speed of processing (Leonard, et al., 2007), the processing of temporal and frequency information (Hill, Hogben, & Bishop, 2005), and the concurrent retention and processing of auditory information (auditory working memory) (for a recent review of working memory associations with SLI, see Montgomery, Magimaira, & Finney, 2010; for working memory and reading/writing associations, see Swanson & Berninger, 1996a, 1996b). The ties between language ability, working memory, and academic achievement are of great interest because of the sentence- and text-processing requirements encountered in academic texts. Many children with language impairments perform poorly on language measures that tax working memory and on independent tests of working memory (Montgomery et al., 2010); however, there are exceptions (Archibald & Joanisse, 2009). As diagnosticians, we should attempt to answer the question of whether working memory constraints impact a child's ability to process language.

At the next level of the onion, we encounter neurobiological differences in the brain. These are not observable in our behavioral testing protocols, but an increasing number of neural imaging studies are contributing information about brain-based

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differences in children with and without language and reading disorders (Berninger, 2008; Shaywitz, Gruen, & Shaywitz, 2008; Silliman & Berninger, 2011). And finally, at the center of the onion are genetic and chromosomal differences. The chances that a child we are testing has a sibling, parent, grandparent, or extended family member with a developmental language/reading disorder is much higher than in the general population (Hayiou-Thomas, Harlaar, Dale, & Plomin, 2010; Rice, Smith, & Gayán, 2009). Confirming a family history of language/reading impairment does not "condemn" a child to a poor outcome because of the enormous complexity of genetic and environmental contributions to language learning, which differ across children. But, as mentioned previously, future research does hold the promise that certain genetic histories link to certain phenotypes of linguistic behavior, and this information should be very useful to us.

TESTING HYPOTHESES ABOUT LANGUAGE DISORDERS

The intent of this section is to operationalize variation in language impairments as testable hypotheses that shape the assessment process. The tests, tasks, and measures used by the diagnostician are chosen specifically to allow a hypothesis to be confirmed (or not). The process described is shaped by my own work setting—a hospital-based outpatient clinic, where norm-referenced tests and criterion-referenced tasks are the most commonly used tools, but there is no question that the process would be enriched by direct observations of classroom performance and other models, including curriculum-based assessment and dynamic assessment.

Drawing from the previous discussion, I present three hypotheses as examples of the types of hypotheses that could be formulated. Each one is also restated as one or more questions to clarify the intended meaning. This is followed by a discussion of applicable assessment tools and decision pathways. The hypothetical child (or adolescent) in each hypothesis is Matthew. An important caveat to consider before starting this discussion is that norm-referenced tests seldom have enough items of any one type to allow examiners to draw absolute conclusions about a linguistic trait. The tools are used to test our working hypotheses. The fact that clinical hypotheses (in many medical and psychological practices) are working hypotheses that gather strength with time and accumulating evidence is not new. In the numbered points that follow, working hypotheses are listed, followed by related questions that will be used to test the hypotheses.

1. Matthew has a primary language impairment.

Is this a primary language impairment, isolated to language, or are there additional cognitive, social–emotional, medical/neurological factors that play a significant role?

This very basic question seems obvious but is nevertheless important to confirm (note that the hypothesis could have been stated in its dichotomous form—Matthew has a secondary language impairment). A careful developmental, medical, and educational history from the parent/caregiver usually provides the answer to this question. Obtaining copies of all relevant documents (e.g., medical records, psychoeducational evaluations, individualized educational plan documents) is critical. It is particularly important to verify cognitive status. Although researchers studying children with SLI typically invoke the criterion that participants score within 1 *SD* on a test of nonverbal intelligence, there is a literature on the longitudinal course of oral and written primary language impairment that has used a criterion of ± 2 *SD*s (e.g., Ellis-Weismer et al., 2000; Rice, Tomblin, Hoffman, Richman, & Marquis, 2004). In these investigations, participants with a cognitive standard score of 85 or more are grouped separately from those whose scores fall between 70 and 85. Not uncommonly, children in the latter group (termed nonspecific language impairment, or NLI) post lower scores on a variety of oral and written language tests and tasks. If

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cognitive test scores are not available in accessible records or historical information, a nonverbal cognitive measure, such as the Test of Nonverbal Intelligence, third edition (TONI-3) (Brown, Sherbenau, & Johnsen, 1997), can be administered. Determination of primary versus secondary status of a language impairment has implications not only for the linguistic phenotype (pattern of language strengths and weaknesses), as discussed previously, but also for prognosis because factors in addition to language per se can affect a child's ability to learn.

2. Poor general language comprehension, not decoding (word recognition), appears to explain Matthew's reading disorder.

Is this reading problem a case of dyslexia, specific comprehension deficit, or is it mixed?

This hypothesis assumes that tests of reading have determined that reading comprehension is below age expectations. Now the question becomes whether a profile of reading disorder can be established. A child with a specific comprehension deficit should do poorly on oral (listening) comprehension tests (as well as reading comprehension tests) but perform within normal limits on tests of word recognition (accuracy). The outermost level in the onion analogy discussed earlier, the linguistic features that are observable, is the focus of this hypothesis. For SLPs, this link between general language comprehension ability and reading is critical to explore; the hypothesis, if confirmed, should have an obvious impact on the direction of intervention.

Careful testing of oral/listening comprehension is also required to confirm this hypothesis. *Word-level tests* tap either vocabulary breadth or depth. An example of the former is asking a child to point to the picture named by an examiner (from a field of several pictures). Tests of vocabulary depth examine how well a word is known *in relation to other words* (e.g., picking two words that are related from a field of four or testing knowledge of synonyms, antonyms, or superordinate/subordinate relationships).

Examining *oral comprehension at the sentence level* is critical. Academic writing, while undeniably a text, unfolds as individual sentences, coded by the use of capital letters and periods or other end-sentence punctuation. To understand these texts, students must comprehend sentences. Table 1 provides examples of norm-referenced tests that can be used as measures of sentence comprehension with children in the age range of interest here along with examples of items and a brief analysis of their content and the nature of the task (what the child is asked to do). As discussed in more detail later, content and task analysis reveals that these sentence-level tools tap different aspects of sentence knowledge and are not necessarily interchangeable. For purposes of testing the present hypothesis, however, it is enough to establish that sentence-level comprehension is compromised. Compared with word- and sentence-level tests of listening comprehension, there are very few *text-level tests of comprehension*. An example of one tool is the Listening to Paragraphs subtest of the Clinical Evaluation of Language Fundamentals, fourth edition (CELF-4; Semel, Wiig, & Secord, 2003), where children hear short texts (5–7 sentences) and then answer factual and inferential questions about them.

Several other tools that are not norm referenced are also helpful in exploring listening comprehension. One of these is to observe a child retelling or generating stories. Because the format requires production of language, narrative retells are sometimes overlooked as sources of information about text comprehension. If a child is asked to retell a story read by the examiner, that child must understand the story to retell it well. A poor performance on this task could be attributed more to a production constraint if follow-up probe questions revealed good understanding of the story content. On the other hand, if both production and answers to probe questions were problematic, text comprehension difficulties are more likely. This distinction between production and comprehension of narratives is built into the Test of Narrative Language (TNL) (Gillam & Pearson, 2004).

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Table 1. A content/task analysis of four tests of language comprehension at the sentence level

Test	Task: What the child does	Content: Linguistic characteristics of input sentences
Clinical Evaluation of Language Fundamentals, Fourth Edition (Semel, Wig, & Secord, 2003): Concepts and Following Directions subtest	Points to objects (e.g., *house, shoe, fish, car*) in accordance with an instruction	Vocabulary is limited to simple object names and modifiers that signal sequence, order, spatial location, exclusion, and temporal order. Grammatical requirements focus on adverbial subordinate clauses (e.g., *Point to the second little house after you point to the last big apple and the last little apple*), noun phrase postmodifying constructions (e.g., relative clauses such as, *Point to the two cars that are to the right of a house, then point to the last house*) and several other higher level forms. Some directions are 18–20 words long.
Comprehensive Test of Spoken Language (Carrow-Woolfolk, 1999): Sentence Comprehension Subtest	Hears a target sentence and is asked whether a second sentence, then a third sentence "means the same thing" (yes/no)	Requires recognition of syntactic paraphrase, for example, *the pretty cat plays with the girl* means the same thing as *the cat that is playing with the girl is pretty*. The majority target and/or comparison sentences contain subordinate clauses including adverbial, relative, and object-complement clauses.
Test for Reception of Grammar-Version 2 (Bishop, 2003)	Points to the picture (from a field of four) that illustrates the sentence spoken by the examiner	Twenty grammatical constructs are each tested four times. Higher level language structures tested include: passive; center-embedded object relatives (e.g., *The sheep the girl looks at is running).*
Token Test for Children–Second Edition (McGhee, Ehrler, & DiSimoni, 2007)	Touches or manipulates colored circles and squares in accordance with an instruction	Parts 1, 2, and 3 require understanding of color/size premodification of objects (circle, square). The number of premodifiers and objects increase: Part 1: *Touch the large red square.* Part 2: *Touch the white square and the red square.* Part 3. *Touch the small white square and the large red square*. Part 4: Nine (of 16) items require comprehension of complex sentences that feature temporal or conditional adverbial clauses (e.g., *While touching the red circle, touch the red square, but first touch the green circle*).

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Another strategy for determining whether oral comprehension difficulties explain reading comprehension difficulties is to compare the two directly. Two passages (same level) from an informal reading inventory can be used for this purpose; one is read to the child and the other is read by the child, and comprehension questions are asked following both. When listening comprehension accounts for reading comprehension difficulties, the expectation is that performance levels would be similar across modalities (difficulty in both). Carlisle and Rice (2002) caution that there is a developmental window, surrounding the fifth grade, when this comparison has the best validity. In children at the beginning stages of reading, listening comprehension is usually better than reading comprehension (for equivalent texts) because of limited word recognition; conversely, in older students, reading comprehension has the advantage because the reader has more control over the pace of information. Another caveat is that the texts that the child hears and reads should be comparable in terms of difficulty level and genre. Hearing an expository passage but reading a narrative passage could be a disadvantage for the listening comprehension performance because informational text is more challenging to many school-aged students, particularly those with language impairments (Ward-Lonergan, 2010). Ideally, clinicians would use several inputs for both reading and listening comprehension and establish that there is a *pattern* whereby listening comprehension is (or is not) the superior modality.

3. The core feature of Matthew's language disorder is difficulty comprehending and producing higher-level meanings/syntax found in complex sentences; working memory limitations exacerbate his difficulties.

Does Matthew produce higher-level sentence structures at rates expected for his age? Does Matthew still omit obligatory tense and agreement errors when speaking and/or writing? How is sentence comprehension affected by sentence complexity and length?

Exploring this hypothesis involves several analyses. First, I would need to look at comprehension across levels of language (this analysis is still situated at the outermost layer of the onion). The hypothesis gains strength if the lowest scores posted are on sentence-level tasks. As noted, a child's factual and experiential knowledge can boost comprehension of text, particularly narrative text. Comprehending decontextualized sentences of the types shown in Table 1 removes that redundancy and forces the child to rely more directly on grammatical knowledge. Second, a content/task analysis reveals that the various sentence comprehension tests tap different types of knowledge and have different working memory requirements. Using the examples shown in Table 1, the two items for Concepts and Following Directions require sophisticated grammatical analysis (adverbial subordination and relative clause embedding) but also feature specific semantic premodifiers of order and direction (*second, last, to the right of*). If a child missed these two items, it would not be clear whether it was the complex grammar or the concepts that caused the problem. But, if the child was correct on the earlier and grammatically simpler items that test the same concepts (e.g., *point to the second house*, *point to the last ball in the row*), we could more confidently attribute error responses on the longer items to a grammatical and/or working memory constraint.

To pursue and untangle the grammar and working memory explanations, analysis of test results on the Test for Reception of Grammar–Version 2 (TROG-2; Bishop, 2003) and Token Test for Children–Second Edition (TTFC-2; McGhee, Ehrler, & DiSimoni, 2007) would be helpful. Examination of the examples for Parts 2 and 3 on the TTFC-2 shows that the grammar is simple and unchanged going from Part 2 to Part 3. For Part 2, the child must hold the input direction in the auditory "loop" long enough to discern the two colors mentioned from five choices. Part 3 requires the same calculation but adds a requirement of size (large and small). In my experience, some children do well on Part 2 but have a precipitous drop in correct responses on Part 3. When this occurs, I interpret this as a sign that working memory may play a

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significant role in sentence comprehension difficulties. The TROG-2, on the other hand, is helpful in confirming grammatical contributions to sentence comprehension problems because sentence length is shorter and specific grammatical structures are targeted with four items for each structure. It is not uncommon to find that a child has clear difficulty with a small set of structures, usually the more syntactically complex items such as the center-embedded object-relative clause as shown in the example in Table 1. Working memory should play less of a role in performance on this test because sentences are generally shorter. The longest sentence on the TROG-2 has 10 words and average sentence length across all items is seven words. This compares with Concepts and Following Directions (CELF-4) where the five longest sentences have 19 or 20 words. Part 4 on the TTFC-2 contains sentences of 15 words (3), 18 words (1), 23 words (1), and 30 words (1). Of note, vocabulary is controlled on all three sentence comprehension tests—simple objects (e.g., *house, fish, shoe, pencil, cup*), shapes (*square, circle*), people (e.g., *girl, man, boy*), and animals (*sheep, elephant*)—and therefore should not affect comprehension performance. Suggestions for dedicated measures of working memory can be found in Montgomery et al. (2010).

A third source of information about grammatical contributions to language impairment is found in language tests that are typically considered to be "expressive" tests (see the discussion given earlier). Responses on the Recalling Sentences subtest of the CELF-4 can be analyzed to see whether content and/or grammar is preserved on items with two or more clauses. A majority of items at higher levels of the Formulated Sentences subtest of the CELF-4 require the child to generate a complex sentence using adverbial conjunctions (e.g., *if, unless, until, as soon as*) or conjuncts (e.g., *otherwise*).

Spontaneous (naturalistic) spoken and written language samples also provide a wealth of information about a child's ability to generate sentence complexity and the status of morphosyntactic (tense and agreement) knowledge. Because the amount and type of subordination that a child uses in a language sample is optional (i.e., under the child's control), we do not have "exact" developmental norms, but it is possible to use the extant literature and clinical experience to develop reasonable expectations. With children aged 11 years and younger, I use the frog story wordless picture book *One Frog Too Many* (Mayer & Mayer, 1975) to elicit a spoken narrative. After using the same book countless times and with the help of the Systematic Analysis of Language Transcripts (SALT) reference database for narratives elicited in response to wordless picture books (Miller, 2009), I expect children with typical language development to generate a story using at least a few exemplars of a variety of subordinate clauses in complex sentences (those with 2 or more clauses). Types I look for include adverbial clauses (particularly those with later-developing conjunctions such as *until, unless, while*), relative clauses, and object complements. In children with language impairments, it is not uncommon to find a restricted set of complex sentences, if any. When subordinate conjunctions are used, they tend to be limited to early-developing forms such as *because, when,* and *so*. Relative clauses are rarely seen. Scott recently reviewed the types of information about word, sentence, and text complexity available from the analysis of written language samples (Scott, 2009b) and expository (informational) text (Scott, 2010).

To summarize, three hypotheses that can be used to structure an assessment provide a pathway for uncovering possible profiles that have surfaced in research on the constructs of oral and written language impairments. Each hypothesis narrows the search. The first hypothesis establishes whether the impairment is restricted to language or not. The second establishes the manner in which oral and written components of the problem relate and the third pursues the precise nature of the basic problem in general comprehension and asks whether an underlying processing deficit (verbal working memory) plays a role. In the

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last section, a case is presented that illustrates the process of hypothesis testing. The case is actually a child with a language impairment accompanied by broader behavioral difficulties. The *process* of hypothesis testing would not differ in a case of secondary language impairment. More specifically, the three hypotheses explored in this section (or their counterhypotheses) can be discerned. They include (a) predictions that follow from the secondary nature of the language impairment, (b) the reading profile and the relative contribution of word recognition and general comprehension, and (c) the specific nature of sentence comprehension difficulties and their relation to working memory.

A CASE STUDY

Jonathan* (age 10 years 7 months) was referred to our outpatient clinic by a pediatrician who suspected that a language disorder was interfering with academic achievement and literacy. This physician was interested in an in-depth analysis of language strengths and weaknesses that could inform intervention. Jonathan's history included both medical and educational information that would place him in the group of secondary language disorder (seizure disorder as a younger child and special education eligibility in the category of autism). His social–emotional status was not a primary focus of the assessment; he could easily participate in a casual conversation, and he tolerated both informal and formal testing well. Rather, we were interested in describing spoken and written language status. The fact that Jonathan is a verbal child and is being educated in a general education classroom with various support services pointed to the hypothesis that "clinical marker" features of a language impairment might resemble those seen in a child with SLI (Kjelgaard & Tager-Flusberg, 2001). With this in mind, it was particularly important to explore grammatical knowledge in both sentence comprehension tasks and production tasks. Literacy was also a concern. Jonathan was struggling with reading comprehension according to school reports and his parents were concerned about writing skills. It will be important to see whether problems in word recognition and general linguistic comprehension contribute to read difficulties or, alternatively, whether a specific comprehension deficit is the main contributor to poor reading comprehension. The latter possibility would be the favored hypothesis for a child with Jonathan's history (Nation, Clarke, Wright, & Williams, 2006). Furthermore, are there any gatekeepers in Jonathan's linguistic profile? What factors account for his struggles with writing composition? We might hypothesize that higher level semantic/syntactic difficulties at both sentence and text levels account for writing problems and one approach would be to compare spoken and written output. Spelling as a gatekeeper to writing is less likely if decoding/spelling are relative strengths.

With these questions in mind, we confirmed that Jonathan has significant problems with oral language, scoring more than 2 *SD* below the mean on the CELF-4 core language quotient. Looking more closely at his performance on the subtests that comprise this quotient, there was a substantial discrepancy between sentence- and word-level tasks (word-level performance was better), pointing to the possibility that sentences are difficult for Jonathan to comprehend and produce. To observe sentence comprehension in more detail, variation in performance across three different tests was examined. Jonathan's performance on Concepts and Following Directions (CELF4) was very poor (3 *SD* below the mean). He reached a ceiling quickly before progressing to items that required comprehension of complex sentences.

On the TROG-2, with shorter sentences and grammar-specific items, Jonathan's score was 1 *SD* below the mean. He had difficulty with center-embedded object-relative clauses

*A pseudonym; several details have been altered to protect identity.

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and *neither/nor* constructions. His performance on the TTFC-2, greater than 1 *SD* below the mean, was revealing in terms of working memory. When an item required just one modifier (see Part 2 of the example in Table 1) he was accurate, but performance deteriorated significantly with two modifiers (Part 3 of the example in Table 1). He also had great difficulty with Part 4 sentences, missing most items; this portion of the test requires comprehension of temporal and conditional subordinate clauses and many of these items are long sentences.

Taken together, these results on sentence comprehension tests demonstrate that Jonathan will have a difficult time understanding complex sentences (e.g., those that contain relative and adverbial clauses) and that his performance can be expected to decline as sentences become longer and tax working memory. In addition, he does not understand the meaning of particular relational modifiers like those tested on Concepts and Following Directions. His poor understanding of higher level language encoded in complex sentences presented difficulties on production tasks as well. He could not make up sentences using words like *unless* and *until* (these would have required a complex sentence with a subordinate adverbial clause), and he spontaneously produced two-clause sentences in only 2 of the 48 utterances when he generated a story. Additionally, he wrote only simple, list-like, object-naming simple sentences when asked to write a story in response to a picture scene. Considering the types of sentences that Jonathan will be asked to comprehend when he enters a fourth-grade general education classroom in the coming year, either when listening to his teacher or when reading textbook assignments, he will be at a considerable disadvantage. Likewise, whether he is responding orally to questions about what he has learned, or when asked to summarize material in writing, Jonathan will struggle. The hypothesis of a significant grammatical component in his language profile is strengthened, and working memory appears to impact performance.

A comparison of Jonathan's oral and written narratives is revealing. Although he produced short and simple sentences when *telling* a story, he was relatively fluent (i.e., he produced a monologue of 48 utterances). He could not even start a written story, producing instead the list described earlier. Although making up a story about one picture (a scene) is more difficult than telling a story to accompany a wordless picture book, it is doubtful that the task difference could explain the entire lack of written composition ability. Examination of his spelling skills showed accuracy on singleton consonants and short vowels in consonant-vowel-consonant words but errors on all higher level spelling patterns including long vowels, syllable juncture patterns, and derived words. It is difficult *not* to conclude that Jonathan's poor spelling is a gatekeeper for written composition—the gap is simply too wide between his transcription skills (trying to spell words) and content needs (what he is trying to communicate in writing). He is reduced to filling a page with simple "labeling" sentences that repeat. Although perseveration is a common characteristic of children with autism, we should note that repetition was not seen anywhere else in his language profile.

Finally, examining Jonathan's reading scores, the hypothesis of a specific comprehension deficit as the sole explanation of Jonathan's reading comprehension difficulties is not confirmed. His general linguistic comprehension difficulties certainly contribute to reading problems, but Jonathan's reading also suffers from poor word recognition, decoding, and fluency. Nation and colleagues (2006), while confirming poor comprehension as the major contributor to poor reading in a group design with 41 children with autism, reported that variability among children was high and some children were poor at word and nonword reading. Jonathan's relatively better comprehension scores (within 1 *SD* on two different reading comprehension tests) are, in fact, unexpected given his difficulty with oral comprehension. There are several possible explanations.

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Unlike the oral comprehension tests, which are highly decontextualized and almost every word contributes critical meaning, the reading tests allow for some benefit of general knowledge and textual knowledge—it is not always necessary to understand every word in the sentence to answer correctly. Also, answers to many of the reading comprehension items are encoded in simpler sentences than those found on oral sentence comprehension tests. It is also possible that he benefits considerably from being able to see a permanent visual record of the material that he is expected to comprehend.

Jonathan will need an intervention program that addresses his lack of knowledge of higher level sentence complexity and the meanings and uses of such sentences within wider texts (Balthazar & Scott, 2007; Scott & Balthazar, 2010). He also needs guided word study that is individualized to his specific developmental level of decoding and encoding orthographic patterns, with immediate applications to develop fluency in text-level reading and writing.

To conclude, the premise of this article is that older children and adolescents with language impairments are a heterogeneous group in terms of specific patterns of linguistic strengths and weaknesses. Unfortunately, however, academic success requires "all language hands on deck" and suffers from any combination of language deficiencies. As children reach the upper elementary and middle school years with a history of successive years of academic struggle, the core linguistic culprits are far from obvious, and there are many candidates. A process of careful language assessment in such cases is described. The process can be conceptualized as one of drawing on the research literature in oral and written language impairments to assist in forming possible hypotheses that can be reasonably tested in the clinic for individual cases. Careful content and task analysis of what we ask children to do during an assessment (both norm-referenced and criterion-referenced tasks) is also required. In the case of Jonathan, the process was helpful in arriving at core features of a language profile that can be used to inform intervention. The degree of detail and integration across levels of language and attempts to explain modality interactions and processing components should stimulate and improve cross-disciplinary communication among those who share responsibilities for improving the academic prospects for these children.

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