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Beyond morphosyntax in developing bilinguals and "specific" language impairment

In the Keynote Article, "The Interface Between Bilingual Development and Specific Language Impairment," Johanne Paradis considers issues and evidence at the intersection of children learning two languages and primary or specific language impairment (SLI). The review focuses on morphosyntactic evidence and the fit of this evidence with maturational (domain-specific) and limited processing capacity (LPC; domain-general) theories of language impairment. We agree with Paradis that studies that systematically and simultaneously investigate the behavioral profile of dual-language learners and children with language impairment are of significant theoretical and practical value. In our commentary we aim to broaden the behavioral profile to be considered in these populations, beyond the level of morphosyntax. In line with this aim we use the term primary language impairment (PLI) for the same population referred to as SLI by Paradis.

We use PLI versus SLI to underscore the point that "specificity" or exclusivity of impairment to the language system has been seriously challenged in recent years (e.g., Hill, 2001; Leonard et al., 2007; Viding et al., 2003). Alternative terms including language impairment, procedural language impairment (Ullman & Pierpont, 2005) and PLI (Kohnert, Windsor, & Ebert, 2009; Windsor & Kohnert, 2009) have been proposed to encompass the subtle nonlinguistic processing weaknesses that exist alongside the more obvious lags in language. We prefer the term PLI, because it is most consistent with all available evidence without presupposing a particular etiological cause onto the diagnostic category (cf. Tomblin, Zhang, Buckwalter, & O'Brien, 2003). As a practical matter, PLI is preferable to language impairment in the present context because it also avoids visual confusion with the abbreviation for first language (L1).

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LIMITATIONS OF KEYNOTE ARTICLE FOCUSED ON MORPHOSYNTAX

Paradis focused exclusively on morphosyntax, stating that this "is the most highly affected linguistic domain in SLI." This viewpoint is consistent with formal theories of language acquisition, which are reflected in the prevalence of investigations on morphosyntactic skills in monolingual children with PLI, that in turn have shaped much of the research that considers both bilingual children and PLI. In a recent review of the empirical literature at the intersection of bilingualism and communication disorders, Kohnert and Medina (2009) found that half of the 32 studies that included both second language (L2) learners and children with PLI investigated some aspect of morphosyntax. Clearly, this is a keen area of interest, and any theory of PLI must be able to account for the well-documented morphosyntactic deficits. At the same time, exclusive focus on evidence at the morphosyntactic level may be misleading or unfairly bias a review toward accepting theories designed to account primarily for morphosyntactic deficits (such as the maturational theory in general and the extended optional infinitive account, in particular) rather than those designed to account for a much broader portion of the PLI profile (such as domain general or LPC theories).

From our perspective there are several reasons to look beyond the level of morphosyntax to inform theoretical and practical issues at the intersection of bilingualism and PLI. First, morphosyntax may not be as severely affected in children with PLI in all inflected languages (e.g., Thordardottir, 2008). In addition, as presented in the extant PLI literature, morphosyntax seems to be limited to children who speak inflected languages, excluding speakers of isolating languages such as Vietnamese, Hmong, or Mandarin. Second, all studies comparing grammatical skills in typically developing (TD) L2 learners to monolingual speakers of the majority language with PLI have found far more similarities than differences in both type and number of morphosyntactic errors (see Paradis Keynote; for a review, see also Kohnert & Medina, 2009). These findings are interesting and important, but very limiting from a practical perspective. Third, there is robust evidence that several other areas of language are affected in PLI, including vocabulary (Leonard, 1998; Rescorla, 2005), discourse (Scott & Windsor, 2000), written language (Mackie & Dockrell, 2004), and social language (Fujiki, Brinton, Morgan, & Hart, 1999). The most observable characteristics of PLI may shift with severity of impairment, characteristics of the ambient languages to be learned and the developing child. Within-child changes over time in the most observable PLI symptoms are partly because of developmental changes in TD children who are used as the reference point for determining PLI (for discussion, see Kohnert, 2008). Fourth, PLI-like deficits on morphosyntactic tasks have been simulated in TD monolingual children and in adult L2 learners by increasing general cognitive processing demands (Hayiou-Thomas, Bishop, & Plunkett, 2004; McDonald, 2006). These findings indicate that a processing deficit may underlie the characteristic grammatical profile in PLI. General processing weaknesses are also a consistent finding in the PLI literature, a point we return to in the following section.

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Our goal here is not to take issue with specific morphosyntactic evidence presented in the lead article; however, we would be remiss if we failed to point out some shortcomings in arguments used to challenge LPC theories. For example, Paradis hypothesizes that for LPC theories to hold true, simultaneous bilingual children with PLI should show disproportionate deficits in the acquisition of specific morphosyntactic structures compared to monolingual peers with PLI. To test this prediction, results are presented from studies that compared the production of select morphosyntactic structures recorded from spontaneous language samples between bilingual and monolingual children with PLI. Null results (no between-group differences in morphological production) were interpreted as running counter to LPC predictions. However, disproportionate delays are only possible in the absence of floor effects and in the presence of measures sufficiently sensitive to detect graded differences in performance. If monolingual children with PLI are not producing a target morpheme (floor effect), it is not possible for bilingual children with PLI to demonstrate lower accuracy or the hypothesized disproportionate deficit or "double delay." In addition, spontaneous production of morphemes may not be a sufficiently sensitive measure for showing a potential double delay, if it exists, if children progress from low to high levels of productive accuracy within a short period of time. Of more importance, similarities between bilingual and monolingual children with PLI on morphosyntactic measures could be explained by threshold effects or interactions between basic cognitive processing mechanisms and environmental opportunities. The assertion that differences in "time on task" for bilingual learners with PLI must result in lower performance compared to monolingual peers with PLI to be consistent with LPC theories represents an additive versus integrative approach to LPC theories and bilingualism.

Similarly, it was argued that for LPC theories to hold there must be "cumulative effects" for L2 learners with PLI; a greater discrepancy in morphosyntax between L2 learners with and without PLI compared to the discrepancy between monolingual children with and without PLI. This is not the case. Any delay because of exposure that L2 learners with PLI experience would also be experienced by their bilingual TD peers who are assumed here to experience the same linguistic environment. In fact, this idea is supported by the data presented from Steenge (2006) and Orgassa and Weegman (2008), as the TD bilinguals in these studies did not match monolingual TD peers in morphosyntactic tasks. Given similar environmental experiences, LPC theories would actually predict comparable differences between affected and unaffected monolingual children as between affected and unaffected L2 learners. This "comparable deficit" prediction is borne out by the evidence presented in Paradis' Keynote: the data shown in Figure 4 show parallel monolingual and bilingual PLI deficits. On a practical note, the suggestion to promote both languages needed by bilingual children with PLI to meet personal, social, educational, and vocational needs is completely consistent with LPC and other highly interactive theories (e.g., see Kohnert, 2008; Kohnert & Derr, 2004; Kohnert & Medina, 2009).

Next we turn our attention to other evidence at the intersection of bilingualism and PLI that can be used to advance theoretical issues and inform clinical practice. In this brief response we focus on information processing skills.

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BROADENING THE BEHAVIORAL PROFILE: GENERAL INFORMATION PROCESSING SKILLS IN PLI

For children with PLI the overall processing of information is less efficient than in unaffected peers. English-speaking children with PLI score significantly lower than unaffected peers on nonword repetition, competing language processing, novel word learning and grammaticality judgment tasks (e.g., Ellis Weismer et al., 2000; Ellis Weismer & Evans, 2002; see also the review in Leonard, 1998). Children with PLI are also slower than unimpaired age peers, even after controlling for differences in response accuracy, to name pictures, to determine whether a string of phonemes is a real or made-up word, or to match a string of word-like sounds to one of two pictures (e.g., Edwards & Lahey, 1996; Kohnert, Windsor, & Miller, 2004; Lahey & Edwards, 1996).

Subtle processing inefficiencies in PLI also extend beyond the language domain. Poorer performance by monolingual children with PLI compared to unaffected age peers has been documented on a wide range of basic perceptual, motor, memory, and attentional tasks that require little or no language ability (e.g., see Miller et al., 2006; Windsor, Milbrath, Carney, & Rakowski, 2001; for a review, see Leonard, 1998). One argument, consistent with maturational or domain-specific theories, is that the documented nonlinguistic processing weaknesses co-occur with the defining language deficit in PLI, but they are not related to it. To address this issue, Viding and colleagues (2003) investigated the extent to which PLI in one twin predicted nonlinguistic ability in the other twin. Participants were 160 monozygotic and 131 same-sex dizygotic 4-year-old sets of English-only speaking twins. Key findings were that language problems in one twin predicted poor nonverbal ability in the other twin, with the strength of this predictive relationship greater for monozygotic than dizygotic twins (Viding et al., 2003; see also Bishop, 2002). These results are consistent with LPC or domain general theories, and may provide the clearest evidence to date that general genetic factors implicated in PLI include language as well as subtle nonverbal problems. Underlying performance on verbal and nonverbal processing inefficiencies in PLI may be weaknesses in attention, working memory, and general processing speed (e.g., Montgomery, 2000; Windsor & Kohnert, 2009). Studies that have included nonlinguistic measures have been primarily conducted with monolingual speakers of English. Recent exceptions are summarized in the following section.

EVIDENCE FROM NONLINGUISTIC PROCESSING TASKS AT THE INTERFACE OF L2 LEARNERS AND PLI

In a series of studies we compared the performance between 100 8- and 13-year-old children placed into one of three groups: TD English-only speakers, English-only speakers with PLI as conventionally identified, and TD bilingual children who learned Spanish as their L1 and English as their L2. Along with a large battery of traditional language, speech, and hearing measures, there were two major types of experimental tasks: language-based processing measures and nonlinguistic cognitive processing measures. Language-based processing measures were administered in English and included timed picture naming, word

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recognition, grammaticality judgment, the competing language processing task, rapid automatic naming, and nonword repetition (Kohnert, Windsor, & Yim, 2006; Windsor & Kohnert, 2004, 2009). Nonlinguistic processing measures included auditory and visual choice detection tasks, in which children were instructed to push one of two buttons in response to pure tones or shapes, visual pattern matching, tone sequencing, rapid visual scanning, and geometric shape matching (Kohnert & Windsor, 2004; Windsor, Kohnert, Loxtercamp, & Kan, 2008). The dependent variables of interest across tasks were response accuracy or speed.

The logic of different processing-based comparisons between TD L2 learners and English-only age peers with and without PLI comes from the monolingual PLI processing literature, summarized in the previous section. The practical motivation for these investigations is bolstered by the repeated finding of comparable performance on morphosyntactic measures by TD L2 learners and monolingual children with PLI (e.g., see the review in Paradis Keynote). The working hypothesis, consistent with LPC theories, is that in PLI a subtle underlying weakness in information processing has a disproportionate effect on language, in large part because language is the most complex, highly temporally constrained and socially demanding of all human behaviors. However, our ultimate goal is not to validate any particular theoretical perspective but rather to accurately profile L2 learners and children with PLI. We hope that investigations that encompass multiple levels of abilities will lead to unified theories of language and complex behavior that can be used to guide more effective clinical decisions at the intersection of bilingualism and PLI.

Results from our combined studies point to clear areas of overlap among TD monolingual and L2 learners as well as fault lines that separate these TD L2 learners from children with PLI (for a review, see Kohnert, Windsor, & Ebert, 2009). The most robust areas of separation between children with PLI and their TD bilingual peers were on nonlinguistic tasks. These nonlinguistic tasks invoked different cognitive demands. Consistent with the broader PLI literature, group differences between TD L2 learners and PLI were most evident in response speed to simple perceptual motor tasks or accuracy on nonverbal working memory tasks. As is the case with language measures, it was also clear that not all general cognitive processing tasks were equally sensitive to the PLI profile. We are in the process of examining the best combination of language and nonlinguistic processing tasks for identifying PLI in a larger group of 6- to 10-year-old children who speak Spanish, Hmong, or English as their L1 (Kohnert, Windsor, & Pham, 2009). Findings from these studies further reinforce the practice of separating differences from disorders among linguistically diverse learners based on carefully constructed nonlinguistic processing measures.

In summary, the PLI profile includes a variety of performance weaknesses on tasks that require little or no language ability. We believe that systematic exploration of task and child factors that underlie within- and across-group performance is critical to help shape robust theory. To date, results from this line of research are most consistent with LPC theories. At the same time, processing evidence at the intersection of TD L2 learners and PLI does not necessarily indicate a causal relationship between language and the general cognitive processing system. Treatment studies with bilingual learners that

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examine language change following the training of nonlinguistic processing skills are needed to directly investigate both the malleability of general cognitive processing mechanisms as well as the nature of cognitive–linguistic relationships in bilingual children with PLI. Preliminary evidence with monolingual children with PLI suggests that training directed at improving general cognitive processing may result in language gains (Ebert & Kohnert, 2009; see also Gillam et al., 2008).

CONCLUSIONS

Systematic investigation at the intersection of bilingualism and PLI has much to offer. Over the past decade there has been considerable activity in the empirical literatures on bilingualism and PLI, with evidence gathered at multiple linguistic and cognitive processing levels, from diverse theoretical perspectives. As with any vibrant field of study, theoretical tension provides an important impetus for moving forward. We greatly appreciate the opportunity to engage in public dialogue with esteemed colleagues who are working on different aspects of the challenging "problem space" that characterizes the intersection of PLI and bilingualism.

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Language combinations, subtypes, and severity in the study of bilingual children with specific language impairment

I commend Johanne Paradis not only for her interesting Keynote Article but also for the careful research that she has conducted along with her collaborators in the area of bilingual language development and disorders. Her contributions have been significant and are sure to shape our theoretical as well as clinical understanding of specific language impairment (SLI). In this Commentary, I focus on three issues. The first stems quite directly from ideas raised in the Keynote Article; the second and third deal with factors that we need to consider when conducting research involving comparison groups of bilingual and monolingual children with SLI.

THE LANGUAGE COMBINATIONS STUDIED IN COMPARISONS BETWEEN BILINGUAL AND MONOLINGUAL CHILDREN WITH SLI

Perhaps the most striking point discussed by Paradis is the finding that the difference between bilingual children with SLI and typically developing (TD) bilingual children (favoring the latter) is no greater than the difference between monolingual children with SLI and their TD monolingual counterparts. As Paradis notes, such a finding has implications for processing capacity accounts of SLI because it suggests that there are no deleterious cumulative effects when a child with SLI must learn two languages rather than one language. This type of finding obviously has great importance for clinical practice as well. For these reasons, I provide here some research questions that should be posed to examine this issue further. These questions revolve around the potential insight that might be gained by studying several different combinations of languages that bilingual children may be acquiring. The premise behind these suggestions is that the magnitude of the

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