SPECIFIC LANGUAGE IMPAIRMENT AND BILINGUALISM: ASSEMBLING THE PIECES*

LAURICE TULLER, LAYAL ABBOUD, SANDRINE FERRÉ, ALICE FLECKSTEIN, PHILIPPE PRÉVOST, CHRISTOPHE DOS SANTOS, MAUREEN SCHEIDNES, & RASHA ZEBIB

1. Introduction

Language acquisition with Specific Language Impairment (SLI) entails impaired language in the absence of other clinically identified deficits (sensorial, neurological, cognitive, behavioral, etc.). Language impairment is clinically identified, but there is considerable variability in diagnostic practices. One common practice is that used in Tomblin et al.'s (1997) epidemiological study of SLI. Over 2,000 (monolingual) kindergarten children were assessed and a diagnostic of SLI was given to children who had two or more out of five composite scores in different areas of language which were below -1.25 SD. As Tomblin et al. note and illustrate in some detail, the resulting prevalence is entirely dependent on the cut-offs both for language impairment and for cognitive disability.[1] Another unresolved factor regarding diagnosis for SLI is the question of subtypes. Available evidence suggests that children may be impaired in one or several areas of language (for recent discussion, see Friedmann and Novogrodsky, 2008; Schulz & Roeper, 2011; van der Lely, 2005). This means that there may be different kinds of SLI, which would presumably entail that there are different kinds of diagnostic markers in terms of language area. These diagnostic questions constitute a fundamental back-drop for any discussion of SLI. Our specific goal in this paper is to examine another puzzle related to SLI: How to identify SLI in children growing up in contexts of bilingualism.

The term bilingualism is typically used to include many different multilingual situations, those involving both simultaneous and successive acquisition of two (or more) languages. The course and outcome of bilingual language acquisition in children is related to a number of variables, currently under study by many researchers: notably, age of onset (AoO) of exposure to the second language, age at which the child is tested, length of exposure to the second language (LoE), linguistic properties of the different languages, quantity and quality of input and use of the languages. Although the precise role each of these variables plays, and how they interact with each other, are far from clear, it is recognized that there are striking similarities between the difficulties experienced by bilingual children in their second language and those experienced by monolingual children with SLI (for early studies, see Håkkasson, 2001; Håkkasson and Nettelbladt, 1993; Paradis & Crago, 2000). For example, studies of accusative clitic production in English-speaking children immersed in French-speaking schools in Canada (Grüter, 2005; Paradis, 2004) revealed the same specific difficulties with these pronominal clitics found in French-speaking monolingual children with SLI (Mo-SLI). Likewise, studies of L2 English in children have found that these children have particular difficulties with the production of tense, which has been argued to be a particularly sensitive marker of SLI in English (Paradis, 2005, 2008). In other words, what is difficult for children with SLI is also difficult for L2 children. Given these observed similarities, the Bi(lingual)-SLI problem is simple to state: are language difficulties observed for a child growing up in a bilingual context the result of insufficient (early) exposure to this language or are they the result of SLI, which, by definition, leads to language difficulties in each of a child's languages.

(1) How can it be ascertained whether low language performance in a bilingual child is due to SLI?

The Bi-SLI puzzle is both theoretically and clinically challenging (for recent over-views, see Armon-Lotem, 2012, Hamann, 2012 and Paradis, 2010). The theoretical challenge for linguists revolves around why such similarities in language difficulties exist in these two groups of learners, but also, whether linguistic theory can identify linguistic areas where these two groups should differ from each other in systematic ways. A generative approach to language acquisition entails the prediction that some areas of language should "come for free" in second language acquisition, and, thus should not have to be acquired again. From this perspective, recursion, for example, and thus clausal embedding, should not be difficult for typical second language learners. Having been acquired in the L1, recursion, as "the fundamental pivot, the axis which forces productivity and allows an efficient flow of thoughts into language" (Roeper, 2011: 81) should be automatically used by healthy children in their L2.

The clinical challenge inherent in the Bi-SLI puzzle is centered on how to come up with ways of ascertaining or excluding SLI in bilingual children that do not involve waiting until sufficient exposure would (presumably) allow for resolution of language difficulties, in the case of Bi-TD children, or not, in the case of Bi-SLI children. Clinicians not only need assessment tools that work, but also tools that are usable in clinical settings, which involve time constraints, and, at least in many countries, monolingual clinicians. The need for such tools is particularly apparent from studies which have documented the prevalence of both under- and over-diagnosis of language impairment in bilingual children (Bedore and Peña, 2008; Crutchley et al., 1997; Grimm and Schulz, to appear; de Jong, 2010; Salameh et al., 2002; Sullivan, 2011): genuine language difficulties due to pathology are over-looked and ascribed to bilingualism or L2-related languages difficulties are interpreted as language impairment.[2]

We will attempt to address in what follows both the research and clinical agendas outlined above. To do this, we will report on results from two kinds of studies. The first study compared child L2 acquisition with monolingual acquisition, both TD and with SLI. In this study we assessed language development in English-French bilingual children who began living in France after age four, subsequent to family immigration to France, and who were attending ordinary French schools. This first study illustrates the pieces of the Bi-SLI puzzle. The second study takes us to the heart of the Bi-SLI puzzle, and illustrates how it might be possible to find a way of assembling the pieces of this puzzle. This study was a four-way Bi-SLI/Bi-TD/Mo-SLI/Mo-TD study. The bilingual children were Arabic-French bilingual children growing up in France.

2. Study One: Discovering the Pieces

Our first study compared a group of 29 6- to 12-year-old L1 English-French L2 learners, growing up in France and attending ordinary French schools, to a group of 28 monolingual French age-peers with SLI. As summarized in Table 1, these children were tested twice, with an interval of approximately one year between testing times. The British children, as illustrated in Figure 1, displayed variation in length of exposition to French, their L2, which ranged from 9 months to 4 years at the first testing time (T1).

	L2	**SLI**
N Participants	29 (18 F, 11 M)	28 (10 F, 17 M)
Age at T1 *M* (*SD*), Range	9;5 *(1;10)* 6;4 – 12;7	9;5 *(1;11)* 6;5 – 12;11
Age at T2 *M* (*SD*), Range	10;5 *(1;11)* 7;4 – 13;8	10;6 *(1;11)* 7;7 – 14;2
Age of Onset	7;0 *(1;10)* 4;5 – 10;9	

Table 1. L1 English-L2 French Children and Monolingual French Children with SLI, T1 and T2

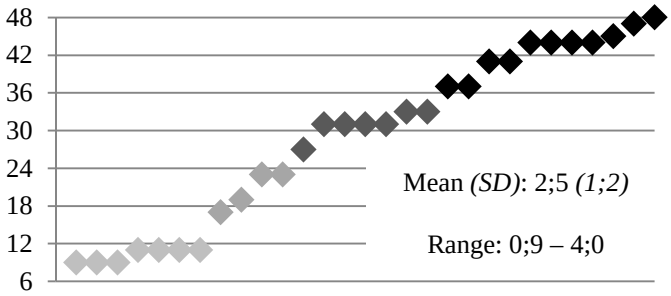


Figure 1. LoE (months) to L2 for each child at T1

Measures on French standardized language tests (phonology, receptive vocabulary, and morphosyntax-production) showed that, at T1, half of the British children (15/29) had at least two scores in the bottom 5th percentile, in other words, below -1.65 SD, a cut-off frequently used by clinicians in France to determine language impairment. Ten of the 29 children were in this range at T2, including some children with over four years LoE to French. A sizeable proportion (12/29 at T1 and 9/29 at T2) had a below average English CELF core language score (< -1 SD), a score designed to be used to make decisions about presence or absence of a language disorder. Furthermore, 8/29 were below norms in both their L1 and their L2 at T1 and 5 remained in this category a year later at T2. Information obtained from parents revealed that 4 of these latter 5 children were in fact developing language in special circumstances, apart from their bilingualism: One child was diagnosed for moderate hearing loss and fitted for hearing aids between T1 and T2, one child had been experiencing frequent OM throughout his childhood, two children were from a family with a history of language difficulties and one of these received a diagnosis for global developmental delay after T2 (age 8;6).

Both groups of children were also assessed with various tasks targeting specific aspects of the acquisition of French. We will focus on three of these here: 1) production of accusative clitics, which has been proposed to be a clinical marker for SLI in French, 2) use of wh-in situ instead of wh-fronting in production of wh-questions, a strategy preferred by children with SLI, and 3) clausal embedding in spontaneous language samples, which children with SLI tend to avoid. We sought to answer the questions in (2):

(2) a. Do L1 English children naturally immersed in a French-speaking community have difficulty producing accusative clitics, the way children with SLI do?
b. Do L2 children avoid syntactic movement, the way children with SLI do?
c. Do L2 children avoid clausal embedding the way, children with SLI do?

Beginning with question (2a), production of pronominal clitics was measured via an elicited production task (Tuller et al., 2011). Focusing on whether children produced a clitic or not (regardless of whether the clitic had the correct gender), the L2 children's performance was strikingly similar to that of the monolingual French children with SLI, confirming the specific difficulty with accusative clitic production previously found in studies of L1 English children learning French in French-speaking schools in Canada (Grüter, 2005; Paradis, 2004), particularly at T1, represented by the black columns in Figure 2: nominative clitics were produced more often than reflexive clitics and reflexive clitics more than accusative clitics.[3] While improvement in object clitic production between T1 and T2 in the SLI group did not approach significance, in the L2 group there was a tendency in this direction.[4]

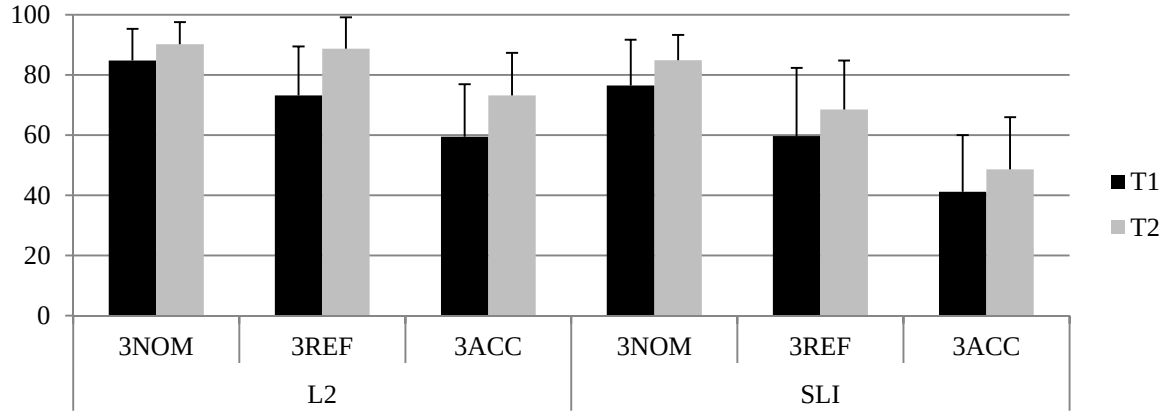


Figure 2. Production of nominative, reflexive, and accusative clitics at T1 and at T2: L2 and SLI

In harmony with this tendency, LoE to French in the L2 group significantly correlated with production of third person accusative clitics at T1 (r_s = .764, p < .001), as is illustrated in Figure 3.[5] These two variables no longer correlated at T2 (see Figure 4), since, although many L2 children improved after an additional year of exposure, several continued to have difficulties, including children with two, three, and four year's exposure to French (and not just the children mentioned above who were later identified as having special circumstances).

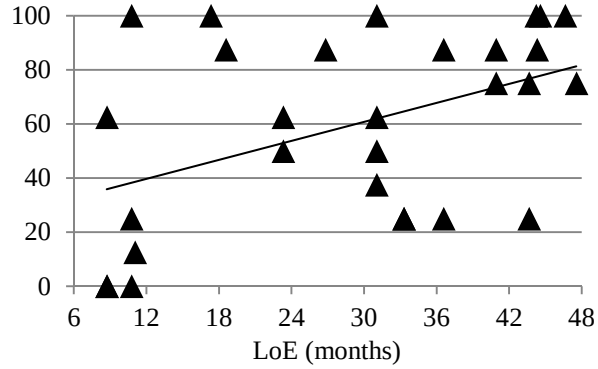


Figure 3. LoE (T1) and Accusative Cl Production (%)

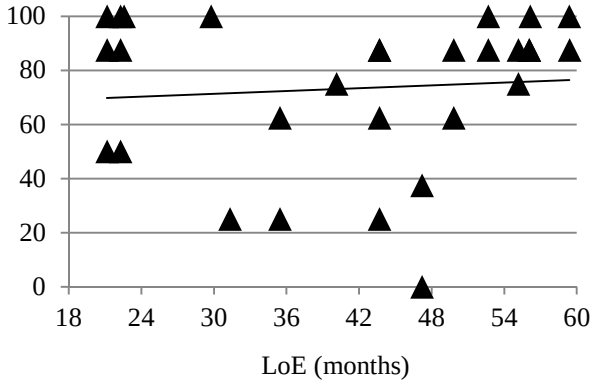
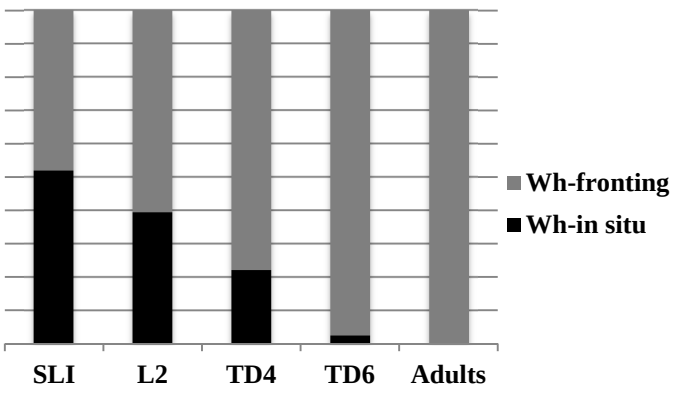


Figure 4. LoE (T2) and Accusative Cl Production (%)

Question (2b) asked whether L2 children avoid syntactic movement. Both young TD children and children with SLI who are acquiring French have been shown to avoid wh-movement in French, a language in which this movement is not obligatory (Hulk & Zuckerman 2000; Hamann 2006; Jakubowicz 2005; Jakubowicz & Strik 2009). Elicited production of wh-questions in French presents children with a choice between different syntactic strategies, some of which involve wh-movement and one, the in-situ strategy, which does not. This choice is particularly interesting in the case of L1 English-speaking children because their L1 uses only one of these strategies, wh-movement. As reported, for T1, by Prévost et al., 2010, and illustrated in Figure 5, the English-French bilingual children behaved very much like the French-speaking children with SLI: both groups produced significantly more wh-in situ questions than TD 6-year-olds.[6] Furthermore, this strategy did not change after an additional year of exposure to French, as shown in Figure 6, and no correlations were found between wh-fronting and LoE (r_s = .0956 at T1).



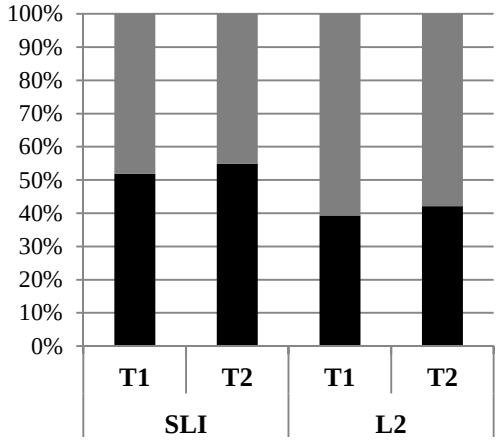


Figure 5. Wh-fronting vs. Wh-in situ (T1)

Figure 6. Wh-fronting vs. Wh-in Situ: T1 vs. T2

Question (2c) asked whether L2 children avoid clausal embedding. French-speaking children with SLI have been shown to avoid clausal embedding. Not only do they have lower rates of clausal embedding, they also produce more unsuccessful attempts at clausal embedding (Hamann et al., 2007; Delage et al., 2008). Tuller et al. (2012) showed that such avoidance strategies continue into adolescence in individuals with SLI. Scheidnes (2012) measured clausal embedding in spontaneous language samples of a subset of the L2 and the SLI participants presented in Table 1 (22 children in each group) (see Scheidnes & Tuller, in press). Although there were no inter-group differences in the proportion of erroneous utterances in the children's language samples (see Figure 7), both groups producing significantly more errors than a group of TD 4-year-old children at T1 ($p > .05$), clausal embedding (illustrated in Figure 8 by the rate of subordination[7]) in the L2 children resembled that of 8- and 11-year-old TD children, their age peers, whereas the SLI children resembled the TD 4-year-olds on this measure.[8]

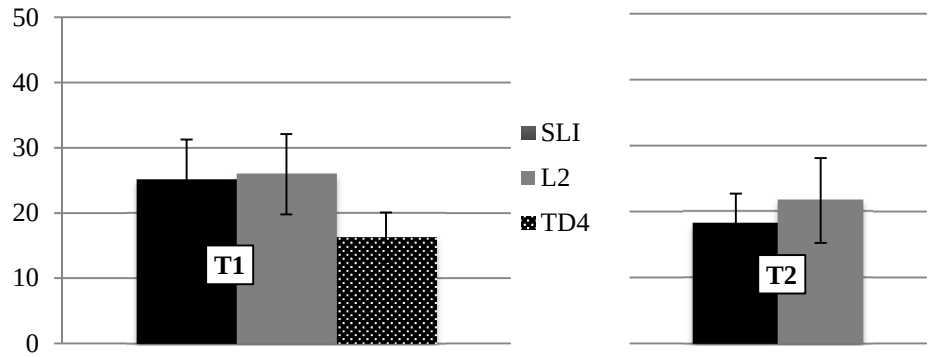


Figure 7. Rates of erroneous utterances at T1 and at T2 (% verbal utterances with ≥ 1 error)

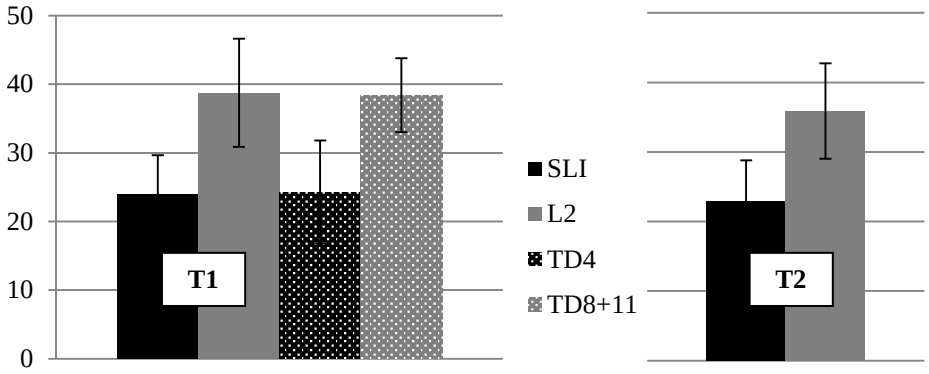


Figure 8 Clausal embedding at T1 and at T2 (% subordination)

Moreover, clausal embedding in the L2 children was not related to LoE, and these children's clausal embedding rate did not improve between T1 and T2, precisely because they were already embedding normally at T1, despite their abundant morphosyntactic errors (mean of 25%).

Summarizing, this first study illustrates several pieces of the Bi-SLI puzzle. First of all, these results show that L2 children may take quite some time to perform at age-level in their L2, more than four years for some of them, which is considerably longer than is commonly believed, a point emphasized by Genesee et al. (2004). At the same time, some children may not perform at age-level in their L1 either, due to shifts in language dominance or perhaps to temporary disruption (some of the children tested in this study were below L1 age-levels at T1 and at L1 age-level a year later). These results thus illustrate more generally the pitfalls of using monolingual norms to assess language in bilingual children (see Paradis, 2005). Use of psycholinguistic measures targeted on specific aspects of French known to cause difficulties in children with SLI led to the following conclusions. Some aspects of language may be more sensitive to LoE in TD bilingual children: Accusative clitic production in French appears to be an example of a linguistic phenomenon which takes some time to master for many L2 children. Some aspects of language may be less sensitive to LoE: This might be the case for clausal embedding (see also Lakshmanan & Selinker 1994; Gavruseva & Lardiere 1996; Haznedar 2003). Some types of tasks may favor L2-SLI similarities: Choice among grammatical alternatives of varying linguistic computational complexity, as in French wh-questions, works this way, most likely because children may avoid computational complexity for different reasons (see Prévost and Tuller, submitted; Prévost et al., 2014). Finally, non-linguistic developmental difficulties may be obscured in bilingual contexts: hearing loss and intellectual disability may go undetected in this context, as difficulties at school are taken to be due to lack of skills in the child's second language, the language of instruction. We sought to examine the implications of these conclusions in a second study.

3. Study Two: The Heart of the Puzzle

3.1 Participants and their classification

We recruited a group of 32 5- to 7-year-old Arabic-French bilingual children, the most socially relevant group of bilingual children in France, where Arabic is the second most widely spoken language after French. Most of these children were in fact born in France, though, even in this case, early language exposure was largely or exclusively in Arabic. Two groups of children were targeted, those most likely to have SLI and those most likely to be TD. Children were thus recruited both from the clienteles of speech-language pathologists (SLP's) as well as in ordinary schools and also in places specifically frequented by persons of Arab origin in France. Our goal was to compare Bi-SLI acquisition with Bi-TD acquisition via performance on linguistically motivated tasks. Before such a comparison could be made, it was first necessary to determine if the bilingual children receiving therapy for SLI were really likely to be Bi-SLI and if the children not receiving therapy for SLI were actually Bi-TD, a restatement of the Bi-SLI question in (1).

All children were tested for French with tools commonly used by SLP's in France in the areas of phonology (Khomsi et al., 2007), vocabulary (expressive and receptive, Chevrie-Muller & Plaza, 2001), and morphosyntax (production and comprehension, Chevrie-Muller & Plaza, 2001). These same language domains and modalities were tested in Arabic via a battery standardized among typical school children in Lebanon (Zebib et al., to appear). To our knowledge, this is the only standardized language battery currently available for Arabic. Adaptations were prepared and recorded by native speakers for Algerian, Libyan, Moroccan, and Tunisian Arabic and children's performance was analyzed in consultation with native speakers and then compared to the Lebanese norms in order to have a (very) rough idea of their level in Arabic.[9] This clearly less than optimal way of testing is illustrative of the situation which prevails for most language communities throughout the world. None of the tests used to evaluate French or Arabic has bilingual norms, and yet in Study 1, the potential dangers of evaluating language in bilingual children through use of monolingual norms were illustrated. COST Action IS0804 (Thordardottir, 2012) recommended easing cut-off criteria for identification of language impairment when monolingually normed tests are applied to bilingual children. Instead of the -1.25 SD cut-off in two language areas for monolingual children, it was suggested, as a rough guide, that the following cut-offs be used: -1.5 SD when a bilingual child is tested in the dominant language, -1.75 SD when tested in one of equally mastered languages, and -2.25 when tested in the weaker language. These recommendations will be referred to as the COST-criteria for language impairment.

Nonverbal cognition was assessed with Raven's Progressive Matrices (Raven, 1998). The exclusionary criterion for SLI was set for scores below a midpoint percentile of 9 (below the low-average nonverbal IQ range, an IQ of 80). Children who performed below the 9th percentile were however not excluded if an alternative normal nonverbal score was available (for example, a normal WISC score).

Application of the COST-criteria for use of monolingual norms with bilingual children[10] and of the nonverbal exclusionary criteria just outlined revealed cases of over-diagnosis for SLI (3/13 children receiving therapy = 13%) and under-diagnosis for both SLI (2/19 children not in therapy = 11%) and for possible Global Developmental Delay[11] (3/32 children = 9%), as presented in Figure 9. A total of eight children were likely to have been misidentified in one or more ways, which amounts to 25% of the entire group of Arabic-French bilingual children. This result is not at all untypical (see Grimm & Schulz, to appear).

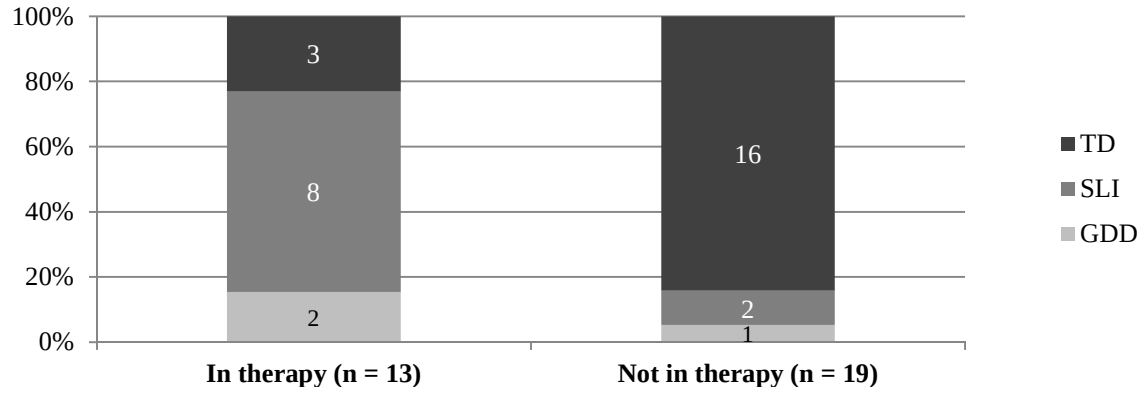


Figure 9. Diagnostic accuracy in 32 Arabic-French bilingual children: *n* and proportion of children with Typical Development (TD), with Specific Language Impairment (SLI), and with Global Developmental Delay (GDD)

The three children with possible GDD were excluded from the present study. The remaining 29 children were assigned to the Bi-SLI or the Bi-TD groups according to the COST-criteria. All of the children identified for probable SLI were put together into the Bi-SLI group (n = 10), and all of the children not identified for SLI were put together into the Bi-TD group (n = 19). Although these two groups, by definition, differed for language performance as

measured by standardized tests in both French and in Arabic, they did not differ for age (U =79.5, p = .476), or for other measures obtained from information gathered via a parental questionnaire (see below): frequency of contact with French (U = 81.5, p = .519) or Arabic (U= 83.5, p = .575) before age 4, for total early exposure to French (U = 122, p = .196), current use of Arabic at home (U = 127, p = .137) and current linguistic richness in French (U = 76.5, p = .390).

Table 2. Participants included in Four-way Study

	Bi-TD	**Bi-SLI**	**Mo-TD**	**Mo-SLI**
N Participants	19	10	14	11
Sex	10 male, 9 female	6 male, 4 female	11 male, 3 female	5 male, 6 female
M Age (SD)	6;3 *(0;9)*	6;4 *(1;4)*	6;0 *(0;4)*	7;7 *(0;9)*

Comparing Figure 10 (French) to Figure 11 (Arabic), it can be seen that, in both groups, children's performance was generally worse in Arabic than it was in French on the subtests assessing language production: Mean scores for Word Repetition (phonology), Expressive Vocabulary, and Sentence Completion in Arabic were low for both the Bi-SLI and the Bi-TD groups. However, performance on Receptive Vocabulary and Sentence Comprehension in Arabic was similar to performance on these subtests in French. This dissociation between receptive and expressive modalities, with level in the former generally being similar in the two language and generally favoring French in the latter, is probably indicative of L1 attrition/incomplete acquisition of Arabic in many of these children, but it should also be recalled that the use of the standardized test for Arabic was unorthodox, due to inexistence of tests for each of the varieties of Arabic used by the children.

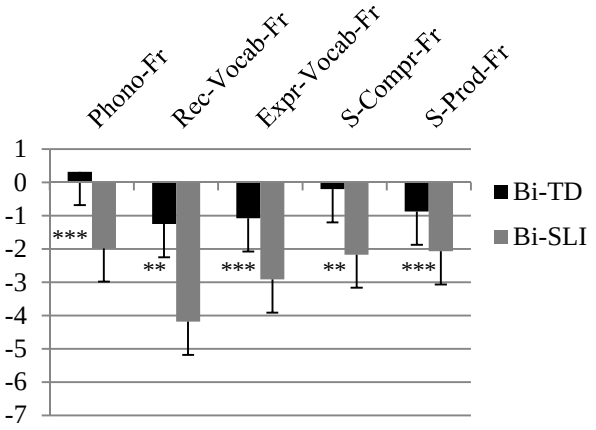


Figure 10. Z-Scores on Standardized French Tests

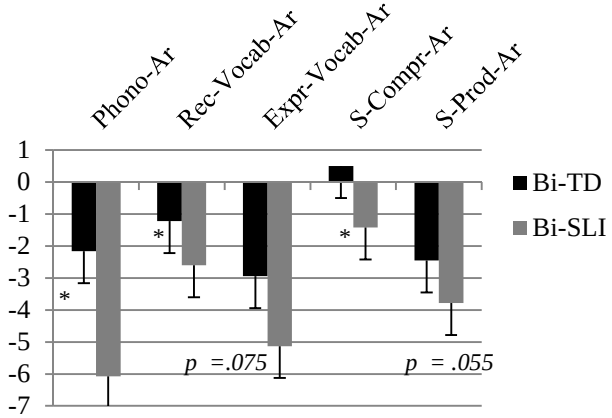


Figure 11. Z-Scores on Standardized Arabic Tests

The probable influence of arrested development of Arabic is supported by parental report on children's current language skills, language use at home, and linguistic richness. This information was obtained via a parental questionnaire, the PABIQ questionnaire (COST Action IS0804), presented in Section 3.2, which includes three cumulative indices for each of these factors, detailed in Table 3.

Table 3. Current Skills, Languages Used at Home, and Linguistic Richness, as measured in the PABIQ (COST Action IS0804)

3. Current Skills	**Arabic /15**	**French /15**
Compared to other children the same age, how do you think your child expresses him/herself in …? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3
Do you think that your child speaks like a child the same age who only speaks …..? *0 = not very well/not as well as them; 1 = a little less well/a few differences; 2 = (generally) the same; 3 = very well, better*	0 1 2 3	0 1 2 3
Compared to other children the same age, do you think your child has difficulties making correct sentences? *0 = yes, many difficulties; 1 = some difficulties; 2 = (generally) the same; 3 = no difficulties, better than other children*	0 1 2 3	0 1 2 3
Are you satisfied with your child's ability to express him/herself in …? *0 = not at all satisfied; 1 = not very satisfied; 2 = pretty satisfied/generally satisfied; 3 = very/totally satisfied*	0 1 2 3	0 1 2 3
Does your child feel frustrated when he/she can't communicate in …? *0 = very frustrated/almost always frustrated/very often frustrated ; 1 = often frustrated/yes ; 2 = sometimes frustrated, but not often; 3 = (almost) never frustrated/no*	0 1 2 3	0 1 2 3
4. Languages Used at Home	**Arabic /16**	**French /16**
How often (0 never, 1 rarely, 2 sometimes, 3 usually, 4 always) is … used in exchanges	0 1 2 3 4	0 1 2 3 4

between your child and his mother ?		
How often is … used in exchanges between your child and his father?	0 1 2 3 4	0 1 2 3 4
How often is … used in exchanges between your child and other adult regularly in the home (grandparent, babysitter, etc.)?	0 1 2 3 4	0 1 2 3 4
How often is … used in exchanges between your child and his/her siblings?	0 1 2 3 4	0 1 2 3 4
5. Linguistic Richness	**Arabic /14**	**French /14**
What language activities does your child do <u>each week</u> and in what language(s)? a. Reading b. Television/movies/cinema c. Storytelling (0 never or almost never, 1 at least once a week, 2 every day)	0 1 2 0 1 2 0 1 2	0 1 2 0 1 2 0 1 2
What language is spoken between your child and the friends he/she plays with regularly?	0 1 2 3 4	0 1 2 3 4
What language is spoken with family friends with whom you are in regular contact?	0 1 2 3 4	0 1 2 3 4

As can be seen in Figure 12, French dominated Arabic in parental estimates of their child's current skills (significantly in the Bi-TD group, Z = 148, p <.05; but not in the Bi-SLI group, Z = 44.0, p = .091) and linguistic richness (Z = 155, p < .01 for Bi-TD and Z = 44, p < .05 for Bi-SLI). Parents' assessment of their children's skills is in accord with the standardized language evaluation in these two languages, and the fact that linguistic richness is greater for French accords with the fact that children had better performance on receptive language tasks than on expressive language tasks in Arabic. It is noteworthy that while Arabic and French were about as frequently used at home in the Bi-TD group (Z = 112, p = .493), in the Bi-SLI group, French was much more frequently used at home (Z = 51, p < .05). This finding may reflect that parents of children experiencing difficulties are more often told (by educators and SLP's) that they should provide an exclusively French environment for their child, and that L1 exposure is harmful to his/her development.

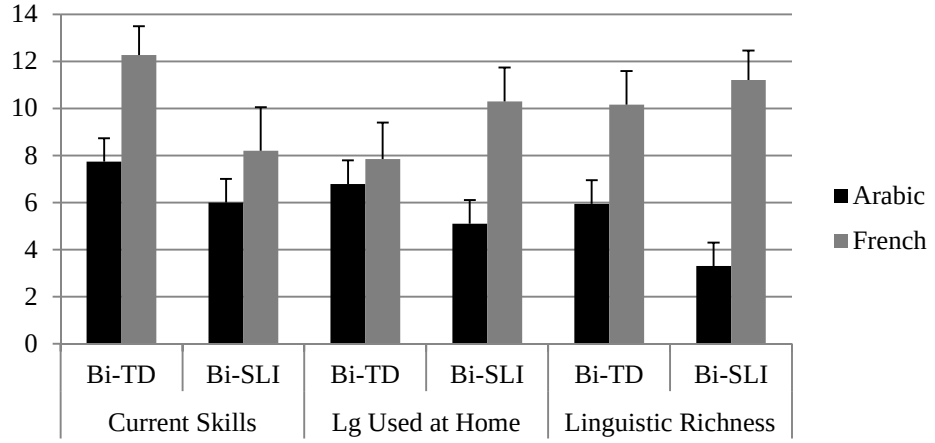


Figure 12. Parental Report of Current Skills, Languages Used at Home, and Linguistic Richness

Despite the discrepancies in language performance between Arabic and French in both groups of children, and despite the fact that language use at home was dissimilar in the two groups of children, fundamental differences in language performance nevertheless clearly emerged between the Bi-SLI and Bi-TD groups: all scores in the Bi-SLI were significantly lower than in the Bi-TD, except for the two expressive Arabic scores, as noted in Figures 10 and 11. However, it is important to underline that these differences are *group* differences. The problem is that clinicians diagnose individual children.

Turning to the individual results, illustrated in Figures 13 and 14 for expressive morphosyntax in French and in Arabic, respectively, it can be seen that scores in the two groups in fact displayed considerable over-lap.[12]

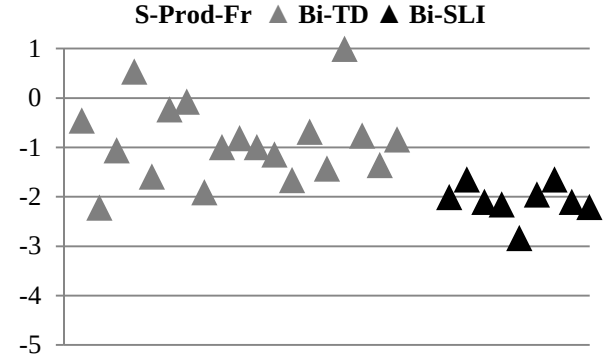


Figure 13. Sentence Production-French: Z-Scores

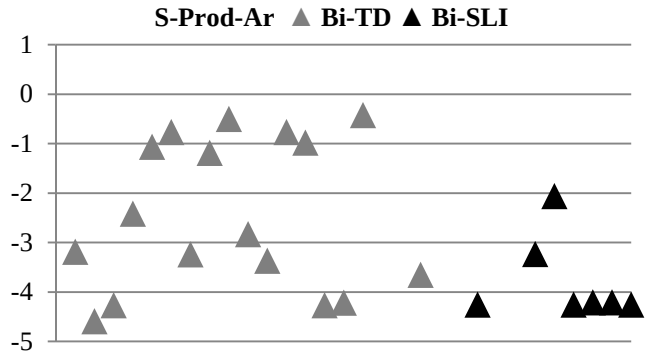


Figure 14. Sentence Production-Arabic: Z- Scores

In other words, there were many Bi-TD children with scores in the same range as the majority of the Bi-SLI children. Sole reliance on these types of tests would make it very difficult to detect SLI in a bilingual child.

3.2 LITMUS tasks and results

In collaboration with colleagues in COST Action IS0804, three language tasks and a parental questionnaire were developed. The language tasks, part of the LITMUS (Language Impairment Testing in Multilingual Settings) toolbox, were designed to target aspects of language which are known to be particularly difficult for children with SLI, yet, at the same time, which are hypothesized not to be difficult for L2 children. These tasks, summarized in Table 4, include a non-word repetition task, a sentence repetition task, and a semantic interpretation task.

It is established that NON-WORD REPETITION (NWR) taps phonological competence and that performance on NWR is quasi-universally impaired in children with SLI (see Chiat, to appear, for review). LITMUS NWR-French (Chiat, to appear; dos Santos & Ferré, 2012) was designed to include nonwords which are largely language-independent by neutralizing segmental complexity (based on a phoneme inventory shared by most languages in the world) and by focusing on syllabic complexity, known to be difficult for children with SLI. TD bilingual children should therefore not be at a disadvantage, whereas Bi-SLI children should have trouble. We report here the total percentage of items identically repeated.

SENTENCE REPETITION (SR) is likewise known to tap linguistic knowledge about syntax and has been found to be a particularly reliable type of task for identifying children with SLI (Conti-Ramsden et al., 2001). LITMUS SR-French (Marinis & Armon-Lotem, to appear; Prévost, Tuller & Zebib, 2012) was designed to include sentence types varying in complexity along two variables, syntactic movement, and, importantly, clausal embedding, which by hypothesis should not disadvantage Bi-TD, but should be difficult for Bi-SLI children. In Study One reported above, it was shown that L2 children use the wh-in situ strategy more frequently than monolingual TD French children *when given the choice*, as was the case in the elicited production task used in that study. We predict that sentence repetition, which does not involve selecting one strategy out of several grammatical strategies, should not put L2 children at a disadvantage. Study One also showed that L2 children produce erroneous utterances in equal frequency to monolingual French children with SLI, but that they use clausal embedding in French much more frequently, like monolingual TD children, even after very little exposure to French. We predict that sentence repetition, which eases some of the processing load inherent in spontaneous production, should allow Bi-TD children to *correctly* produce sentences with clausal embedding, whereas Bi-SLI children will have particular difficulty with these sentences. In keeping with the goal of developing clinically useable tasks, the simplest measure will be used to report performance on this task: identical repetition of the sentence heard.

Interpretive rules, such as the exhaustive interpretation involved in wh-questions, appear to be constant cross-linguistically. Following the same logic used in the design of LITMUS-NWR and LITMUS-SR, bilingual children should not have to learn to exhaustively interpret wh-questions when they acquire their second language, and thus accurate interpretation should be available after very little exposure. In children with SLI, on the other hand, EXHAUSTIVITY has been shown to be difficult (Schulz & Roeper, 2011). The Exhaustivity task (Schulz & Roeper, 2011) targets this particular interpretative ability, by inviting children to respond to a series of wh-questions (simple, double, and triple) corresponding to picture with multiple answers depicted (for example, "Who is sitting on a chair?" and a picture depicting five family members sitting on a chair and one standing). We report here the measure of exhaustive readings for the simple wh-questions. [13]

All three language tasks are presented to the child in the form of PowerPoint presentations with pre-recorded oral stimuli. Children's answers were recorded/noted.

Finally, there is now an accumulation of robust findings about the reliability of parental report regarding risk factors for SLI, and there is also support for the usefulness of parental report of early and current language exposure and use in bilingual children (see Tuller, to appear, for review). The PABIQ (COST Action IS0804; Tuller, to appear) is based on an adaptation of the ALDeQ (Paradis et al., 2010) and the ALEQ (Paradis, 2011) questionnaires. It is administered in a direct interview with parents (taking about 15 minutes) and contains questions about the child's early language history, current language skills, the child's language use at home and elsewhere, and language difficulties in first degree relatives.

Table 4. LITMUS tools used

Tools	Area	Structure
LITMUS-NWR-French	Phonology	Repetition of non-words, both language "independent" and language dependent
LITMUS-SR-French	Syntax	Repetition of 7 sentence types: simple canonical sentences in the present tense, simple canonical sentences in the *passé composé*, object right dislocation, passive, object wh-questions, finite and infinitival complement clauses, relative clauses
Exhaustivity-French	Semantics	Interpretation of simple, paired, and triple wh-questions. Child responds to a question about a picture, verbally or by pointing.
PABIQ	Parental questionnaire	Questions about early language history and concerns, family history of language difficulties, and early and current language exposure and use (see Table 3).

Each of the three linguistic tasks distinguished the Arabic-French Bi-SLI group from the Arabic-French Bi-TD group, as can be seen in Figures 15, 16, and 17.[14] These figures also show that there was over-lap in individual scores in the two groups, for each of the three tasks.

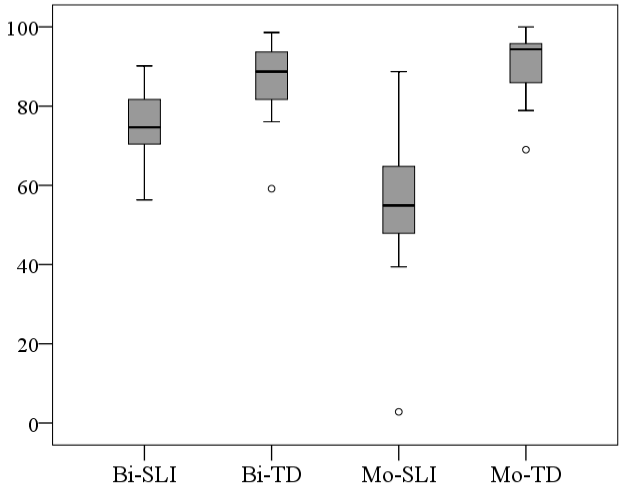


Figure 15. NWR (%)

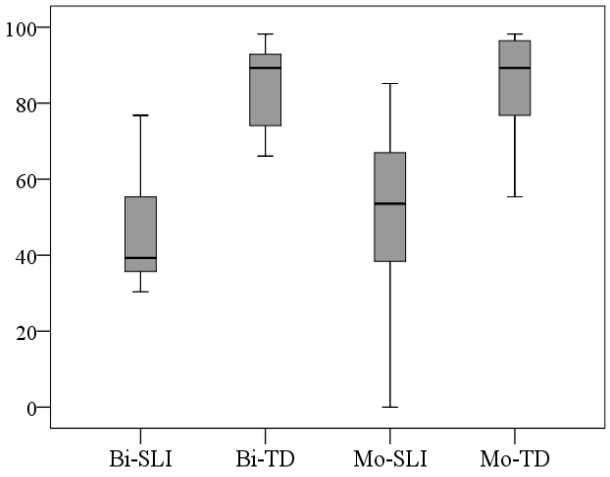


Figure 16. SR (% Identical repetition)

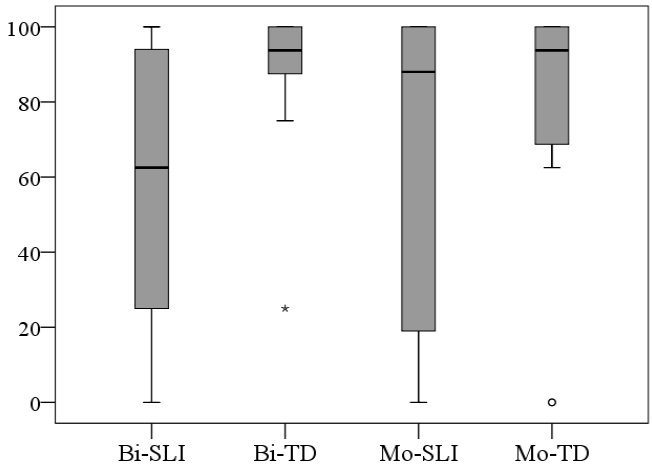


Figure 17. Exhaustivity (% correct on simple wh-questions)

Putting children's scores on the three LITMUS-French tasks together, as in Figure 18, yielded high accuracy in distinguishing Bi-SLI children from Bi-TD children. In the COST-Criteria defined Bi-TD group, it emerged that all of the children, except two, scored at 60% or better on all three tasks. Only ELB and ZOA had any score below 60%. In the COST-Criteria-defined Bi-SLI group, all of the children except one, had at least one score below 60%. Only one child (JOC) had all three scores above 60%. Adopting the 60% cut-off in this way yielded 90% accuracy (26/29 children were correctly identified), with a specificity of 89.5% (17/19 Bi-TD identified as Bi-TD) and a sensitivity of 90.0% (9/10 Bi-SLI identified as Bi-SLI), a very encouraging result.

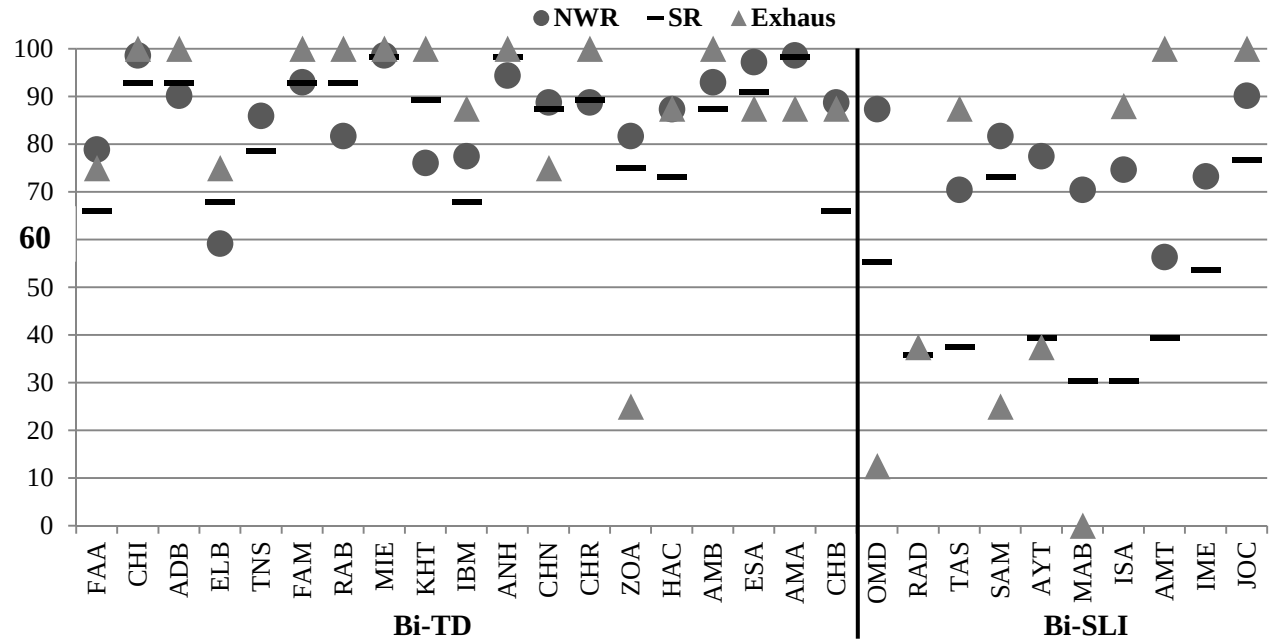


Figure 18. Individuals scores (% correct) for Nonword Repetition, Sentence Repetition, and Exhaustivity

Support for this result was provided by information obtained via the PABIQ. Parental responses on the items regarding possible risk factors for SLI formed the basis for calculation of a No Risk Index (Tuller, to appear). As can be seen in Table 5, the Bi-TD and Bi-SLI groups differed significantly on each of these measures, and on the cumulative index.

Table 5. No Risk scores on PABIQ: Bi-TD vs. Bi-SLI

	Bi-TD	**Bi-SLI**	***p***	***U***
Age 1st Word (M, SD)	11 mo. *(4)*	17 mo. *(8)*	.007	153.0
Age 1st Sentence (M, SD)	19 mo. *(6)*	32 mo. *(12)*	.001	165.5
N children whose parents were concerned about early lg. develop.	2/19	7/10		
Positive Early Development Index **/14** (*M, SD*) [15]	13.2 *(1.7)*	8.2 *(4.0)*	.000	15.5
N family members with lg. difficulties (M, SD)	0.7 *(0.9)*	3.1*(1.9)*	.001	168.0
Positive Family History **/9** (*M, SD*)[16]	8.3 *(1.0)*	5.8 *(1.9)*	.001	23.0
No Risk Index /23 (*M, SD*) [17]	21.4 *(2.1)*	14.0 *(4.8)*	.000	5.5

Turning to individual results, Figure 19 ranks all of the bilingual children according to their score on the No Risk Index. As can be seen, the No Risk Index sharply separated the Bi-TD children from the Bi-SLI children, with only one child (AMA) falling with his group. This index gave corroborating results even for the children who may have been misdiagnosed (as ascertained via the COST-criteria for language impairment and the nonverbal criteria presented above), and thus whose parents could not have responded based on prior supposition of (a)typical language development: ZOA, FAA, and CHB, in therapy for SLI, fell, correctly, with the Bi-TD group, and TAS and SAM, who were not in therapy, were correctly classified with the Bi-SLI group by the No Risk Index. Finally, the three children who were outliers in their groups on the combined LITMUS tools (ZOA and ELB in the Bi-TD group and JOC in the Bi-SLI group) fell with their respective groups according to the PABIQ No Risk Index.

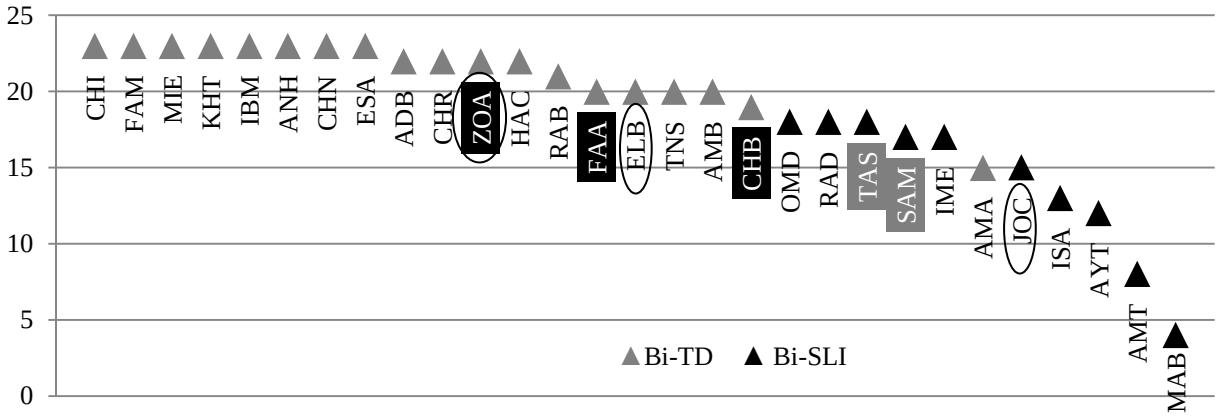


Figure 19. Classification by No Risk Index (/23): Arabic-French Bilinguals (*N* = 29)

4. Discussion and Conclusion

This paper has addressed theoretical and clinical issues regarding the question of how SLI can be identified in bilingual settings. A first study was presented to illustrate several aspects of this question. It was seen that L1 English-speaking children acquiring French, even in entirely natural contexts, have French performance which resembles that of monolingual French children with SLI, both quantitatively (as measured by standardized assessment tools) and qualitatively (as determined by measures targeting specific linguistic structures known to be difficult for children with SLI: elicited production of accusative clitic production and of wh-movement, and clausal embedding in spontaneous language samples). It was furthermore shown that low performance in these L2 children continued over a long period: many children tested after an additional year of exposure were still not performing like monolingual French age-peers, including children with a total of four to five years of exposure. This result underscores the fact that L2 children may take quite a long time to achieve age-equivalent language levels, much longer than had been assumed, in consonance with studies such as Hakuta et al., 2000, which found that oral proficiency in L2 English I bilingual children in the U.S. and in Canada took children 3 to 5 years to develop (and academic English, 4 to 7 years), and Marinis and Chondrogianni, 2010, which found that L2 English children began producing tense morphemes age-appropriately only after four years' exposure.

The L2 children in Study 1 did not resemble the monolingual children with SLI on all measures, however: in measures of clausal embedding, their performance was age-appropriate, even for children with only one year's exposure. It was suggested that not only the linguistic structure tested, but also the way in which it is tested contribute to how (dis)similar L2 performance is from SLI performance.

Study 2 reported on the use of three linguistically motivated tasks, developed within COST Action IS0804, which were designed to distinguish Bi-SLI children from Bi-TD children, in conjunction with a parental questionnaire designed for use with parents of bilingual children to gather information about risk factors for language impairment and about early and current language exposure and use. All three tasks target structures known to cause difficulty for children with SLI, but without penalizing L2 children. The NWR task specifically targets complex syllable structure, while neutralizing segmental complexity by using a common phoneme inventory. SR targets both syntactic movement and clausal embedding. These two production tasks used repetition, and semantic assessment used a comprehension task, in which children named or pointed to characters performing actions. Sentence repetition obviates the need for the child to search for correct morphosyntactic forms (which probably contributed to the difficulty the English-French bilingual children had with accusative clitic production) and does not give the child ~~has~~ the option of avoiding movement (as did elicited production of wh-questions in French, which prompted the English-French bilingual children to make frequent use of the in situ strategy). More generally, inflectional errors should be minimized in children who are developing normally, again, as no search is required to find the appropriate forms of inflected words or, more generally, to use resources to search for lexical items, as these are all provided in the stimuli.

It was shown that scores on all three language tests distinguished the Bi-SLI Arabic-French group from the Bi-TD Arabic-French group tested in Study 2. More importantly, when *individual* scores for each of the three tasks were considered together, a general cut-off of 60% accuracy emerged which left very minimal over-lap (specificity and sensitivity of 90% each). Bi-SLI children (with one exception) had at least one score below this level, and Bi-TD children (with two exceptions) had all scores above this level. This result would appear to indicate that testing in three different language areas, phonology, syntax and semantics, allowed the possibility of children with a form of SLI touching only one area or only two areas. Information about risk factors for SLI obtained from the parental questionnaire, the PABIQ, reinforced the validity of these results. A thorough analysis of the language exposure and use information, not attempted here, will doubtless supplement these findings.

The children tested in both Study 1 and Study 2 provide additional illustration of the reality of the problem of under- and over-identification of language impairment in bilingual children. In the Bi-TD group in Study 2 (Arabic-French bilingual children), ascertained to be developing language normally, 2 of these 19 children were in therapy for language impairment, which amounts to 10.5% over-diagnosis. In that same study, language impairment had not been previously detected in 2 of the 10 children ascertained to have SLI, which amounts to 20% under-diagnosis. The full extent of under-diagnosis in the bilingual children, however, should take into account the 3 children with suspected GDD (both language impairment and intellectual disability): Out of the total of 13 children found to have difficulties (10 with SLI and 3 with GDD), 5 of them had difficulties that had not been recognized (39%), 2 of which had been identified for language impairment but not for intellectual disability (15%), and 3 of which had not been identified at all (23%). Under-diagnosis in the context of bilingualism was also seen in Study 1 in the group of English-French bilingual children recruited in ordinary schools: significant hearing loss, intellectual disability, and probable SLI were all identified over the course of that study. Our results are in accord with most previous studies in finding that *under*-diagnosis in bilingual children is in fact a (more) prevalent problem (Crutchley et al., 1997; Grimm and Schulz, to appear). An important new finding was that the danger of under-diagnosis concerns not only language impairment itself, but also intellectual disability and hearing loss, which can be associated with language impairment.

The tools used in Study 2, both the language tasks and the parental questionnaire, were designed to allow for more accurate identification of the source of language difficulties in bilingual children. It should be emphasized that these tasks are suitable for clinical use. The language tests are in French (or use nonwords, in the case of the task testing phonology), the children's L2, and, importantly, the only language most clinicians in France are able to test. Scores used here to distinguish Bi-SLI children from Bi-TD children were the simplest scores: total identical repetition

(for NWR and SR) and total correct interpretation (for Exhaustivity). These results thus appear over-all to be quite encouraging. An important question to raise is whether they could in some way be related to the particular situation of Arabic-French bilingual children in France. In other words, are these tools usable and accurate in other bilingual contexts? A parallel study in Lebanon (Henry et al., 2013) provides a relevant comparison. Arabic-French bilingualism in Lebanon is very different from Arabic-French bilingualism in France. The sociolinguistic status of both Arabic and French is very high in Lebanon, whereas in France the status of Arabic is very low. Both Arabic and French are used at school in Lebanon, and multilingualism is highly encouraged and quite prominent in Lebanese society; French is the sole language of instruction in French schools, and multilingualism is not at all favored in France. On the other hand, language use and preferences tend to be related to social identification (including religious and political allegiance) in Lebanon (see Melhem, 2012; Abboud, 2013). Finally, awareness about disabilities such as SLI tends to be less widespread in Lebanon than in France, where children are systematically screened in kindergarten (Abboud, 2013). The parallel Lebanese study used three of the same tools used in the French study reported here (NWR, SR, and the PABIQ). However, an Arabic version of LITMUS-SR was used (built on the basis of the same linguistic motivation, but in a language which was the L1 for some of the children and the L2 for other children), and only the language-independent part of LITMUS-NWR was used. These differences between the French and the Lebanese studies provided fertile ground for testing the viability of the approach presented here. Henry et al. (in press) reported that the accuracy of the combined use of LITMUS tools and the PABIQ to be as encouraging in the Lebanese context as it was found to be in the French context: each of the 10 Bi-SLI children tested had a least one LITMUS score below 60% and only 2/32 Bi-TD children had a single LITMUS score below this cut-off. Parental report from the PABIQ sharply distinguished the two groups of children (see also Kouba El Hreich & Moitel-Massara, to appear) as it did in the French study reported here.

In conclusion, specific *kinds* of tasks targeting linguistically defined structures, in different areas, *together*, may provide a way for clinically feasible identification of SLI in bilingual children, *when used with a parental questionnaire* gathering information about risk factors for language impairment, as well as early and current language exposure and use. Furthermore, these tools appear to be useable in different multilingual contexts, illustrating that a universal approach to grammar assessment, quite logically, can be applied universally.

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[1] Using this method for ascertaining language impairment and a nonverbal IQ cut-off of 85, Tomblin et al. found a prevalence of 7.4%.

[2] *Late* diagnosis is also part of under-diagnosis. Indeed several studies have found that bilingual children with SLI in some settings tend to be identified later then monolingual children with SLI, as a result of a wait-and-see/watch policy (Bedore and Peña, 2008 ; Crutchley et al., 1997; Salameh et al., 2002).

[3] In the SLI group, 3NOM > 3REF (at T1, Z = -2.385, p < .05, and at T2, Z = -2.728, p < .01), 3REF > 3ACC at T1 (Z = -2.728, p < 01) and at T2 (Z = -2.493, p < .05). In the L2 group 3NOM > 3REF at T1 (Z = -1.893, p = .058), but not at T2 (Z = -.081, p = .935), whereas 3REF > 3ACC both at T1 (Z = -3.278, p < .01) and at T2 (Z = -2.493, p < .05). The following non-parametric statistic tests were used in this study and in the following: the Kruskal-Wallis and Mann Whitney U tests for multiple and inter-groups comparisons of independent measures, the Wilcoxon signed-rank test for longitudinal or within-group differences, and Spearman's rho to test for dependence between variables.

[4] At T2, performance on reflexive clitics was better than at T1 in the L2 group (Z = -2.956, p < .01), but not in the SLI group (Z = -1.588, p = .112). Likewise, performance on accusative clitics progressed in the L2 group, approaching significance (Z = -1.794, p = .073), but not at all in the SLI group (Z = -1.355, p = .182). The only significant inter-group differences were at T2, for 3REF (U = 272, p < .05) and for 3ACC (U = 253, p < .05).

[5] Also consonant with this result was the fact that production of accusative clitics was correlated with age in the SLI group at T1, showing that this measure is indeed sensitive to the amount of exposure.

[6] L2 vs. TD6: U = 27.5, p < .000. SLI vs. TD6: U = 20, p < .0001. The incidence of wh-fronting was lower in children with SLI than in the L2ers (47.8% vs. 60. 7%), but this difference was not statistically significant (U = 287, p = .087).

[7] Rate of subordination was calculated in the following manner: total number or subordinate clauses/total number of utterances containing at least one verb.

[8] At T2, the L2-SLI difference was significant (U = 104, p = 0.006). Whereas the SLI had a rate significantly below that of the TD8+11 (U = 78.5, p < 0.002), the L2 group did not differ significantly from the TD8+11, at T1 or at T2. Error rate is not reported for the TD8+11 group because it is so small (see Scheidnes, 2012).

[9] The battery was also adapted orally for one Sudanese-Arabic speaking child.

[10] COST-criteria were applied in the most conservative way possible with language dominance determined by relative performance in the two languages, and thus, for most children by using a cut-off of -1.5 for French and -2.25 for Arabic.

[11] Global Developmental Delay refers to children with significant delay in two or more developmental domains (Srour et al., 2006). This label was used to designate those bilingual children who manifested both impaired language and impaired nonverbal cognition, as defined above.

[12] Two Bi-SLI children and two Bi-TD children were unable to complete this task in Arabic.

[13] Paired and triple wh-questions were difficult for many of the TD French children, both monolingual and bilingual (see Schulz, to appear).

[14] This difference was significant for NWR (U = 30.5, p < .01) and for SR (U = 11.0, p < .001), and nearly so for Exhaustivity (U = 45.0, p = .054).

[15] The Positive Early Development Index is calculated in the following manner: Age of 1st word /6 (≤ 15 months 6 points ; 16 - 24 months 4 points ; ≥ 15 months 0 points) + Age of 1st sentence /6 (≤ 24 months 6 points ; 15 - 30 months 4 points ; ≥ 31 months 0 points) + Early Parental Concerns (no = 2 points, yes = 0 points).

[16] Parents were asked if their child's siblings, mother, and father, had any of the following three types of difficulties, "Difficulties mainly with reading and spelling," "Difficulties understanding others when they speak," and "Difficulties expressing oneself orally (pronunciation, forming sentences, finding the right word, etc.)." Absence of each type of difficulty in each of the three family member categories gave one point, for a total of 3 points per difficulty, and 9 points maximum for the Positive Family History Index.

[17] The No Risk Index is the sum of the Positive Early Development (/14) and the Positive Family History (/9) indices.