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Amount trumps timing in bilingual vocabulary acquisition: Effects of input in simultaneous and sequential school-age bilinguals

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Abstract

Objectives: This study examined the extent to which the language performance of school-age bilingual children is impacted by the amount of language exposure they have received in each language versus the timing of this exposure in terms of the age of first exposure (AoE).

Methods: Receptive and expressive vocabulary and word morphology measures were administered in both languages to school-age simultaneous and sequential learners of French (other language English), and to their monolingual counterparts.

Data and analysis: The study included 64 children in first grade and 68 children in third grade in French schools in Montreal. Within each grade level, simultaneous bilinguals, sequential bilinguals, and monolinguals were equivalent in age, nonverbal cognition and socio-economic status (maternal education). Detailed information on previous language exposure was gathered by parent report.

Conclusions: Simultaneous bilinguals performed somewhat better than sequential bilinguals; however both groups overall performed significantly more poorly than monolinguals. Differences in performance between simultaneous and sequential bilinguals were mediated by differences in amount, not timing, of exposure. Sequential learners in grade 1 required lower amounts of input to reach high French scores than did their simultaneous counterparts; sequential and simultaneous learners in grade 3 did not differ in this respect. This finding suggests that the recency of bilingual exposure is a significant determiner of the rate of second language learning. The amount of exposure to each language since birth predicted performance in each language of the bilingual children.

Originality: Bilingual children with different AoEs were compared while also controlling for differences in amount of exposure.

Significant implications: The results call into question the traditional separation between simultaneous and sequential bilinguals and shows that an early start of bilingualism does not in and of itself predict better performance or performance within the monolingual range. Better performance was more strongly related to amount than timing of exposure.

Keywords

Bilingual, simultaneous, sequential, input, age of acquisition, vocabulary, French

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The language input that children receive has been shown to be one the strongest factors impacting the rate of language development in both monolingual and bilingual children (Huttenlocher et al., 1991; Pearson, 2007). The study of the effects of input in bilingual acquisition is particularly important. From a methodological point of view, the bilingual context allows for the control of various confounding variables – given that both languages are acquired by the same child. From a practical point of view, an increasingly detailed understanding of the relationship between input and the rate of bilingual acquisition plays a crucial role in improving methods to correctly assess bilingual development for various purposes, including educational placement and progress and the detection of language impairment. Quantity is an important dimension of input that has received considerable recent research attention. Another dimension is the timing of the input. It has proven particularly difficult to tease out the effects of these two dimensions because they tend to covary (see e.g., Jia, Aaronson, & Wu, 2012) – the earlier a child is exposed to a language, the greater the child's overall exposure to that language tends to be. Traditionally, a distinction is made between children termed simultaneous bilinguals and those termed sequential bilinguals. Although the cut-off used varies, the distinction often involves age 3 years (McLaughlin, 1978); in practice, many studies include either children exposed to bilingualism from birth or shortly thereafter, or children whose first significant exposure to a second language (L2) starts when they enter school, reflecting a reality in the life of many bilingual children. Studies on school-age bilingual children tend to involve sequential bilinguals, also termed L2 learners. Less is known about simultaneous bilinguals once they enter school and few studies have directly compared the performance of simultaneous and sequential bilingual school-age children. This study examined the performance of two age groups of school-age bilingual children, including simultaneous and sequential learners, looking at effects of both the amount and timing of input in each language within each age group and across the two age groups. In addition, effects of socio-economic status (SES) and language status were carefully controlled.

Effects of amount of exposure in childhood bilinguals

Strong effects of amount of exposure on the rate of bilingual development have been documented in a number of studies among both simultaneous and sequential learners. Among preschool children (simultaneous learners), such effects have been shown repeatedly for vocabulary (e.g., Hoff et al., 2012; Pearson, Fernandez, Lewedeg, & Oller, 1997; Elin Thordardottir, 2011; Elin Thordardottir, Rothenberg, Rivard, & Naves, 2006). Recent studies have helped clarify the nature of this relationship, showing that added amounts of input add to performance in vocabulary in a gradual way (Hoff et al., 2012; Elin Thordardottir, 2011). In studies of preschool children, amount of exposure may be defined in global terms as the language of each parent or the language of home or daycare, but increasingly, studies are using a more detailed documentation of the number of hours spent in each environment. Using such detailed measures, Elin Thordardottir (2011, 2014) and Brandeker and Elin Thordardottir (2015) found that simultaneous bilinguals age 3 years and age 5 years who had spent 40% or more of their waking hours since birth in a given language environment, scored, as a group, within normal range monolingual limits (at or above −1 SD of the monolingual mean) in both vocabulary and grammar in that language, whereas those with less exposure, as a group, did not – a finding reported also for young preschoolers by Hoff et al. (2012). The amount of input has also been shown to strongly influence the rate of grammatical development in preschool children, through examination of mean length of utterance (Blom, 2010), particular grammatical structures (Nicoladis, Palmer, & Marentette, 2007), standardized test scores (Elin Thordardottir et al., 2006), and detailed analysis of the diversity and accuracy of grammatical morphology in language samples (Elin Thordardottir, 2015a).

Among school-age bilinguals – with studies most often involving L2 learners – amount of exposure has also been found to impact performance. This effect has been documented primarily in vocabulary, as vocabulary tends to be a central focus. Oller, Cobo-Lewis, and Pearson (2007), however, reported a larger effect of input on vocabulary than on grammatical development in school-age L2 speakers. Studies of school-age L2 learners have focused on several language combinations, and have consistently reported that school-age children make progress in the L2 with time (e.g., Bialystok, Luk, Peets, & Yang, 2010; Hammer, Jia, & Uchikoshi, 2011; Hammer, Lawrence, & Miccio, 2008; Jackson, Schatschneider, & Leacox, 2014; Mancilla-Martinez & Lesaux, 2011; Oller et al., 2007; Rydland, Grøver, & Lawrence, 2014; Simos, Sideridis, Mouzak, & Chatzidaki, 2014; Elin Thordardottir & Juliusdottir, 2013; Elin Thordardottir, in press). In these studies, performance in the L2 is found to increase with accumulated experience, or the number of years spent in the school environment. However, it is also a consistent finding in these studies that the L2 learners, as a group, lag significantly behind their native class mates in the L2. Further, those studies that have employed a longitudinal design show that the extent of the difference between L2 and native speakers tends to remain constant throughout the school years (Jackson et al., 2014; Mancilla-Martinez & Lesaux, 2011; Rydland et al., 2014; Simos et al., 2014; Elin Thordardottir & Juliusdottir, 2013). Some studies using longitudinal modeling report a somewhat faster learning among the L2 speakers (Simos et al., 2014), and some report a somewhat slower rate among the L2 speakers (Jackson et al., 2014). However, overall, these studies suggest that, over the course of the school years, L2 learners are acquiring the L2 at a similar rate as the native speakers. This allows them to make progress, but not to catch up to the moving target with which they are being compared. Overall, studies on school-age children have employed fairly crude measures of amount of input, such as years of schooling. Therefore, effects of variable amounts of exposure beyond the school day are not well understood.

Effects of age of first exposure

The way in which the rate of language acquisition is impacted by age of first exposure (AoE) to bilingualism is not well understood, and reports on it have been somewhat controversial. From a practical standpoint, although those assessing bilingual children are advised to take this factor into account, it is far from clear how to interpret its effects when assessing individual children. Early reports on L2 learners indicated that children first exposed to an L2 in the middle school years outperformed children exposed later in the long run (see the review in Collier, 1989). Other studies have found adolescents to outperform children exposed earlier (Muircheartaigh & Hickey, 2008); however, these children also exhibited more anxiety about their L2 learning, suggesting that they may employ different strategies of learning. Age effects in L2 acquisition may have a number of origins. The existence of biologically driven critical or sensitive periods has been proposed in various forms (e.g., Abrahamsson & Hyltenstam, 2009; Lenneberg, 1967). Another possible factor is that older children may approach the learning task in a different way due to their more advanced cognitive capacities and motivations (e.g., Muircheartaigh & Hickey). Further, children with higher AoEs enter their L2 at a much higher level than do children with low AoEs – they have much more learning to do to match native age peers than do younger children. The relative effects of amount of exposure and AoE have been remarkably difficult to tease out (see Jia et al., 2012).

A few recent studies have examined AoE in preschool and school-age populations while at the same time controlling for the amount of exposure. In a sample of simultaneously bilingual preschool children age 5 years, all of whom had AoEs of 36 months or less, Elin Thordardottir (2011) compared subgroups of children matched on the overall amount of exposure they had received in their two languages (French and English), but who had AoEs before 6 months versus after 22 months of age.

No significant difference was found in receptive or expressive vocabulary in either language. Turning to school-age children, Elin Thordardottir and Juliusdottir (2013) compared school-age L2 speakers of Icelandic with AoEs in middle school age versus in adolescence, with the two groups matched on length of residence (LoR) in Iceland. The early arrivers outperformed the late arrivers. These findings go against those of Muircheartaigh and Hickey (2008), who found that children immersed in Irish classes in adolescence outperformed children immersed at a younger age. In another larger group study of Icelandic L2 learners including three age groups, AoE as well as amount of exposure was strongly correlated with Icelandic performance (vocabulary and grammar), but only in the middle school age and adolescent groups. Among young school-age children, Icelandic performance varied greatly, but neither amount of exposure nor AoE predicted performance, nor did the designation of children as being simultaneous or sequential learners of Icelandic. From the pattern of performance of the various age groups in that study, with the older children also being recent arrivers, it was concluded that the rate of L2 learning might be influenced more strongly by the *recency* of L2 input, rather than by age or AoE in absolute terms (Elin Thordardottir, in press). Unsworth (2016) compared simultaneous and sequential learners of English and Dutch, first exposed to Dutch at age 1–3 years versus 4–7 years. Cumulative exposure was equated between the groups in terms of number of years of Dutch school attended – this meant that the groups were mismatched in chronological age at the time of testing (7 years versus 9 years). Performance was examined across three linguistic domains, vocabulary, morphosyntax, and syntax-semantics, using experimental elicitation and a truth value scrambling task. Comparing the groups in separate analyses with input and AoE as covariates, no differences were found between the two groups. Further, similar errors were found in both groups. Results were interpreted to suggest that there was little indication of AoE effects in the results when amount of input was considered.

Purpose of the study

In practical terms, recent advances in our understanding of the relationship between input and performance in preschool children have shown that one viable way of making sense of the great heterogeneity of performance of bilingual children is to document their previous language experiences carefully and relate the performance of individual children to that of children with similar previous exposure patterns – such information can be used to increase the accuracy of assessment of language impairment of young bilingual children (see Elin Thordardottir, 2014, 2015b). The relationship of amount of input and performance among bilingual school-age children is less well understood. The present study examined the performance of two groups of school-age children; children in grade 1, who were in their second year of French school and children in grade 3, who were in their fourth year. Within each age group, children varied in their language exposure histories in terms of how much exposure they had had to French versus their other language and in terms of when their French exposure started. In that respect, they included groups of both simultaneous and sequential bilinguals. Given that the study was conducted in Montreal and focused on French and English, the factors of SES and language status could be controlled. The main questions asked in this study included the following: (1) whether the amount of exposure since birth is still a relevant variable predicting performance in bilingual school-age children and (2) how simultaneous and sequential school-age bilinguals compare to each other and to monolinguals. Reasons why the amount of exposure might not be as relevant in school-age as in preschool age include that the children in the present study vary widely in AoEs; therefore, the relationship between amount of exposure and age becomes different for different children. Further, a number of questions can be asked about the simultaneous learners once they reach school age. Given that simultaneous learners at age 5 years were previously found to require 40–60% exposure to score within the

monolingual range (Elin Thordardottir, 2011, 2015a), does this criterion still hold once these children get older? Can a low-level exposure (less than 40%) lead to high performance if sustained over more years? Is there a minimum overall amount of input that is necessary to score within the monolingual range among school-age children?

It was predicted that, within each grade level, greater amounts of exposure to French would be associated with greater French performance. Further, it was predicted that, within each grade level, simultaneous bilinguals would outperform sequential bilinguals, due to their overall greater exposure to French. Given the traditional assumptions about simultaneous and sequential learners, simultaneous learners were expected to outperform sequential learners, and to perform close to monolingual levels.

Methods

Participants

Participants included a total of 132 children: children enrolled in grade 1 ($n = 64$) and children enrolled in grade 3 ($n = 68$) in French schools in Montreal. Each of the two age group comprised monolingual speakers of French (MonF), bilingual children whose exposure to French started before age 36 months (simultaneous learners of French, SimF), and bilingual children whose exposure to French started after 36 months (sequential learners of French, SeqF). Background characteristics were documented through a detailed parent questionnaire and are reported in Table 1. Children in grade 1 had a mean age of 82.2 months (SD 5.3), or 6 years 10 months; children in grade 3 had a mean age of 106.4 months (SD 5.4), or 8 years, 10 months. Table 1 gives the following background variables for each language group within each age group: chronological age, number of years of maternal education as a proxy for SES, nonverbal cognition (Brief IQ score of the Leiter International Performance Scale, Revised, Roid, & Miller, 1997), the percentage of exposure to French since birth (percentage of waking hours spent with French speakers), and the age of first regular exposure to French (AoE). Within each age group, the three language groups were compared on each background variable by a one-way analysis of variance (ANOVA). For the children in grade 1, no significant group differences were found between language groups for age ($p = .315$), maternal education ($p = .928$), or nonverbal cognitive score ($p = .323$). A significant group difference was found for AoE ($F(2,62) = 193.738$, $p < .000$. Post hoc tests (Fischer least significant difference (LSD)) revealed that the SeqF group differed significantly from each of the other groups on AoE ($p < .000$), whereas the MonF and SimF groups did not differ significantly from each other ($p = .238$). A significant group difference was also found for exposure to French ($F(2,63) = 96.066$, $p < .000$). Post hoc tests revealed that all language groups differed significantly from each other ($p < .000$). For children in grade 3, the same pattern was found: no significant group differences emerged for age ($p = .079$), maternal education ($p = .336$), or nonverbal cognition ($p = .197$). Significant language group differences were found for AoE ($F(2,67) = 212.815$, $p < .000$) and exposure to French ($F(2,67)$, $p < .000$). For AoE, post hoc tests revealed that the SeqF group differed from the other two groups ($p < .000$); the SimF and MonF groups did not differ significantly from each other ($p = .173$). For exposure to French, all groups differed significantly from each of the other groups ($p < .000$). The children passed a hearing screening conducted with a portable audiometer in a quiet (but not soundproof) room on the day of the test (10 dB HL at 1, 2, and 4 kHz, and 30 dB HL at .5 kHz).

Exposure to French was documented through a detailed parent questionnaire; the same one as that used in our previous studies (Elin Thordardottir et al., 2006; Elin Thordardottir, 2011, 2015a), with a slight modification in this study involving the addition of a section on school, given that the

Table 1. Background characteristics.

	Grade 1			Grade 3		
	MonF	SimF	SeqF	MonF	SimF	SeqF
n	18	29	17	14	33	21
Age (months)	83.6	81.2	82.5	105.3	105.6	108.6
	(5.5)	(5.2)	(5.3)	(3.1)	(5.0)	(6.5)
Mat. ed.	18.7	18.5	18.3	18.8	17.8	17.3
	(2.8)	(3.1)	(3.6)	(1.7)	(3.0)	(3.3)
Leiter Brief IQ	114.6	110.2	119.1	110.4	110.2	103.4
	(15.7)	(17.9)	(17.2)	(11.9)	(14.9)	(14.3)
%French	99.8*	63.4*	17.8*	99.4*	59.9*	18.2*
overall	(.03)	(24.4)	(11.2)	(1.3)	(2.6)	(9.8)
% home	100*	57.2*	4.1*	99.9*	52.2*	3.8*
in French	(0)	(29.5)	(10.8)	(0.4)	(37.1)	(11.8)
% school	98.4	92.2	93.6	97.6	92.4	89.0
In French	(1.6)	(14.5)	(11.8)	(2.3)	(11.1)	(15.9)
Since K						
AoE (months)	0	3.03	48.4*	0	4.4	57.1*
	(0)	(7.1)	(13.1)	(0)	(8.6)	(14.4)

*Significant group difference $p < .05$.
SimF: simultaneous learners of French; SeqF: sequential learners of French; MonF: monolingual speakers of French; AoE: age of first exposure.

previous studies focused on preschool children. The parents indicate what people speak to (or around) the child in the home and in what proportion, what languages were spoken in daycare settings attended and schools attended, and the dates of daycare and school attendance together with number of hours per week. Other environments that are a regular part of the child's life are surveyed as well, such as weekends with grandparents or lengthy trips to other countries. From this information, the percentage of time spent in each language is computed for each year of life of the child – this is averaged to obtain the overall score representing the percentage spent in each language since birth. Overall exposure to French, therefore, refers to the percentage of waking hours across all contexts since birth spent in environments with French-speaking people versus environments involving other languages in the child's life (the calculation does not take TV time into account). The questionnaire also provides information on the age at which significant exposure to French started (AoE). Children were considered to be MonF if their overall exposure to French was 95% or more. Of the bilingual children ($n = 100$), 35 had English only as their other language, 14 had primarily English with minor amounts of exposure to a third language, 31 had primarily a minority language with some English, and 10 had a minority language only in addition to French. The common language for all the children was French. In Quebec, all children must by law be schooled in French, except those children who meet strict criteria of having parents who were schooled in English in Canada. For this reason, many children who speak English before school entry go to English schools. This makes it difficult to recruit large school-age samples of bilingual children who speak only English and French. For this reason, children of more varied backgrounds were included in this study to ensure a larger sample of French learners. However, children speaking only English and French, the two majority languages of Montreal, are also analyzed separately, as indicated in later sections of the paper. Of the 132 children, 124 were students in schools belonging

to French school boards in Montreal. In these schools, all content must by law be taught in French and the use of other languages is not permitted except in foreign language classes (this is different from French immersion programs, which belong to the English school boards). Seventeen of these children were enrolled in Armenian or Russian schools, which belong to the French school board and are, therefore, subject to this rule. In these schools, all content must be taught in French only; however, some portion of the school day is conducted in Armenian or Russian. Eight children were enrolled in French immersion schools of the English school board, where half the school day is in French and half in English. These variations in French exposure in the school are taken into account in the calculation of the child's overall exposure to French and exposure to French in the school versus home context (see Table 1).

In addition to overall exposure to French, Table 1 reports the percentage of the home environment that occurred in French since birth, and the percentage of the school environment since kindergarten that occurred in French. All of the MonF children were exposed exclusively or almost exclusively to French in their homes and at school. Most of the SeqF children were exposed to French primarily in settings outside the home – only 2/17 SeqF children in grade 1 and 3/21 in grade 3 were reported to be exposed to some French in their home. SimF children varied the most in the settings in which they were exposed to French: of the first graders, 26/29 SimF children had French in their home, and of the third graders, 18/21 SimF children had some French in their home. At both grade levels, the percentage of French in the home for SimF children ranged from 6% to 100%. It should be recalled that the calculation of exposure took into account all contexts, not only the home. The percentage of home interactions reported to occur in French is reported for each group in Table 1. At both grade levels, language groups differed significantly in the amount of French exposure in the home context: grade 1: $F(2,58) = 79.791$, $p < .000$; grade 3: $F(2, 62) = 52.581$, $p = <.000$. In each case, post hoc tests revealed that all groups differed significantly from each other. The percentage of the school context occurring in French was not significantly different across language groups at either grade level: grade 1: $p = .374$; grade 3: $p = .328$.

Procedure

Children were tested individually by trained research assistants. Testing sessions took place in the laboratory at McGill University and in various settings closer to the homes of the children, such as in quiet rooms of public libraries and at sports facilities. MonF children were seen once for a session lasting approximately 2.5 hours. Bilingual children whose other language was English, Russian, or Armenian and who had sufficient knowledge of these respective languages to be tested were seen twice. This study is concerned only with the French and English results – the testing in these two languages employed French and English versions of the same tests. Testing was conducted in French in one session and in English in the other session, with the order counterbalanced across participants. The testing of French and English was conducted by different testers who were native speakers of these respective languages and who were instructed to give no indication that they understood other languages. The hearing screening and test of nonverbal cognition were administered in either the French or other language session.

The French and English vocabulary and word structure tests that are the focus of this study were administered as part of a larger set of standardized and experimental measures. In each case, the French version is an adaptation of the English test used (1–3 were administered to all children in the study; 4–6 were administered only to those whose other language was English). Each of these tests was administered and scored according to their respective manuals as follows.

French: (1) Receptive vocabulary (Échelle de vocabulaire en images Peabody (EVIP, Dunn, Thériault-Whalen, & Dunn, 1994); (2) Expressive Vocabulary; and (3) Word Structure, addressing both inflectional and derivational morphology (2 and 3 are subtests of the CELF-4 Canadian (CELF-4 cdn, *Évaluation clinique des notions langagières fondamentales. Version pour francophones du Canada*, Semel, Wiig, Secord, Boulianne, & Labelle, 2009))).

English: (4) Receptive vocabulary (The Peabody Picture Vocabulary Test - 3rd Edition, Dunn & Dunn, 1997); (5) Expressive Vocabulary; and (6) Word Structure (4 and 6 are subtests of the CELF-4 (*Clinical Evaluation of Language Fundamentals 4*, Semel, Wiig, & Secord, 2003)).

Results

French performance of simultaneous bilinguals, sequential bilinguals, and monolinguals

Our first analysis involves a comparison of the mean scores of the three language groups: monolinguals, simultaneous bilinguals, and sequential bilinguals. This comparison is done at each grade level separately, reflecting the hypothesis that the language groups may compare differently in grades 1 and 3. The scores reported are raw scores.

Grade 1. Means and SDs for each of the language tests are shown for the first graders in Figure 1(a). The performance of the three language groups was compared by a one-way ANOVA. A significant effect of language group was found for the receptive vocabulary raw score ($F(2,61) = 12{,}375$, $p < .000$, $\eta^2 = .296$). Post hoc Fischer LSD tests revealed that all groups differed significantly from each other ($p < .01$). A significant language group difference was also found for expressive vocabulary ($F(2,61) = 3.851$, $p = .027$, $\eta^2 = .115$. Post hoc tests revealed that the SeqF and the MonF groups differed significantly from each other ($p = .008$), whereas no significant difference was found between the SimF and MonF groups ($p = .101$) or between the SimF and SeqF groups ($p = .159$). Finally, a significant difference was found for word structure ($F(2,60) = 11.526$, $p < .000$, $\eta^2 = .284$). Post hoc tests revealed significant differences between all groups (SimF versus SeqF, $p = .007$; SimF versus MonF, $p = .014$; SeqF versus MonF, $p < .000$).

Grade 3. A significant group difference was found for receptive vocabulary raw score $F(2,64) = 7.942$, $p = .001$, $\eta^2 = .204$, with post hoc tests revealing significant differences between all groups ($p < .05$). A significant difference was also found for expressive vocabulary ($F(2,63) = 8.192$, $p = .001$, $\eta^2 = .212$. Post hoc tests showed that each of the bilingual groups, SimF and SeqF, differed significantly from the MonF group ($p = .010$ and $< .000$, respectively). However, the SimF and SeqF groups did not differ significantly from each other ($p = .056$). The omnibus test of group differences was not significant for word structure ($p = .071$).

Effects of amount of exposure and age of exposure

The group comparisons reported in the previous section indicate significant group differences between bilingual and monolingual groups and also, on some, but not all tests, between SimF and SeqF groups. As the language groups, by design, differed significantly in the amount of previous exposure to French and in their AoE to French (see Table 1), the group comparisons for each language measure were rerun as analyses of covariance (ANCOVAs) with %exposure to French over lifetime as a covariate and with AoE as a covariate. For children in grade 1, ANCOVAS

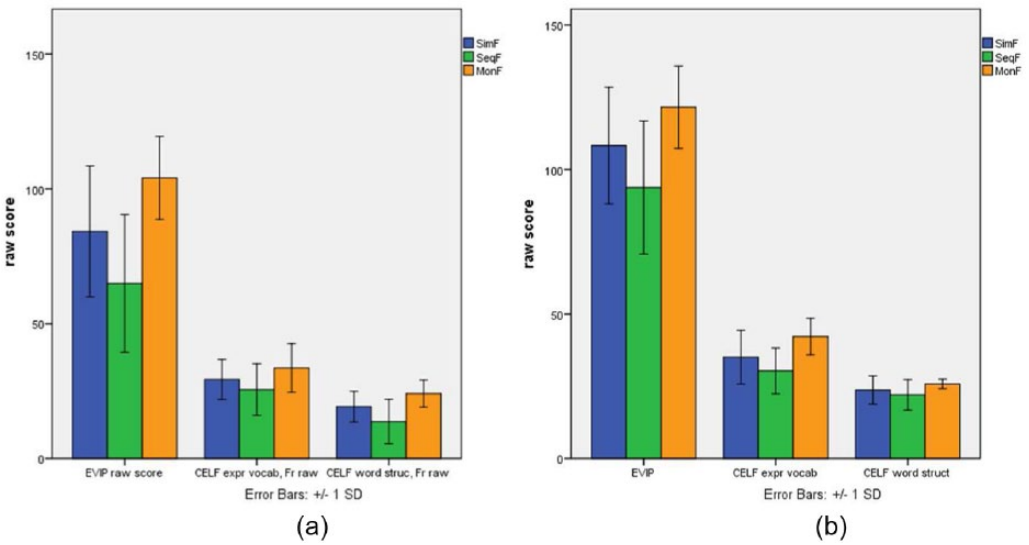

Figure 1. Group means and SDs on French language tests for simultaneous bilinguals, sequential bilinguals, and monolinguals in grade 1 (a) and grade 3 (b). EVIP: French receptive vocabulary; CELF-EV: French expressive vocabulary; CELF-WS: French word structure; SimF: simultaneous learners of French; SeqF: sequential learners of French; MonF: monolingual speakers of French.

with %exposure as the covariate revealed no significant group differences: receptive vocabulary, $p = .819$; expressive vocabulary, $p = .712$; word structure, $p = .868$. ANCOVAS with AoE as the covariate revealed no significant difference for expressive vocabulary ($p = .326$) or word structure ($p = .144$), but revealed a significant difference for receptive vocabulary ($F(2,61) = 3.620$, $p = .033$, partial $\eta^2 = .111$). For children in grade 3, the ANCOVA with %exposure to French as the covariate revealed no significant group differences for any of the three measures: receptive vocabulary, $p = .957$; expressive vocabulary, $p = .708$; $p = .111$. With AoE as the covariate, no significant group difference were found for receptive vocabulary ($p = .106$) or for word structure ($p = .392$). However, the group difference for expressive vocabulary remained significant ($F(2,63) = 3.867$, $p = .026$, partial $\eta^2 = .114$).

These ANCOVAs indicate that group differences in performance are largely mediated by previous experiences; however, they are not conclusive as to the relative effects of the sheer amount of previous exposure versus the age at which exposure to French started (AoE), although the pattern of results suggests a greater role for amount than timing of exposure given that no group differences were seen when amount was the covariate, whereas some group differences remained when AoE was the covariate. As a further attempt to disentangle the effect on performance of these two background variables, a comparison was made between high and low performing SeqF bilinguals in grades 1 and 3. Only SeqF bilinguals were included in this analysis because they are the group that has a range in both amount of exposure and AoE – the SimF bilinguals being similar to the MonF group in this respect. Receptive vocabulary was chosen for this comparison because it yielded a significant group difference between all groups at both grade levels when no covariate was entered and, thus, appeared the most sensitive to background effects. Each age group of SeqF children was divided into high and low performers by median split. For children in grade 1, the raw receptive vocabulary (EVIP) score separating high and low SeqF performers was 59. For children in grade 3, the corresponding score was 98 for the SeqF group and 109 for the

Table 2. French receptive vocabulary (EVIP) scores and background variables for high and low performing sequential learners of French (SeqF) in grades 1 and 3.

	Grade 1			Grade 3		
	Low	High	*t*-test	High	Low	*t*-test
EVIP raw score	41.6	83.1	$p<.000$	75.22	110.5	$p<.000$
	(15.8)	(13.8)	$d=2.80$	(18.7)	(9.5)	$d=2.37$
% French lifetime	11.3	23.5	$p=.022$	14.1	20.2	$p=.185$
	(4.7)	(12.5)	$d=1.36$	(5.0)	(12.4)	
AoE French in months	48.0	47.2	$p=.914$	63.1	56.0	$p=.252$
	(15.5)	(11.9)		(15.1)	(10.9)	

AoE: age of first exposure.

SimF group. Table 2 reports the receptive vocabulary scores and background variables for each group. Within each grade level, independent samples *t*-tests were used to compare high and low performers. At each of the two grade levels, high and low performers differed significantly on the outcome variable of interest, receptive vocabulary: grade 1: $t(14) = -2.424$, $p < .000$; Cohen's $d = 2.80$; grade 3: $t(17) = -5.088$, $p < .000$. In grade 1, a significant group difference was also found for the amount of previous exposure to French ($t(14) = -2.680$, $p = .022$, Cohen's $d = 1.36$). No significant difference was found for AoE ($p = .911$). In grade 3, no significant group differences were found for amount of exposure ($p = .185$) or AoE ($p = .252$).

The ANCOVA and median split analyses just reported treat simultaneous and sequential bilinguals as two separate groups. Such a dichotomous view is consistent with tradition in the literature. In this study, while most of the simultaneous children were exposed to two languages at or close to birth, and many of the sequential children closer to school entry, the separation point needs to be set somewhere – if not, children with AoEs in mid preschool age belong in neither group and have to be excluded. In this study, the cut-off was set at 36 months, following tradition; however, other cut-off points have been proposed. In a third analysis of the effects of AoE and amount of exposure, regression analyses were employed that view AoE and percent exposure to French over lifetime as continuous variables. Simultaneous multiple regressions were run for the grade 1 and 3 bilingual children separately to predict French receptive vocabulary from %French exposure and AoE. For bilingual children in grade 1, these variables significantly predicted French receptive vocabulary ($F(2,44) = 6.020$, $p = 0.005$, $r = .472$). To assess the relative contribution of each of the two predictor variables, the standardized beta coefficients were compared: AoE = −0.22, $p = .922$; French exposure: 0.455, $p = 0.44$. For children in grade 3, similar results were found: AoE and French exposure significantly predicted French receptive vocabulary: $F(2,50) = 7.269$, $p = .005$, $r = .482$. The standardized beta coefficient were, for AoE: 0.146, $p = .461$; for French exposure: 0.584, $p = 0.005$. The standardized beta coefficient converts each variable to standard deviation units, making it possible to compare their absolute value directly. Results for both grade levels indicate that the contribution of amount of French exposure is much greater than that of AoE.

The regression analyses just reported comprised all the bilingual children, including those whose other language in addition to French was English and those whose other language was one other than English. The purpose of including all children was to increase the overall number of children, looking at the effect of age of exposure and the amount of exposure to the common language all the children are learning (French). However, children exposed only to French and English differ from other school-age bilinguals in Montreal in that they speak two majority languages rather than a

Table 3. Background characteristic of children tested in French and in English.

	Age	Mat. Ed.	Brief IQ	AoE Fr*	AoE Eng*	Expo Fr*	Expo Eng*
Only French	92.9	18.7	114.5	0	59.7	99.6	0.003
OnlyF	(11.7)	(2.3)	(15.1)	(0)	(20.6)	(0.01)	(0.004)
n = 33							
More French	97.3	17.8	115.4	0	31.0	85.5	13.9
MoreF	(13.5)	(3.8)	(18.9)	(0)	(27.9)	(10.4)	(10.6)
n = 22							
Equal F & E	95.9	18.0	10.2	7.6	1.4	49.7	47.8
EqualFE	(12.7)	(1.8)	(15.7)	(8.9)	(3.27)	(0.7)	(8.5)
n = 10							
More English	97.5	17.7	108.6	38.0	0	19.1	36.1
MoreE	(12.6)	(1.8)	(15.7)	(27.1)	(0)	(10.7)	(43.9)
n = 17							

*A significant difference was found between the exposure groups on this variable.
AoE: age of first exposure.

majority (French) and a minority home language. An anonymous reviewer raised the question of whether similar effects of amount and timing would apply also to children who speak only French and English. To examine this, the regression analysis was conducted again with the subgroup of 49 bilingual children exposed only to French and English (see Table 3). Because of the smaller number of children, both age groups were combined for this analysis. The results were comparable to those found with the larger group (simultaneous regression with French receptive vocabulary raw score as the dependent variable and AoE and %exposure to French as the predictor variables: $F = 10.372$, $p < .000$, $r = .301$: standardized beta coefficient for AoE: .033, $p. = 833$: %exposure to French: .581, $p < .003$). As a further check of the effect of age, given that both age groups were included, another simultaneous regression was run with AoE, %French, and chronological age as the predictor variables. Again, the result indicated that amount was a more important predictor of performance than AoE, and somewhat more important than age: $F = 14.774$, $p < .000$, $r = .704$; standardized beta for AoE: –.020, $p = .898$; for amount of exposure: .525, $p < .002$; for age: .432, $p < .000$.

Relationship between exposure to French and performance within each grade level

A main question of interest in this study was whether the percentage of exposure to French would be a meaningful predictor of vocabulary performance for school-age children, as it is for preschoolers. Figure 2 shows a scatterplot of individual children's score on receptive vocabulary as a function of the percentage of waking hours spent in French environments since birth for all children in grade 1 (Figure 2(a)) and in grade 3 (Figure 2(b)). At each grade level, French receptive vocabulary scores increase with increasing exposure. For the entire group of children in grade 1, scores on each of the French tests correlated significantly with the percentage of time spent in French over the child's lifetime (receptive vocabulary: $r = .599$, $p < .000$; expressive vocabulary: $r = .433$, $p < .000$, word structure: $r = .636$, $p < .000$). Similarly, for children in grade 3, all the French measures correlated significantly with exposure: receptive vocabulary: $r = .548$, $p < .000$; expressive vocabulary: $r = .525$, $p \leq .000$; word structure: $p = .483$, $p < .000$). The graph also depicts the mean and the −1 SD range for the monolingual children. These plots indicate that roughly half of

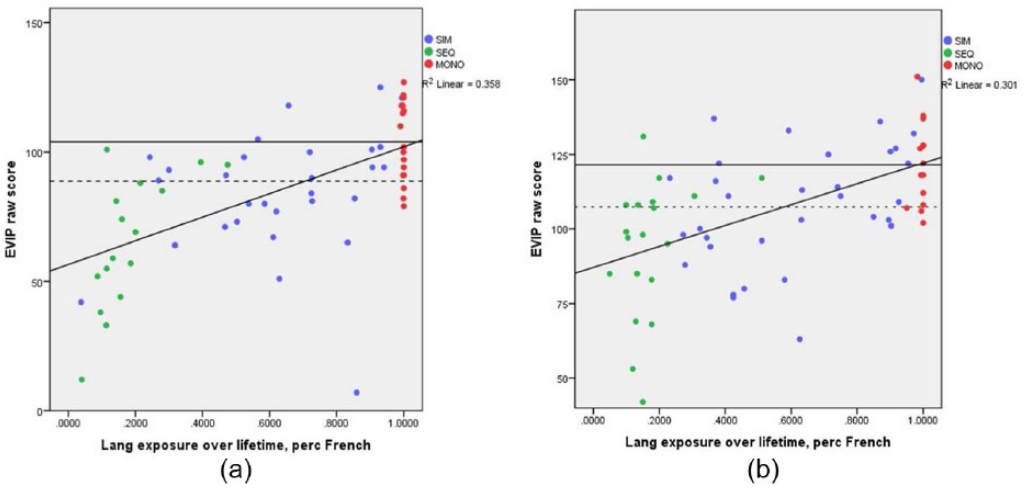

Figure 2. French receptive vocabulary (Échelle de vocabulaire en images Peabody (EVIP)) raw scores as a function of the percentage of time spent in French contexts since birth, for children in grade 1 (a) and in grade 3 (b), including sequential learners of French (SeqF) bilinguals (green), simultaneous learners of French (SimF) bilinguals (blue), and monolinguals (red). The horizontal reference lines indicate the mean score (solid line) and −1 SD (dotted line) for the monolingual children. (Color online only.)

the SimF children scored within the −1 SD monolingual range, whereas only roughly 30% of SeqF children did. The fitted line and the −1 SD line intersect at approximately 60% exposure to French; however, considerable variability is seen such that some children achieve scores above this line at lower exposure levels. It is noteworthy in Figure 2 that there is little overlap between the three language groups in terms of percentage exposure to French: children in the SeqF groups have spent up to roughly 30% of their waking hours over their lifetime in French environments, whereas children in the SimF French have spent roughly 30–90% of their time in French environments. Overall, the SimF groups perform better than the SeqF groups at both grade levels (see the group comparisons discussed earlier). However, the scatterplots clearly indicate that there is more overlap in language scores than there is in exposure percentages. This indicates that the SeqF children are achieving their French learning in less time than the other groups.

In order to further examine the relationship between increasing exposure amounts and increases in scores among the SeqF and SimF children, the scatterplots in Figure 3 depict the French receptive, expressive vocabulary, and word structure scores of the SeqF and SimF groups as a function of amount of time spent in French-speaking environments. Amount of exposure in these scatterplots is shown as absolute number of hours in French rather than as a percentage of the children's lifetime. For this conversion, the child's age in months is multiplied by the percentage of time spent in French and by 300 (the estimated number of hours per months spent in communicative environments based on background questionnaires reporting daily language use). Figure 3 shows French receptive vocabulary scores as a function of thousands of hours of French exposure for SimF and SeqF bilinguals in grade 1 (Figure 3(a)) and in grade 3 (Figure 3(b)). In each panel of Figure 3, the fitted lines indicate the rate at which French performance increases as the amount of French exposure increases. Visual inspection indicates that, for each of the language measures, the slopes are considerably steeper for SeqF than for SimF learners. In order to test for significant differences in the slope of the two groups, a statistical comparison of the raw regression coefficients (*B*) for each of the variables was made between groups of SimF and SeqF children at each grade level. For this

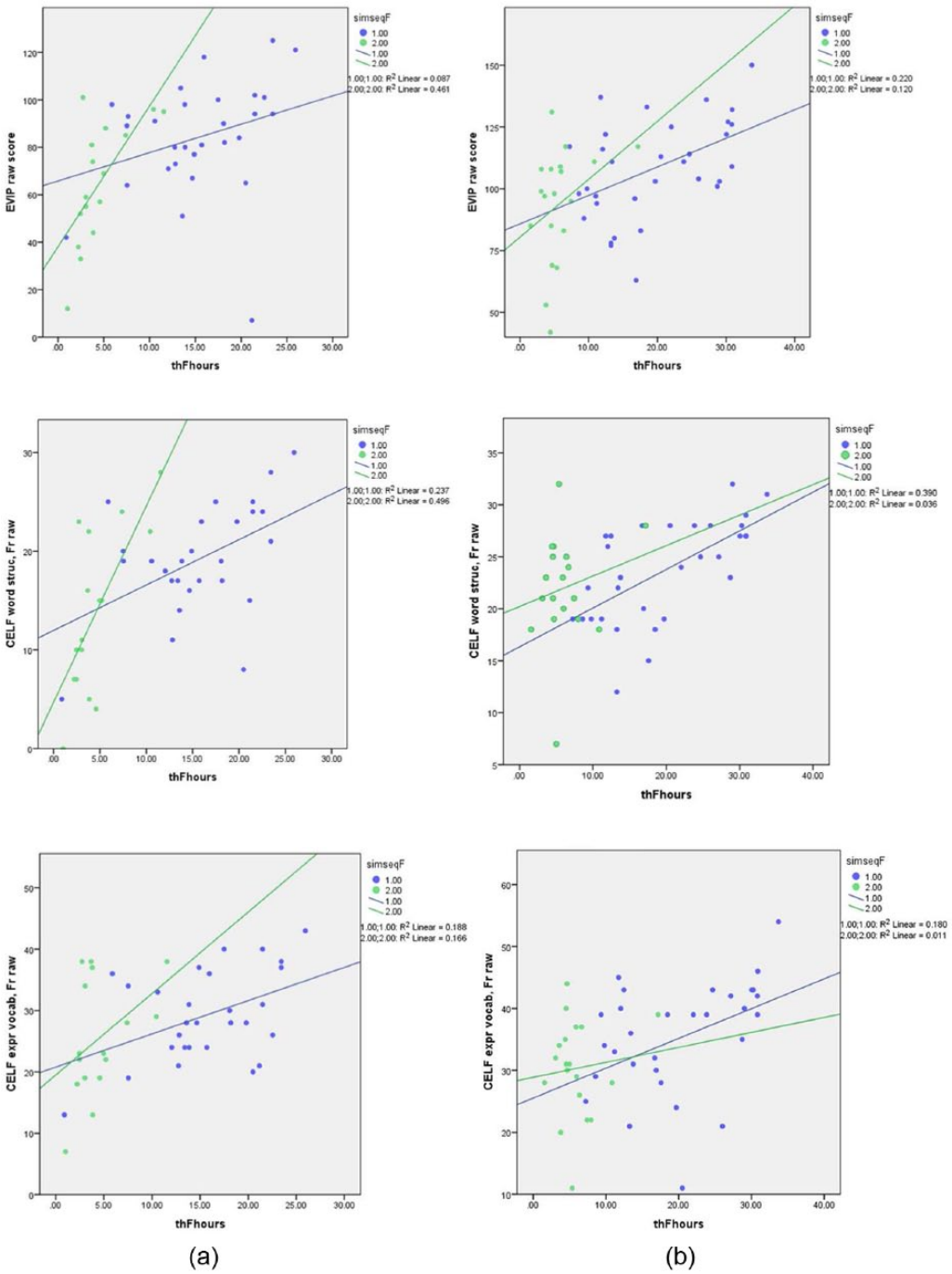

Figure 3. French receptive vocabulary (Échelle de vocabulaire en images Peabody (EVIP), top panel), French expressive vocabulary (CELF-EV, middle panel), and French word structure (CELF-WS, bottom panel) as a function of the number of hours of exposure to French for simultaneous learners of French (SimF) and sequential learners of French (SeqF) bilingual children in grade 1 (a) and in grade 3 (b).

Table 4. Raw regression coefficients (*B*) for the predictor variable thousands of hours of French exposure for each of the language measures (French receptive vocabulary – EVIP, French expressive vocabulary – CELF-EV and French word structure – CELF-WS) for simultaneous learners of French (SimF) and sequential learners of French (SeqF) groups of children, in grades 1 and 3.

	Grade 1				Grade 3			
	SimF	SeqF	*t*	*p*	SimF	SeqF	*t*	*p*
EVIP	1.19	5.93	2.269	.029	0.40	2.34	.831	.410
CELF-EV	0.54	1.33	1.092	.281	0.48	0.24	–.237	.814
CELF-WS	0.46	1.99	2.978	.005	0.37	0.29	–.128	.899

purpose, a dummy variable was created assigning a value of 1 to SeqF learners and 0 to SimF learners. This dummy variable was multiplied by the thousands of hours of exposure variable, giving the new variable SeqFhours. A regression was then run with the dummy variable, amount of exposure, and SeqFhours as the predictors in the regression equation. The term SeqFhours then tests the null hypothesis that the regression coefficients for SimF and SeqF are not significantly different. The results of this analysis, shown in Table 4, show that in the younger group, regression coefficients are significantly higher for SeqF than for SimF children (receptive vocabulary: 5.93 versus 1.19; word structure: 1.99 versus 0.46). For expressive vocabulary, the regression coefficient is also higher for the SeqF children (1.33 versus 0.54), but the difference is not significant. For the children in grade 3, no significant difference was found between the SimF and SeqF groups. Visual inspection reveals that the regression coefficient is larger for the SeqF group for receptive vocabulary (2.34 versus 0.40); for the other two measures, the regression coefficient is slightly higher for the SimF group than the SeqF group.

Relative proficiency in French and English

Analysis of bilingual children's relative proficiency in their two languages focused only on a subgroup of the bilingual children: those who were tested in French and English and who were exposed only to these two languages on a regular basis. The resulting subgroup comprises 49 bilingual children. Following previous work on bilingual preschool children (Elin Thordardottir, 2011), the children were divided into subgroups based on the percent of waking hours spent in French (only French (OnlyF, 90–100% French, $n = 33$), More French than English (MoreF, 61–89% French, $n = 22$), Equal French and English (EqualFE, 40–60% French, $n = 10$), and More English than French (MoreE, 11–39% French, $n = 17$). In the present sample, there are no monolingual speakers of English. Three children who were classified as OnlyF based strictly on their documented exposure levels as per parent report were able to be tested in English and were thus moved to the MoreF group; one child whose exposure calculation indicated MoreF was moved to the OnlyF group because of inability to be tested in English. Children in grades 1 and 3 were combined in this analysis to allow for larger numbers of children per subgroup.

The background characteristics of children in each of the language exposure groups are shown in Table 3. An ANOVA showed that the four exposure groups did not differ significantly in age ($p = 510$), maternal education ($p = .529$), or nonverbal cognition (Leiter brief IQ: $p = .544$). As expected, the groups did differ significantly in their previous exposure to French ($F(3,81) = 454.750$, $p < .000$), with post hoc tests showing all groups differed significantly from each other. The groups also differed significantly on previous exposure to English ($F(3,66) = 11.205$, $p < .000$). Post hoc tests

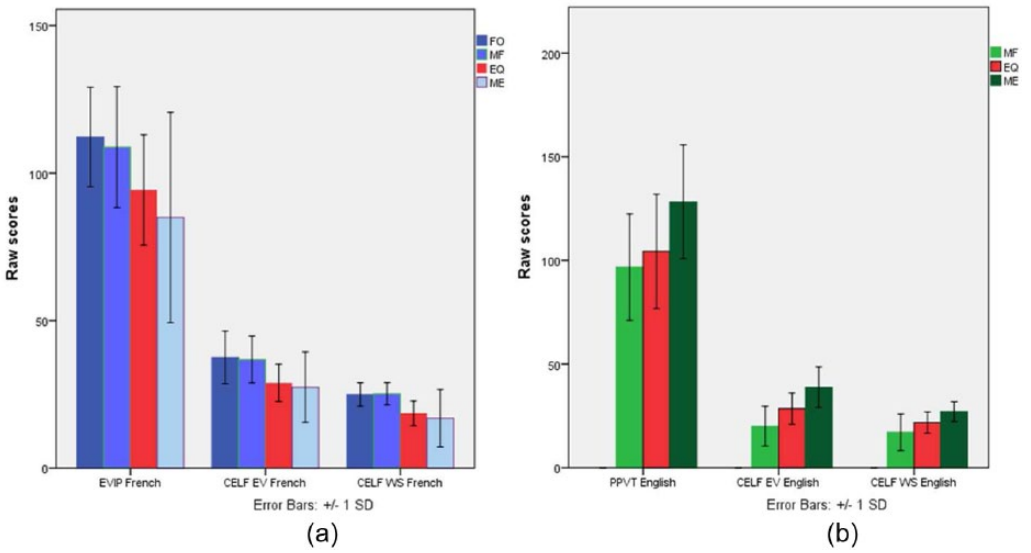

Figure 4. Performance in French (a) and English (b) of bilingual children having received French exposure only, More French, Equal French and English, and More English, on receptive vocabulary (Échelle de vocabulaire en images Peabody (EVIP) and Peabody Picture Vocabulary Test (PPVT), respectively), expressive vocabulary (French and English expressive vocabulary (CELF-EV), respectively) and word structure (French and English word structure (CELF-WS), respectively).

showed that the MoreE group differed significantly from each of the other groups. It should be noted that the fact that the groups did not compare identically in their exposure to French and English is that the grouping was based on their exposure to French and some of the children had minor exposure to a third language, such that their English and French exposure did not add up to 100% for all of the children. The groups differed significantly in their AoE to French and to English. For AoE French, the results were $F(3,80) = 38.536$, $p < .000$. Post hoc tests revealed that the MoreE group differed significantly from the OnlyF group and the MoreF group, but not from the EqualFE group in AoE to French. For AoE to English, the result was $F(3,53) = 22.613$, $p < .000$, with post hoc tests showing significant differences between all group except the MoreE and the EqualFE groups.

The performance of each of the exposure groups in French and English is shown in Figure 4. Visual inspection of this figure indicates that performance in French increased systematically as exposure to French increased. Similarly, performance in English increased systematically as exposure to English increased. For French receptive vocabulary, a significant group difference was found ($F(3,79) = 5.994$, $p = .001$). Post hoc Tukey tests revealed that the MoreE group performed significantly worse than the OnlyF group ($p < .001$) – no other pair-wise group differences were significant. A significant group difference was found as well on French expressive vocabulary ($F(3,78) = 6.161$, $p = .001$), with post hoc tests revealing again that the MoreE group performed significantly worse than the OnlyF group ($p < .003$) and the MoreF group ($p < .012$). The difference between the OnlyF and EqualFE groups was marginal ($p < .050$). For French word structure, the difference was significant ($F(3,79) = 10.801$, $p < .000$), with post hoc tests revealing that both the MoreE and EqualFE groups performed significantly worse than the OnlyF group ($p < .000$ and .010, respectively). In addition, the MoreF group performed better than both the EqualFE and MoreE groups ($p < .012$ and .000, respectively).

Looking now at performance in English, the exposure groups differed significantly on English receptive vocabulary ($F(2,41) = 5.998$, $p = .005$), with Fischer LSD post hoc tests revealing that the MoreE group performed significantly better than each of the two other groups tested in English (MoreF, $p = .002$; EqualFE, $p = .038$). A significant group difference was found on the English expressive vocabulary ($F(2,41) = 16.927$, $p < .000$). Post hoc tests revealed that each group differed significantly from the other two (MoreF and EqualFE: $p = .032$, MoreF versus MoreE, $p < .000$; EqualFE versus MoreE, $p = .011$). Finally, a significant group difference was found for the English word structure: $F(2,41) = 8.812$, $p = .001$. Post hoc tests revealed that the MoreE group performed better than both the MoreF and EqualFE groups ($p < .000$ and .070, respectively), whereas no difference was found between the MoreE and EqualFE groups.

Discussion

The goal of this study was to examine the influence of language exposure on the language performance of bilingual school-age children, with a particular focus on both the amount of exposure received in each language and the timing of this exposure. Few studies have directly compared the language skills of simultaneous and sequential bilingual children while also controlling for the amount of exposure. The present study compared simultaneous and sequential learners of French at two grade levels, accounting for both amount and timing of exposure, and controlling for several important factors that frequently confound studies on bilingual children, including SES, nonverbal cognition, and language status. These are important methodological advantages of this study.

Amount versus timing of bilingual exposure

A main motivation for comparing the French performance of simultaneous and sequential learners of French was to examine the relative effects of amount and timing of bilingual exposure. Another motivation for this comparison was to better understand how meaningful this distinction is in the evaluation of the language skills of bilingual children. Comparison of these groups in grade 1 and in grade 3, respectively, reveals several important effects; firstly, although the amount of exposure and the timing of exposure to a language are hard to disentangle, the evidence does indicate that amount trumps timing. Secondly, simultaneous and sequential learners did not systematically differ amongst each other in their performance. In many of the comparisons, simultaneous and sequential learners differed from the monolinguals but not from each other. Thirdly, the difference between simultaneous and sequential learners was more pronounced in grade 1 than in grade 3. Further, there was evidence that sequential learners in grade 1differed from simultaneous learners in that they required less overall input to achieve high scores in French, whereas such a difference in the amount of input associated with high scores was not found among children enrolled in grade 3. This indicates that sequential learners of French in grade 1 exhibit a faster learning rate than sequential learners in grade 3. Although the study is not longitudinal, these results do suggest that sequential learners may exhibit an initial rapid learning rate that subsequently slows down. Fourthly, in terms of how simultaneous versus sequential learners are expected to perform in relation to monolingual speakers, it was a startling finding that *both groups* scored significantly below the monolingual French-speaking children on French receptive vocabulary both in grades 1 and 3, as well as on French expressive vocabulary in grade 3 and on French word structure in grade 1.

These findings shed new light on the expected performance of school-age bilinguals in several ways. Studies on the language performance of school-age children generally report on L2 learners, most frequently children whose first exposure to the L2 starts at school. There has been less research focus on the long-term performance of simultaneous bilingual children. This may reflect the expectation that simultaneous learners typically reach high levels of proficiency in both of

their languages because of the "native" status of both, stemming from very early exposure in the home (termed 2L1, or two first languages). This line of thinking might lead researchers and educators to consider simultaneous bilinguals to be less at risk than L2 learners for academic difficulty related to language issues. If this is the expectation, then the finding that the simultaneous bilinguals performed significantly less well than monolinguals at both grade levels is certainly noteworthy. This finding shows that an early start, or designation as "native", simultaneous, or 2L1 bilingual, not only does not guarantee performance comparable to that of monolinguals, but in fact also is not typically associated with performance in that range. In light of the distinction that is traditionally made between simultaneous and sequential bilinguals, it is also noteworthy that on many of the tests, the simultaneous and sequential bilinguals were more similar to each other than they were to the monolinguals.

These results call into question the basis for the traditional separation of children as simultaneous and sequential bilinguals. In that respect, they are in agreement with the recent comparison between simultaneous and sequential school-age bilinguals made by Unsworth (2016), who also reported amount of exposure to be a more important determinant of performance than AoE. However, a notable difference between the two studies is that Unsworth found her bilinguals to perform within the monolingual range, whereas this study finds both bilingual groups to lag significantly behind the monolingual group on many measures, in particular receptive vocabulary. Reasons for this discrepancy might lie in ceiling effects in Unsworth's study or in other sampling factors. Overall, however, the results of both studies speak against the contention that there is a critical age by which bilingual exposure must start in order for the child to reach a high performance level. The somewhat better performance of children with earlier AoEs to French was mediated by their overall larger amount of exposure to French. In this study, the much greater importance of amount of input rather than AoE was shown both for a sample of children from various language backgrounds acquiring French as simultaneous or sequential learners, and for a smaller subsample of children speaking French and English. It is imperative that studies of critical or sensitive periods in bilingual acquisition carefully control both the timing and the amount of exposure.

Studies on school-age L2 learners have consistently documented persistent gaps between L2 learners and monolinguals, in particular in the area of vocabulary (e.g., Bialystok et al., 2010; Hammer et al., 2011; Jackson et al., 2014; Mancilla-Martinez & Lesaux, 2011; Oller et al., 2007; Rydland et al., 2014; Simos et al., 2014; Elin Thordardottir & Juliusdottir, 2013; Elin Thordardottir, in press). The lower performance of the L2 children is, in most cases, partly attributed to SES factors, given that the L2 speakers are typically recent immigrants and speak a minority language. Particularly large gaps between native and L2 speakers are reported in studies on L2 speakers with multiple risk factors, such as very low SES (Jackson et al., 2014) and speakers learning an L2 of particularly low economic value (Elin Thordardottir & Juliusdottir, 2013; Elin Thordardottir, in press). In the present study, however, the significant differences found between monolingual and bilingual speakers (both simultaneous and sequential) cannot be attributed to differences in SES, nor to minority language status, since the children of all exposure levels were of equivalent SES, and that differences were found between children of various exposure levels who speak French and English, two majority languages. Instead, the differences appear to be the result of bilingual learning as such.

The relationship between exposure and performance

It is known that amount of exposure impacts the L2 learning of school-age children. However, this has generally been studied by examining how language scores increase as more years are spent in the L2 schooling environment. How the performance of individual children at the same grade level is impacted by their personal language history has received less attention. In this study, we were

interested in whether the documentation of a child's exposure history is useful in predicting that child's performance in each of their languages, as it has been shown to be for simultaneously bilingual preschoolers. The results show, firstly, that similar to findings on preschool children (e.g., Elin Thordardottir, 2011, who used a similar research design), in general, a lawful relationship continues to be found between exposure to the language since birth and performance in the language. The scatterplot in Figure 2 shows that children having received more exposure to French in general get higher scores in French. This relationship between exposure and performance is found at both grade levels. Sequential learners naturally have the lowest exposure levels and simultaneous learners a larger range of levels; little overlap is seen in their levels of accumulated exposure over their lifetime. In spite of this, their scores overlap considerably, indicating that the sequential bilinguals are learning French faster than the simultaneous bilinguals. Further analysis indicated a significant difference in the relationship of amount of exposure and French vocabulary scores between simultaneous and sequential learners in grade 1, but not in grade 3. This suggests that a particularly rapid rate of learning is seen in an initial period of exposure to the L2, which subsequently slows down – note, however, that the present study is cross-sectional. A longitudinal study would be required to verify this change in learning rate in individual children as they grow older. The more rapid rate allows the sequential bilinguals to catch up with the simultaneous bilinguals, but not with the monolinguals. Rapid learning in an initial period of L2 exposure has been suggested in several previous studies for kindergarten children (Hammer et al., 2008) and older school children (Elin Thordardottir, in press). These studies and the present one suggest that, when evaluating school-age bilingual children, important variables to consider include not only amount and AoE, but also the length of time since exposure to that language started.

Performance across the two languages

Those children who were English speakers permitted examination of the effect of exposure on both languages. This comparison shows that dividing the bilingual children into exposure groups based on the relative exposure they have received to French or English results in a similar distribution of performance levels in both French and English: the more the children have been exposed to French, the better they perform in French and the worse they perform in English (Figure 4). This pattern is parallel to that documented previously for preschool children (Elin Thordardottir, 2011) and, similar to the study on preschool children, the findings of this study indicate that the children that received less exposure to French than English (39% or less) are the ones who consistently scored significantly lower than monolinguals in French. This was true for receptive and expressive vocabulary – for word structure, significant differences were found between all exposure groups, indicating that word structure is more sensitive to differences in exposure than is vocabulary size. This may indicate that knowledge of word structure taps into a more advanced linguistic skill than the receptive and expressive subtests.

This study examined the effect of amount of input received in each language regardless of where that input was received. Similarly, the AoE to a language did not take into account whether both languages were spoken in the home or in other settings. This was done by design to examine how strongly sheer input and its timing predict performance; however, other studies have focused more closely on the settings and neighborhoods in which input in each language is received, and from which communicative partners (e.g., Rydland, et al., 2014; Rydland, Aukrust, & Fulland, 2013). This study did not focus on such context factors; however, it attempted to assess overall amounts of input in a fairly detailed manner. To conclude, this study has shown that amount of input since birth continues to be a relevant predictor of bilingual performance in the school years. This indicates that measuring previous input continues to be of use in language assessment, as it has been shown to be for preschool children (see Elin Thordardottir, 2015a). Importantly, this study

shows that amount of input exerts a stronger influence on L2 vocabulary performance than does the timing of the input. Therefore, the findings call that into question the categorization of children as simultaneous and sequential bilinguals, at least for children with AoEs up to the age of school entry. The data further indicate that the difference between these groups of bilinguals is greatest in the initial period of exposure of the sequential bilinguals, and subsequently diminishes, such that sequential bilinguals catch up with the simultaneous bilinguals, but neither group catches up with the monolinguals.

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