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Modelling vocabulary development among multilingual children prior to and following the transition to school entry

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Abstract

Differences between monolingual and multilingual vocabulary development have been observed but few studies provide a longitudinal perspective on vocabulary development before and following school entry. This study compares vocabulary growth profiles of 106 multilingual children to 211 monolingual peers before and after school entry to examine whether: (1) school entry coincides with different rates of vocabulary growth compared to prior to school entry, (2) compared to monolingual peers, multilingual children show different vocabulary sizes or rates of vocabulary growth, (3) the age of onset of second-language acquisition for multilingual children is associated with vocabulary size or rate of vocabulary growth, and (4) the sociolinguistic context of the languages spoken by multilingual children is associated with vocabulary size or rate of vocabulary growth. Results showed increases in vocabulary size across time for all children, with a steeper increase prior to school entry. A significant difference between monolingual and

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No potential conflict of interest was reported by the authors.

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multilingual children who speak a minority language was observed with regards to vocabulary size at school entry and vocabulary growth prior to school entry, but growth rate differences were no longer present following school entry. Taken together, results suggest that *which* languages children speak may matter more than being *multilingual* per se.

Keywords

Vocabulary; bilingual; second-language learning; age of acquisition; simultaneous; sequential; sociolinguistic context

Introduction

Vocabulary is among the first language abilities to develop, starting with understanding and producing one's first words, and it continues to develop throughout one's lifetime as new words are learned. In addition to a lifetime of growth, vocabulary supports the acquisition of other linguistic domains from early speech sound development (Stoel-Gammon 2011), to morphology and syntax (Marchman and Bates 1994). Once school begins, vocabulary plays an important role in learning to read (Verhoeven, van Leeuwe, and Vermeer 2011). Childrens' vocabulary development is a complex process that is influenced by a number of factors including the family's socio-economic status (Scheffner Hammer, Lawrence, and Miccio 2008; Magnuson et al. 2009), the amount of language input from the mother (Hart and Risley 1995), the lexical diversity of the mother's input (Pan et al. 2005), and the number of languages to which children are exposed (e.g. Pearson, Fernandez, and Oller 1993).

To date, the specific language that a monolingual child acquires appears to have little influence on vocabulary size when these factors are taken into account. However, only a small body of research has compared vocabulary development cross-linguistically, and it has focused on toddlers, showing few cross-linguistic differences in vocabulary size for monolinguals at 20 months of age (Bornstein et al. 2004). Nonetheless, for children learning more than one language, researchers have found that these children tend to score lower than their monolingual peers on standardized vocabulary tasks prior to school entry (e.g. Allman 2005; Bialystok et al. 2010) and following school entry (Bialystok et al. 2010; Uchikoshi 2006). This lower achievement has been found to persist through to the age of 9–12 years (Bialystok et al. 2010; Oller, Pearson, and Cobo-Lewis 2007). Although these differences between monolingual and bilingual vocabulary development have been observed, few studies provide a longitudinal perspective on bilingual vocabulary development, particularly with regards to changes in growth rates before and following the transition to school entry. The present study compared vocabulary growth profiles of children who were acquiring two or more languages (i.e. multilingual children) to their monolingual peers by following them before and after school entry.

Factors influencing bilingual vocabulary development

In addition to the family's socio-economic status, and the amount of language input and lexical diversity from the mother, the vocabulary development of children acquiring more

than one language in early childhood seems to be influenced by factors specific to the multilingual context. However, given that bilingual children are a heterogeneous population, research that has tackled bilingual vocabulary development has presented different, and at times, conflicting results. To better understand these results, previous research has suggested that differences in vocabulary development between bilingual and monolingual children, and between different bilingual groups, can be reduced to four main factors.

The first factor is the language of assessment, which requires the availability of comparable measures for each of the child's languages that reflect the dialect spoken by the child. Even when assessment tools exist for the specific language, few have been developed with bilingual or multilingual children in mind. The language of assessment is one explanation for lower vocabulary scores among bilingual children. Specifically, studies that evaluate only one of the children's languages have found that bilingual children score lower than their monolingual peers, especially when the children are assessed in their second language (Junker and Stockman 2002; Oller, Pearson, and Cobo-Lewis 2007; Pearson, Fernandez, and Oller 1993). When both of the children's languages are evaluated, particularly when bilingual children have acquired their languages simultaneously, their *total* vocabulary scores (i.e. adding together words from both languages) have been found to exceed those of monolinguals (Junker and Stockman 2002; Pearson, Fernandez, and Oller 1993). This result suggests that bilingual children are not delayed in their acquisition of new words compared to monolingual peers, but that their vocabulary is distributed across two languages.

The second factor is the age of onset of second-language acquisition, which is often tied to the language learning environment (e.g. naturalistic or academic) and the social and emotional ties the child builds with each language community. The age of onset of second-language acquisition has also been found to explain differences in vocabulary scores for bilingual children. Bilingual children who learned both languages simultaneously, or *simultaneous bilinguals*, have been found to have more balanced abilities across their two languages (Junker and Stockman 2002). These results are in contrast with children who learned their second language after having begun to acquire their first, or *sequential bilinguals*, who often have more advanced abilities in their first language and weaker abilities in their second (Oller, Pearson, and Cobo-Lewis 2007). Studies often focus on the current language that children use in school: for sequential bilinguals this can be the language with which they have the least experience, which not surprisingly, might result in lower estimates of vocabulary size.

The third factor which can impact vocabulary scores is the current language exposure pattern. The amount of exposure is a dynamic factor that can change across time due to changes in language use at home, starting school, or relocation. For simultaneous bilingual children, differences can be observed due to the amount of exposure to each language such that the language with greater exposure will have a larger vocabulary than the language with less exposure (MacLeod et al. 2013). Many sequential bilingual children experience a rapid reduction in exposure to their first language following school entry, which results in slower vocabulary growth for this language (Anderson 2004; Sheng, Lu, and Kan 2011). For both simultaneous and sequential bilinguals, the amount of exposure can explain differences

observed across children who have similar ages of language acquisition, but differ with regards to language exposure.

The fourth factor is the sociolinguistic context, which refers to the broader community in which children live and can influence the options for education, opportunities to use each of the children's languages outside of the home, and attitudes regarding bi- or multilingual language learning. The sociolinguistic context can influence vocabulary scores for bilingual children. Most bilingual children learn the majority language in school (e.g. English), and the minority language is learned at home or in their community (e.g. Arabic). In contrast, some bilingual children live in bilingual regions with two majority languages that are used in schooling and that also receive official support from the government (e.g. French and English in select areas of Canada, such as Montreal). Studies of majority language bilinguals have found that children perform within the normal range for receptive vocabulary (Thordardottir et al. 2006), but minority language bilinguals perform lower than their monolingual peers (Allman 2005; Bialystok et al. 2010; Uchikoshi 2006). Sociolinguistic contexts may also explain some differences observed across studies. In particular, differences in sociolinguistic contexts might account for long-term results such as decreases in the first language vocabulary towards the end of primary school for Spanish–English bilingual children in the USA (e.g. Oller, Pearson, and Cobo-Lewis 2007), but less systematic first language decreases for Welsh–English bilingual children in Wales (e.g. Mueller Gathercole 2007). The sociolinguistic context appears to contribute to bilingual children's language abilities and long-term outcomes.

In sum, research has made it clear that bilingual language development is influenced by (a) the language of assessment, (b) the age of second-language acquisition, (c) the current language exposure and (d) the sociolinguistic context. For monolingual and multilingual children alike, the transition to school is an important milestone. For multilingual children, this transition can bring about important changes to the amount of language exposure of each language, particularly in minority language contexts where little support exists for the child's home language outside of the home. Although researchers have compared bilingual children of different age groups, few studies have been longitudinal (Lesaux, Rupp, and Siegel 2007), and fewer have documented language abilities prior to and following school entry. A principal goal of the present study was to address this gap in our knowledge by clarifying how a subset of the factors identified above interact across time, particularly prior to and following school entry.

Longitudinal models of vocabulary development

Developmental trajectories are a recent innovation in the study of bilingual language abilities that allow for the description of developmental pathways. Researchers have tended to focus on group differences observed at distinct points in time (e.g. Bialystok et al. 2010), either in static (e.g. MacLeod et al. 2013), or longitudinal studies (e.g. Oller, Pearson, and Cobo-Lewis 2007). In contrast, a developmental trajectory describes not only how a behaviour changes in relation to children's age by identifying group differences at different time points, but also describes differences in their rate of growth (Thomas et al. 2009). Developmental trajectories are ideally suited for studying the dynamic nature of bilingual

language development (De Bot, Lowie, and Verspoor 2007). A recent study of the development of reading abilities underscored the importance of a longitudinal approach, Lesaux, Rupp, and Siegel (2007) compared a large group of English Language Learners (ELL) to their native-speaking English peers from the initial stages of reading in kindergarten to grade four. Although the ELL performed more poorly than their native-speaking English peers on 4 of the 10 measures taken in kindergarten, they performed comparably to their peers by grade four and the two groups showed similar non-linear developmental trends. These results contrast with recent trajectory studies of vocabulary abilities that suggest that a vocabulary gap between bilingual and monolingual children persists with age.

Two studies that specifically focused on bilingual vocabulary abilities using developmental trajectories were conducted recently. In the first study, Scheffner Hammer, Lawrence, and Miccio (2008) applied a developmental trajectories approach to the study of vocabulary development among minority language bilingual children who spoke Spanish and English. Children were assessed in English and Spanish in the fall and spring of their first two years in a Head Start school programme (i.e. between ages 3 and 5 years). Using a linear mixed model growth curve approach, they found distinct patterns for the language of assessment with regards to vocabulary development that were tied to current language exposure patterns. In English, children with both English and Spanish at home had higher scores upon school entry and maintained higher scores across the study period, although children with Spanish-only at home began to close this gap by age 5. In Spanish, however, children with Spanish-only at home had higher scores upon entry in school, whereas children with both languages at home lost ground over the study period. Thus, growth curve analyses allowed not only to identify group differences in each language measured at specific times, but also to identify group differences in how each language evolved.

As another example, Mancilla-Martinez and Lesaux (2011) investigated vocabulary development from school entry at 4½ through to the age of 12 years in minority language bilingual children who spoke English and Spanish. The bilingual children were subdivided into those who were dominant in English, balanced English-Spanish, and dominant in Spanish. A growth curve model using quadratic specifications best described the curvilinear shape of vocabulary growth over time, and different effects for language of assessment and language exposure patterns were observed. Specifically, the model showed initial English vocabulary differences across groups with English-dominant group outperforming the two other groups; however, the rate of growth showed a different pattern such that the balanced and Spanish-dominant groups showed greater growth. At the end of the study period, the gap had narrowed considerably between the three groups in English. In contrast the results for Spanish demonstrated that the differences across groups in vocabulary were maintained across time. Specifically, the Spanish-dominant bilinguals had larger vocabularies from the age of 4–12 and the English-dominant bilinguals had the smallest vocabularies across this age period. Finally, all three bilingual groups remained below monolingual norms in both English and Spanish.

In short, these recent studies of vocabulary development highlight the importance of using advanced statistical modelling not only to provide insight about group differences but also to provide a means of describing growth profiles of different groups.

Current study

To summarise, vocabulary development of children acquiring more than one language is influenced by factors that affect monolingual children, such as socio-economic status and the mother's lexical diversity, and by factors that are specific to the multilingual context. Research on bilingual vocabulary development has focused on either preschool-aged children or school-aged children, and few studies have followed children from before entering school to several years following school entry. The main goal of the present study was to model the vocabulary development before and following school entry of monolingual and multilingual children. Specifically, we modelled multilingual and monolingual children's vocabulary development to describe and compare their growth profiles as they acquired the language of schooling. In addition to factors hypothesized to impact the vocabulary development of both multilingual and monolingual children (i.e. family income, maternal education, child's cognition, and attending daycare), we sought to understand how two factors specific to the multilingual context might impact vocabulary development: age of second-language learning and sociolinguistic context. Given that the focus of the broader study was not on multilingual language development, children were only assessed in a majority language (i.e. French or English) and their current amount of language use for each language was only assessed at the age of 6 years. Thus, we were not able to explore how the other two factors, language of assessment and current language use, impacted vocabulary development.

The study was conducted in the province of Québec, a province with a complex sociolinguistic landscape. French is the official language at the provincial level and thus the language of schooling for most children and government resources are available in French. However, English is an official minority language within the province and an official language at the national level; thus, it receives some support at the provincial level and some children can be schooled in this language. Finally, a number of minority languages are spoken with no official designation and thus little governmental support. The unique sociolinguistic context of the present study provided an exceptional opportunity to compare directly monolingual children with children acquiring two majority languages, and with children acquiring a minority language and one or both of the majority languages. In addition, children in the current study also differed with regards to the age of second-language acquisition, which allowed us to examine the effects of age of second-language acquisition.

Instead of focusing only on group differences over time, the present longitudinal study used a latent growth curve modelling approach that aimed to estimate between-person differences in within-person change (Curran, Obeidat, and Losardo 2010; Preacher et al. 2008). In other words, this approach separates the variance into a part that occurs within a specific child and a part that occurs between children. Within-person change is typically referred to as individual growth curves or latent trajectories and these can vary from one person to the next

with regards to their shape (Curran, Obeidat, and Losardo 2010). These curves or trajectories are defined by their intercept and slope. In contrast, between-person differences correspond to variations in intercept and slope values from one person to another (Curran, Obeidat, and Losardo 2010), and are represented by variance around the mean growth terms or random factors. Thus, the latent growth curve model calculates an intercept factor and a slope factor. The intercept factor represents information about the overall mean and variance of the individual intercepts across the measurement points (Karevold et al. 2012). In contrast, the slope factor represents individual variability in change over time in the measured behaviour; with the mean of the slope factor measuring the average change in the measured behaviour over time, and the variance of the slope factor representing individual differences in change over time (Karevold et al. 2012). For longitudinal data collected across several years, a latent growth curve model is more flexible than traditional analyses methods (e.g. repeated measures analyses of variance or analyses of covariance), because it can adapt to complex data sets that include partially missing data, non-normally distributed repeated measures, and non-linear trajectories (Curran, Obeidat, and Losardo 2010). Thus, this approach is ideally suited to the present research questions and data.

Research questions

In the present study, children's vocabulary was measured between the ages of 3½ years and 8 years with school entry occurring after the children's 5th birthday. We examined the following four research questions exploring differences in vocabulary size (associated with the intercept) and rate of vocabulary growth (associated with the slope). (1) For all children, does school entry coincide in different rates of vocabulary growth compared to rates of vocabulary growth prior to school entry? We hypothesized that the first measurement point following school entry (i.e. 6 years of age) might be a key pivot point in vocabulary development for all children as school provides a common ground for learning the school language. (2) When compared to monolingual peers, do multilingual children show (a) different vocabulary sizes upon school entry and/or (b) different rates of vocabulary growth before and after school entry? Based on the research of Scheffner Hammer, Lawrence, and Miccio (2008), we hypothesized that school entry would play an important role on vocabulary size: multilingual children may start with smaller vocabulary size, but show more rapid growth after school entry because formal education might provide a more uniform exposure to the language of schooling. (3) For multilingual children, is the factor of age of second-language acquisition associated with (a) vocabulary size upon school entry and/or (b) the rate of vocabulary growth before and after school entry? Given that previous research has shown smaller vocabularies among sequential bilinguals (e.g. Oller, Pearson, and Cobo-Lewis 2007), we hypothesized that children with simultaneous exposure to two languages would show larger vocabulary sizes than children with sequential exposure to a second (and third language), but that the rates of growth would be comparable. (4) For multilingual children, is the factor of sociolinguistic context of the languages spoken associated with (a) vocabulary size upon school entry and/or (b) the rate of vocabulary growth before and after school entry? Because we assessed children in a majority language, we hypothesized that children who spoke only majority language(s) would have larger vocabularies than children who also spoke a minority language (e.g. Thordardottir et al. 2006 vs. Bialystok et al. 2010),

but that minority language children would show more rapid growth following school entry when they presumably became more systematically exposed to the language of schooling, as was found for a subset of children in Mancilla-Martinez and Lesaux (2011).

Methods

Participants

The participants were drawn from a larger longitudinal study of psychosocial development of children from birth to the age of 18 years (i.e. Jetté, Desrosiers, and Tremblay 1997). In 1996, newborns and their families from main urban areas of the province were recruited to participate in a longitudinal study. A total of 1000 babies identified through Québec's birth registry were randomly selected with a stratification procedure based on child sex and maternal administrative region of residence in two major urban areas. The main exclusionary criteria were the following: babies born very premature (i.e. before 24 weeks of gestation), babies had died or who were sick, parents who spoke neither French nor English, or families who had moved or with another family member who was seriously sick. Once exclusionary criteria, inability to contact ($N = 15$) and refusals ($N = 221$) were taken into account, 572 families accepted participation at age 5 months (Jetté, Desrosiers, and Tremblay 1997; Tremblay et al. 2004). The children were then assessed at regular intervals (more frequently as infants and toddlers, and then approximately once a year until the age of 18 years). The province of Québec has a complex linguistic landscape: French is the official language at the provincial level, English is an official minority language at the provincial level, and a number of minority languages are spoken with no official designation. In this context, many children were multilingual, speaking two or three languages.

For the present study, 317 children whose parents completed a questionnaire about language use and exposure at 6 years of age were selected from the larger longitudinal study. The children's language exposure, as reported on this questionnaire, was used to create the monolingual and multilingual groups (see Table 1 for summary). At 6 years of age, 211 children were monolingual speakers of either French (197) or English (14); and 106 children spoke more than 1 language. A number of children spoke more than 2 languages and represented 20% of the multilingual children (i.e. 22 children).[1] For the multilingual children, we grouped them in two different ways in our analyses: one based on age of acquisition of their second language, and one based on the sociolinguistic status of their languages. For the present study, we focused on the children's receptive vocabulary measured between the ages of 3½ and 8 years. Some families were not available to participate in certain sessions; these missing data are accounted for in the analyses.

For the age of exposure grouping, we defined simultaneous language exposure as exposure to 2 languages before the age of 3 years, and sequential language exposure as exposure to a second (and third language) after this age (Vihman and McLaughlin 1982; Kohnert 2010; Paradis 2010). Based on parent report, of the 106 multilingual children, 38 children had

[1]Separate analysis of variances were conducted for each time-point to investigate whether the trilingual children were different from the bilingual children on vocabulary scores. The results of these analyses showed a significant group difference only at the 6 year-old measurement point ($F(1, 99) = 5.14$, $p < .025$), indicating that trilinguals had smaller vocabularies than bilinguals. Because the groups were otherwise not significantly different, the bilinguals and trilingual children were combined to create the 'multilingual' group.

acquired 2 languages simultaneously: 20 had acquired English and French, and 18 had acquired another language and either English and/or French. For the remaining 68 children, parents reported that they had acquired a second (and third) language sequentially: 45 had acquired English and French, and 23 had acquired another language and either English and/or French. For the sociolinguistic grouping, we grouped together children who spoke the two majority languages only (i.e. French and English) and children who spoke at least one of these languages and a minority language. In addition to French and English, children spoke a variety of languages: Italian, Arabic, Greek, Spanish, German, Portuguese, Polish, and Tagalog. The trilingual children were grouped with the minority language speakers.

Measures

The data from five time points were used to model vocabulary development for monolingual and multilingual children. The children's receptive vocabulary was measured in French or English at five time points: at 3½, 5, 6, 7, and 8 years of age. Measures of non-verbal cognition, mother's education, family income, and daycare attendance were obtained during this time period. We measured receptive vocabulary at two points prior to school entry (i.e. 3½ and 5 years), one point closely following school entry (i.e. 6 years), and two later time points (i.e. 7 and 8 years). In the province of Québec, children must have turned 5 years of age before 1 October in order to begin kindergarten in September. For example, a child who turns 5 years of age on 1 January 2016 will wait to begin school in September 2016, while a child who turns 5 years of age on 15 October 2016 will wait to begin school in the following September (i.e. 2017).

Vocabulary—The children's receptive vocabulary was measured in either English or French, based on the parent's report of the language used most at home at the beginning of the testing period. Only 2% of monolingual children were assessed in English, while 24% of multilingual children were assessed in English. In subsequent years, the language of assessment could be changed if requested by the parent, but only four multilingual children switched between English and French during the testing period. Language of testing remained constant for all the remaining children. In previous studies of cognitive development within this cohort, only the vocabulary assessment was found to be sensitive to the language of administration (Séguin et al. 2009; Geoffroy et al. 2010). Hence, we have corrected for this effect by standardizing scores using grand mean centring of scores across time and within version to avoid impacting the growth functions.

The tools used to assess the children's receptive vocabulary were the *Peabody Picture Vocabulary Test-Revised* (*PPVT-R*: Dunn and Dunn 1981) or the *Évaluation du vocabulaire en images Peabody* (*EVIP*: Dunn, Thériault-Whalen, and Dunn 1993). Both versions are designed to measure receptive vocabulary of children from the ages of 2½ to 18 years and commonly used to this end in the province of Québec. The normative population for the PPVT-R is drawn from English speakers living in the United States. The internal validity of PPVT-R has been assessed using the split-half method and the alpha coefficient, both of which exceed .90 across age groups; the test–retest validity of the test has been assessed and also exceeds .90 across age groups. The normative population for the EVIP is drawn from speakers of French living in Canada. The internal validity of the EVIP has been assessed

using the index of Claparède, which exceeded 1.5 indicating validity for the age groups below 13 years.

These tests contain five training items, followed by a maximum of 170 in French or 228 in English test items placed in growing order of complexity, covering a wide variety of semantic categories, including nouns, verbs and adjectives. For each item, children must identify among four pictures the one that represents the word said by the evaluator. The test is designed such that only a subset of the total items is presented to children based on their age and abilities following a standard procedure to establish floor and ceiling items. A floor item is provided at each six-month interval and can be adjusted such that children need to correctly identify eight consecutive items. A ceiling is established when children incorrectly identifies 6 items within a group of 8 consecutive items. Thus, although the number of test items differ between French and English, children between 3½ and 8 years do not complete all items on these tests.

Other measures—In addition to the childrens age of exposure and the sociolinguistic status of the ' languages spoken, we included covariates known to be associated with vocabulary development such as non-verbal cognitive ability, sex of the child, daycare attendance, maternal education and family revenue (Geoffroy et al. 2007; Geoffroy et al. 2010). We measured children's non-verbal cognition using the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV)-Block Design Subtest at 6 years of age (Wechsler 2003). As a proxy to socio-economic status, we calculated maternal education (measured on a 9-point scale) and the family income (measured on an eight-point scale) averaged across the study period. Finally, we tallied the number of years that children attended daycare prior to school entry. These measures are summarized for each group in Table 1.

Statistical analyses

All analyses were conducted using Mplus statistical software version 7.11 (Muthén and Muthén 1998–2013) and maximum likelihood with robust standard errors estimation. Full information maximum likelihood was used to account for missing data. Tests of goodness of fit included the comparative fit index (CFI; Bentler 1990), Tucker–Lewis index (TLI), root-mean-square error of approximation (RMSEA; Browne and Cudeck 1993), and standardized root-mean residual (SRMR). Traditionally, CFI and TLI ≥.90 and RMSEA and SRMR ≤.08 are considered as indicative of acceptable fit, whereas CFI and TLI ≥.95 and RMSEA and SRMR ≤.05 are considered as indicative of excellent fit (Little 2013).

Results

Correlation matrix

A correlation matrix was constructed to provide an overview of the relations between the variables (see Table 2). Significant positive correlations were observed between the measures of vocabulary across the five time points. In addition, maternal education and family income were positively correlated with vocabulary at all-time points. Multilingual status per se (i.e. multilingual vs. monolingual) was not correlated with vocabulary, but negative correlations were observed between vocabulary and simultaneous language

exposure (i.e. simultaneous multilinguals) at 8 years, majority language status multilinguals (i.e. majority multilinguals) at 6, 7 and 8 years, and minority language status multilinguals (i.e. majority multilinguals) at 6 and 8 years. Finally, daycare was negatively correlated with multilingual status generally, and simultaneous language exposure and minority language status more specifically.

Growth curve models

Two steps of analyses were conducted. The first research question, which explored differences in vocabulary rates prior to and following school entry, was assessed in a latent growth curve model to examine change in receptive vocabulary from 3½ to 8 years of age via a non-conditional growth model. Second, a conditional growth model was created by adding covariates to the best fitting growth model of receptive vocabulary to examine the next three research questions on the potential association of being multilingual (multilingual model), learning a second language simultaneously or sequentially (age of acquisition model), or learning a majority or minority second language (sociolinguistic context model) with mean levels of receptive vocabulary (intercept) and change in vocabulary across time (slopes).

Unconditional growth curve model

Research Question 1—For all children, does school entry coincide in different rates of vocabulary growth compared to rates of vocabulary growth prior to school entry? As we were particularly interested in receptive vocabulary before and after the entry into formal schooling, a piecewise latent growth curve model was conducted to model individual variability in vocabulary scores and changes in vocabulary. A piecewise latent growth curve model allowed for breaking up the growth trajectory into two growth factors, in our case before and following school entry (i.e. from 3½ to 8 years). The model was centred at 6 years (intercept), the measurement point closely following school entry, and thus the first growth factor, slope 1, captured growth from 3½ to 6 years, until, and including school entry, while the second growth factor, slope 2, captured growth from 6 to 8 years, after school entry. In this way, the piecewise model captured different growth patterns occurring during the observed period (Chou et al. 2004). In this type of model, there was one intercept factor for each individual, which represented information about overall means across the five time points. The slope factors described within-individual change over time. The means of the slope factors were the average change in vocabulary per interval, and the variances of the slopes represented between-individual variability in the change in vocabulary, as some children changed more than others.

We tested a first model that modelled linear change from 3½ to 6 years (slope 1) and from 6 to 8 years (slope 2), but this model did not fit the data well ($\chi^2(6, 317) = 38.04$; CFI = .93; TLI = .89; RMSEA = .13; SRMR = .15). Modification indices and the observed means of receptive vocabulary indicated that while growth from 3½ to 6 was linear, growth from 6 to 8 years did not follow a linear trajectory.

A second model was fitted where the penultimate loading (at 7 years) was freed. This model fit the data well ($\chi^2(5, 317) = 12.96$; CFI = .98; TLI = .97; RMSEA = .07; SRMR = .05) and

was used in the following analyses (see Figure 1). The model confirmed that while growth is linear from 3½ to 6 years, it is not linear from 6 to 8 years, with steeper growth in vocabulary from 6 to 7 years, than from 7 to 8 years being identified.

The results of this second model first showed that the mean centred vocabulary score on the measure at 6 years of age (the intercept) was 11.6, and it changed at a rate of 22.2 per year before the age of six, but only at a rate of 11.5 per year after this age. Second, the results showed that there was significant variability in mean receptive vocabulary between children (intercept, centred $M = 11.6$, $p < .001$; variance = 186.6, $p < .001$). Also, mean growth rate was significant and there was significant variability between children from 3½ to 6 years (slope 1, centred $M = 22.2$, $p < .001$; variance = 21.0, $p < .001$) and from 6 to 8 years (slope 2, centred $M = 11.5$, $p < .001$, variance = 19.7, $p = .001$). Significant (unexplained) variability among individuals in the unconditional model was expected and was a necessary condition for examination of the factors that may (partly) account for this variability. Thus, we examined whether part of this between-individual variability could be systematically accounted for by factors of interest (covariates and multilingual status) in the conditional growth curve models. Finally, results showed that the intercept and slope factors were significantly correlated for both slopes, but in opposite direction: the higher the mean levels of receptive vocabulary at age 6 (intercept), the steeper the growth rate had been between 3½ and 6 years ($r = .43$, $p < .001$), and the flatter the growth rate between 6 and 8 years ($r = -.44$, $p < .001$). In terms of the correlation between the slopes themselves: the steeper the growth rate observed between 3½ and 6 years, the flatter the growth rate observed between 6 and 8 years ($r = -.37$, $p < .003$).

Conditional growth curve models

Multilingual model. Research Question 2—When compared to monolingual peers, do multilingual children show (a) different vocabulary sizes upon school entry and (b) different rates of vocabulary growth before and after school entry? To answer this question, we explored the role of multilingual status (see Table 3 and Figure 2). A dichotomous variable identifying monolingual and multilingual children, together with the covariates which included, sex of the child, non-verbal cognition, family income, maternal education, and daycare attendance were entered as covariates into the previously described model (i.e. the second model). Together, the covariates explained 9% of the variance of the intercept, 5% of the first slope, and 3% of the second slope.

This model fit the data well (model 1: $\chi^2(17) = 20.84$, CFI = .99, TLI = .99, RMSEA = .03, SRMR = .03) and showed no significant differences between monolinguals and multilinguals as a whole for vocabulary size (intercept: $\beta = -.04$, $p = .49$) upon school entry. There were no significant group differences with regards to growth. In addition, higher mean slopes prior to school entry was associated with daycare attendance (slope 1: $\beta = .164$, $p < .005$) and higher mean vocabulary scores at the intercept were associated with maternal education (intercept: $\beta = .20$, $p < .001$) and family income (intercept: $\beta = .14$, $p < .03$). The other covariates did not predict growth rate or intercept across the time periods.

Age of onset of second language exposure model: Research Question 3—For multilingual children, is the age of second-language acquisition associated with (a) the vocabulary size upon school entry or (b) the rate of vocabulary growth before and after school entry? Next, we explored the role of age of onset of second-language acquisition (see Table 3 and Figure 3). Thus, we subdivided the multilingual group into simultaneous and sequential language exposure groups and also entered the covariates (i.e. sex of the child, non-verbal IQ, family income, daycare attendance and maternal education) into a model comparing them to monolinguals; the model fit the data well (model 2: $\chi^2(19) = 21.73$, CFI = .99, TLI = .99, RMSEA = .02, SRMR = .03). When age of onset of second-language acquisition was examined, results showed no significant differences in vocabulary size at intercept between the simultaneous and the monolingual groups (intercept: $\beta = -.11$, $p = .11$), nor between the sequential and the monolingual groups (intercept: $\beta = -.01$, $p = .83$). Additionally, there were no significant differences with regards to early and later growth rate between the groups. The covariate of daycare attendance did predict growth rate in vocabulary prior to school entry (slope 1: $\beta = .16$, $p < .05$), but the other covariates did not predict growth rate across the time periods. Maternal education (intercept: $\beta = .21$, $p < .009$) and family income ($\beta = .13$, $p < .05$) did significantly predict higher vocabulary scores at the 6 year intercept. Together, the covariates explained 10%, 4%, and 4% of the variance of the intercept, first slope and second slope of vocabulary, respectively.

Sociolinguistic context model: Research Question 4—For multilingual children, is the sociolinguistic context of the languages spoken associated with (a) the vocabulary size upon school entry or (b) the rate of vocabulary growth before and after school entry? Finally, we explored how sociolinguistic context was associated with vocabulary development (see Table 3 and Figure 4). For this analysis, we compared the multilinguals to the monolinguals based on the languages spoken: either only majority languages (i.e. English and French) or majority and minority languages (e.g. English or French and another language). We entered the language status and the covariates (i.e. sex of the child, non-verbal IQ, family income, daycare attendance and maternal education) into the model. The model fit the data well (model 3: $\chi^2(19) = 24.25$, CFI = .99, TLI = .98, RMSEA = .03, SRMR = .03). When language status was added to the model, results showed that only minority language multilingual children had a lower mean level of vocabulary than monolingual children (intercept: $\beta = -.17$, $p < .017$), whereas the majority language multilingual children showed comparable mean level of vocabulary to the monolingual children (intercept: $\beta = .06$, $p = .28$). The minority language multilinguals also had a less rapid growth rate in vocabulary between 3½ and 6 years (slope 1: $\beta = -.19$, $p < .007$) compared to monolinguals. Interestingly, these same minority language multilinguals showed a similar growth rate following entry in school compared to their monolingual peers (slope 2: $\beta = .04$, $p = .74$). It is important to note that the significant associations with minority language status remained even when age of onset of second-language acquisition was taken into account. The covariates did not predict growth rate in vocabulary across these time periods but maternal education (intercept: $\beta = .19$, $p < .012$) and family income (intercept: $\beta = .13$, $p < .047$) did significantly predict higher mean vocabulary scores at the intercept. Together, the covariates explained 12%, 9%, and 5% of the variance of the intercept, first slope and second slope of vocabulary, respectively.

Discussion

The goal of the present study was to investigate vocabulary development among monolingual and multilingual children prior to and following school entry. Using latent growth curve modelling, we explored four models to answer these four research questions: (1) for all children, does school entry coincide with different rates of vocabulary growth compared to rates of vocabulary growth prior to school entry? (2) When compared to monolingual peers, do multilingual children show different vocabulary sizes and/or different rates of vocabulary growth? (3) For multilingual children, is the age of onset of second-language acquisition associated with vocabulary size and/or rate of vocabulary growth? (4) For multilingual children, is the sociolinguistic context of the languages spoken associated with vocabulary size and/or rate of vocabulary growth?

To explore the first research question, we evaluated several models to identify the one that best fit the data. Given that school entry in our context occurred after the children's 5th birthday, we hypothesized that 6 years of age might be a key pivot point in vocabulary development for these children. Thus, we focused on a piecewise latent growth curve model with the intercept centred at 6 years of age. Consistent with our predictions, school entry did serve as a pivot point in vocabulary development. Prior to this age, we found a steady rate of development (i.e. linear growth) in vocabulary, which corresponded to the period of steepest growth. Following this age, we found a decreasing rate of development (i.e. non-linear growth), with the least amount of growth occurring between the ages of 7 and 8 years. The results showed that children made significant gains in their vocabulary across the study period from 3½ to 8 years, but had the fastest growth prior to school entry. Further, the relation between vocabulary size and growth rate was such that children with smaller vocabulary at the age of 6 years had less steep growth curves prior to this age, but steeper growth rates following school entry. These results suggest that although some children start school with smaller vocabularies, when exposed to many new words in a formal school setting (or perhaps to better language models), they learn words more quickly.

To explore the second research question of how multilingualism is associated with receptive vocabulary development, we compared the multilingual children to their monolingual peers with regards to their mean vocabulary and their rate of vocabulary growth. We included several covariates, including the sex of the child, non-verbal cognition, daycare attendance, family income, and maternal education in the model. For both monolingual and multilingual children, higher vocabulary scores at 6 years of age were predicted by higher family revenue and higher maternal education; and steeper growth curves prior to school entry were predicted by daycare attendance. When we explored differences between monolingual and multilingual children, results indicated no significant differences in mean vocabularies at the age of 6 years and no significant differences in growth rates either before or following school entry. The lack of differences in vocabulary at the age of 6 years contrasts with previous research (e.g. Bialystok et al. 2010; Oller, Pearson, and Cobo-Lewis 2007) and may be linked to our ability in the context of the current study to assess many multilingual children in their strongest language (i.e. either English or French). The finding of similar growth rates suggests that multilingual children learn new words at a rate commensurate with their monolingual peers. This new finding supports the notion that multilingual

language exposure does not in itself slow down the process of word learning. Indeed, these children might actually learn words more rapidly if one considers that they are also learning new vocabulary in their other language(s) at the same time, as has been reported in studies that measured vocabulary in both languages (e.g. Junker and Stockman 2002; Pearson, Fernandez, and Oller 1993). However, because we only measured their vocabulary in one language, we can only speculate on this point.

To explore the third research question of how age of onset of second-language acquisition is associated with vocabulary size and rate of development, we compared simultaneous multilingual children and sequential multilingual children to their monolingual peers. Again, we included the sex of the child, non-verbal cognition, daycare attendance, family income and maternal education as covariates in the model. As in the previous model, maternal education and family income significantly predicted higher vocabulary scores at the age of 6 years across the groups, and daycare attendance predicted greater growth rate prior to school entry. However, when age of onset of second-language acquisition was examined, no significant differences were observed across the groups for vocabulary size at the age of 6 years or in mean growth rates. In light of previous research reporting smaller vocabulary size for sequential bilingual children (e.g. Oller, Pearson, and Cobo-Lewis 2007), the present findings may appear surprising. However, when we explored the characteristics of the sequential group, we see that the majority of these children (i.e. 45 of 68) had learned either French or English prior to the age of 3 years. Because they were also evaluated on one of these languages, their relative strength in the language that they had spoken since birth is not surprising. Previous researchers who found that sequential bilinguals had smaller vocabulary size had often assessed children's vocabulary in their non-dominant language (Oller, Pearson, and Cobo-Lewis 2007; Scheffner Hammer, Lawrence, and Miccio 2008). In fact, our finding is consistent with previous research reporting that bilinguals can show monolingual-like vocabulary size when they are assessed in their dominant language (e.g. Thordardottir et al. 2006). When simultaneous speakers are compared to sequential speakers, previous research has reported contradictory findings: some simultaneous bilinguals had stronger vocabulary than their sequential bilingual peers (e.g. Scheffner Hammer, Lawrence, and Miccio 2008), while others had weaker abilities (Mancilla-Martinez and Lesaux 2011). In the present study, the simultaneous multilingual children support the research that shows similar vocabulary abilities in at least one of their languages when compared to their monolingual and sequential multilingual peers.

To explore the fourth research question of how the sociolinguistic status of the languages spoken by the children is associated with vocabulary size and rate of development, we compared bilingual children who spoke majority languages (English and French) and bilingual and trilingual children who spoke a minority language (a language other than English or French) in addition to English and/or French to their monolingual peers. Given that few studies have compared, in the same setting, multilingual speakers who acquire two majority languages vs. those who acquire a minority and a majority language, we believe that this fourth question contributes important new data. Again, we included the sex of the child, non-verbal cognition, daycare attendance, family income and maternal education as covariates in the model, but only family income and maternal education significantly predicted higher vocabulary scores at the age of 6 years across the groups. When

sociolinguistic status was considered, the children who spoke a minority language had smaller mean vocabularies at 6 years of age than children who spoke majority languages (either bilingual or monolingual). In addition, these minority language children also showed less rapid growth in vocabulary prior to school entry. These associations were observed even when age of onset of second-language acquisition was taken into account. Admittedly, as we only measured the children in the majority language, the lower scores for minority language speakers may be due to the fact that we measured (one of) their weaker language(s). In contrast, the majority language bilinguals were more likely to be measured in their dominant language because assessments were conducted in either English or French, whichever was the child's strongest language according to the parents. Most important, though, is that after school entry, the minority language speakers' growth rate no longer lagged behind their peers: instead of having significantly less rapid growth than their monolingual peers, they had similar growth rates compared to their peers. This result contrasts Mancilla-Martinez and Lesaux (2011) who observed differences in the English growth rate for children from balanced English–Spanish or Spanish-dominant homes. As a whole, our results suggest that when faced with increased input in the majority language, the minority language children met this challenge by increasing their rate of word learning. Thus, the increased exposure in school provided a boost in their school-based language, allowing them to keep pace with their monolingual peers in their rate of learning in this language. However, a similar rate of vocabulary learning after school entry was not sufficient for them to catch up with their monolingual peers in their vocabulary size before the end of the study period.

Our results highlight the important role of school entry in understanding vocabulary growth rates for both monolingual and multilingual children. Overall, we observed steeper linear growth curves prior to school entry followed by less steep non-linear growth after school entry. However, individual differences were observed such that children with less steep growth curves prior to school entry had steeper growth curves following school entry, and vice versa. For the children with smaller vocabulary size before starting school, formal schooling appears to provide them with more opportunities for learning new vocabulary. Thus, formal schooling may level the playing field by counterbalancing the benefits of attending daycare, higher family revenue and maternal education on early vocabulary size.

A unique contribution of the present study is a better understanding of the role of school entry for minority language children. We found that school entry brought about particular changes for minority language children: they had significantly smaller vocabularies and significantly lower growth rate in the language of schooling prior to school entry but similar growth rates following school entry compared to peers. In their study of children from kindergarten to grade four, Lesaux, Rupp, and Siegel (2007) observed that although minority language children were significantly weaker than their English-speaking peers in kindergarten on reading-related skills, they made gains and were comparable to their peers by grade four. Although we did not document evidence of minority children catching up fully with their peers, we also did not follow them up to grade four. However, together the findings of both studies indicate that the school context may stabilize the developmental trajectories for the language of schooling for minority language children by providing a common context for language learning. Despite this stabilizing effect, the minority language multilinguals did have smaller vocabulary sizes throughout the study period, which may

place them at risk for lower academic achievement. In future work, we aim to study both languages spoken by bilingual children (and their parents) to better understand the impact of school entry on both of their languages and on their achievement in school.

The present study was part of a larger longitudinal study of the psychosocial development of children from birth to the age of 18 years. Although we were able to measure the vocabulary development of children between the ages of 3½ and 8 years, the measures were obtained in either French or English. Whereas French and English were majority languages in this context as they are used in schooling and receive official support from the government, there was more variability within the minority language group in the status of the different languages. As a result, we do not have a complete picture of the multilingual children's vocabulary development. In particular, for the 13% of children who spoke a minority language, the diversity of the languages spoken and the absence of standard tools for many of these languages made it difficult to measure their complete vocabulary abilities. Although we cannot pretend to have captured the full range of factors that influence vocabulary development, we were able to document how the role of cognition, sex of the child, family revenue, maternal education, daycare and multilingual status together might contribute to vocabulary development. As a group, these factors accounted for an important amount of variance in the intercept (9%) and the slopes prior to (5%) and following (3%) school entry. Future research, however, should attempt to measure both (or all three) languages wherever possible to provide a more complete picture of vocabulary repertoire. This complete picture would allow for analyses of how language dominance impacts vocabulary size and rates of development.

Conclusion

Previous research on bilingual vocabulary development has focused on group differences observed at distinct points in time, either in static or longitudinal studies. In contrast, the present study provides a dynamic view of vocabulary development between the ages of 3½ and 8 years, a period that encompasses school entry in our region (i.e. after the child's 5th birthday). The unique sociolinguistic context allowed us to compare monolingual children with multilingual children who spoke both majority languages, and with children who spoke a minority language in addition to one or both majority languages. The results of our study suggest that smaller vocabularies when entering school may be more accurately associated with multilingual who speak a minority language rather than multilingual children in general. In other words, being multilingual in and of itself did not slow children's rate of vocabulary growth in the majority language. In fact, in contrast to Mancilla-Martinez and Lesaux (2011) who reported different rates of growth between bilingual and monolingual children after school entry, the monolingual and multilingual children in this study showed similar rates of growth following school entry. Only minority language children showed slower growth rates, and these were limited to measures obtained during the preschool years. Once minority language children entered the formal school system, their word-learning rate was comparable to the other groups. The differences between monolingual and multilingual children suggest that *which* languages children speak as a function of their status in the community may matter more than being multilingual per se.

More generally, our results indicate that school entry may mark an important change in all children's vocabulary growth: whereas vocabulary changed steadily, linearly, prior to school entry, growth rate decreased progressively following entry to school. In addition, children with a smaller vocabulary at the age of 6 years had less steep growth curves prior to this age but followed by steeper growth rates following school entry. The opposite was true for children with relatively large early vocabularies. Additional research is necessary to confirm these findings; however, as a whole, our findings suggest that, at least in terms of vocabulary growth, there may be some truth in Horace Mann's (1848) famous quote that 'Education, then, beyond all other devices of human origin, is the great equalizer of the conditions of men—the balance-wheel of the social machinery.'

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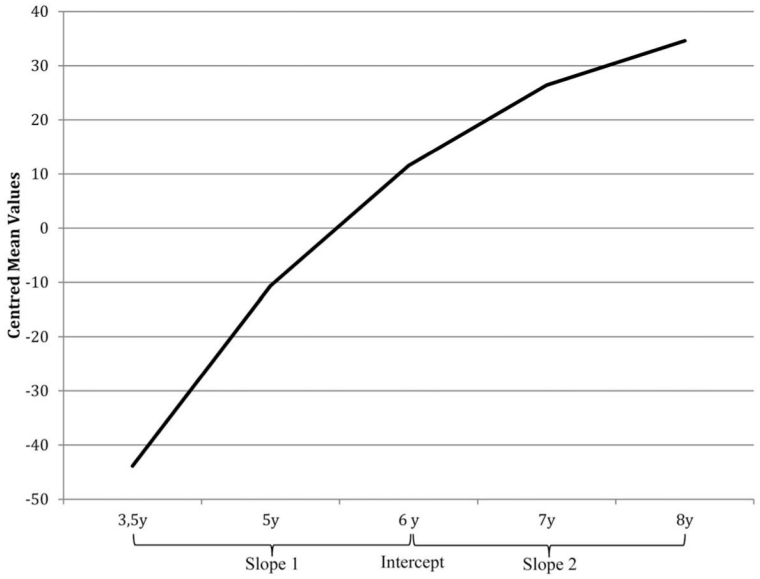

Figure 1.
Development of vocabulary from 3½ to 8 years based on centred mean values.

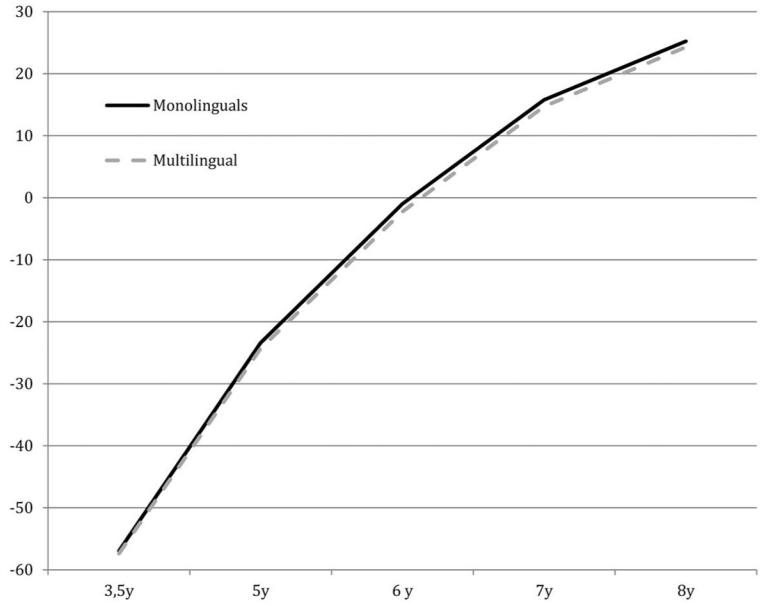

Figure 2.

Development of vocabulary from 3½ to 8 years for monolingual vs. multilingual children based on centred mean values.

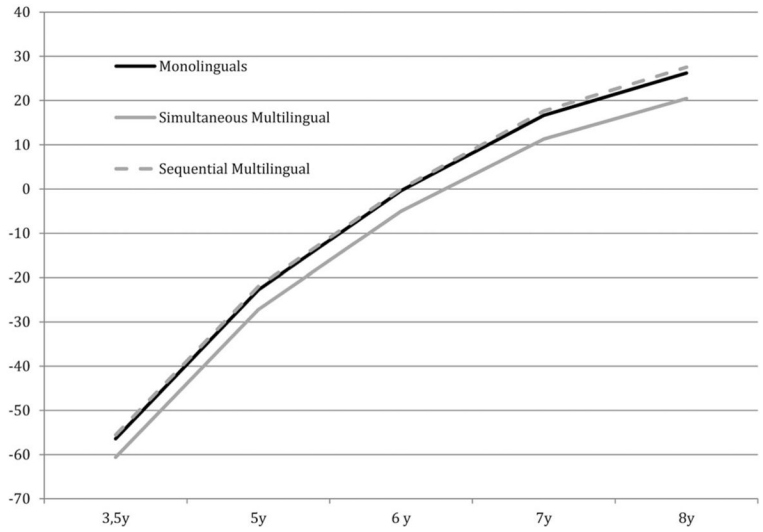

Figure 3.

Development of vocabulary from 3½ to 8 years by age of acquisition based on centred mean values.

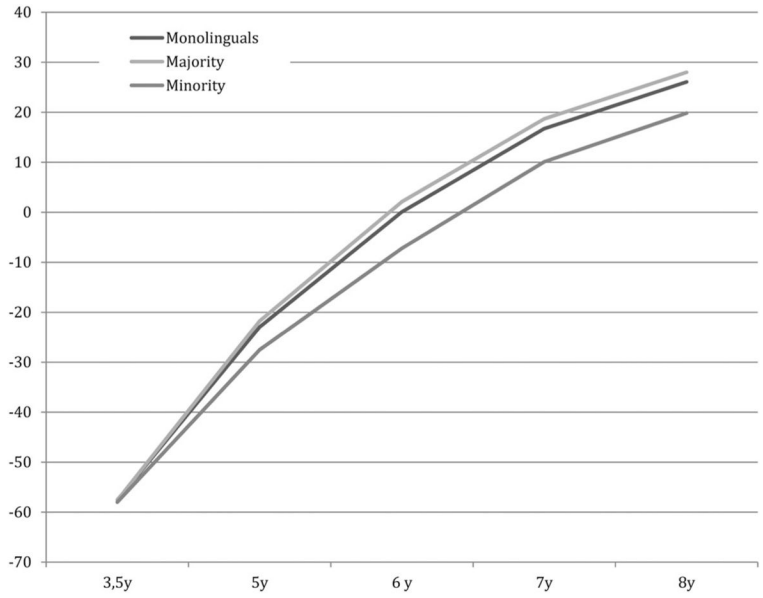

Figure 4.

Development of vocabulary from 3½ to 8 years by sociolinguistic context based on centred mean values.

Table 1

Summary of number of participants and covariates across the groups, including the two breakdowns for the multilingual sub-groups.

Group	Number of participants	Mean non-verbal cognition[a] (SD)	Mean mother's level of education[b] (SD)	Mean family revenue[c] (SD)	Mean years attended daycare (SD)
Multilingual[d]	106	28.4 (29.8)	3.2 (1.4)	6.3 (1.7)	2.5 (1.7)
Simultaneous	38	30.6 (28.1)	3.1 (1.5)	6.1 (1.5)	2.8 (1.5)
Sequential	68	27.3 (23.3)	3.2 (1.4)	6.4 (1.8)	2.0 (1.9)
Majority	65	29.6 (25.9)	3.4 (1.4)	6.5 (1.7)	2.8 (1.6)
Minority	41	26.3 (22.8)	2.8 (1.4)	6.0 (1.7)	1.9 (1.8)
Monolingual	211	31.7 (29.7)	4.5 (2.0)	6.4 (1.5)	3.0 (1.6)

[a] Non-verbal cognition was measured via the WISC-IV-Block Design Subtest.

[b] Mother's level of education reported on a scale from 1 (partial completion of a secondary education, 'high school') to 9 (completion of a doctorate); 3 = partial completion of undergraduate university degree.

[c] Family revenue reported on a scale from 1 (below 10,000 Canadian$) to 8 (above 80,000 Canadian$).

[d] The multilingual group was further divided based on sequential vs. simultaneous age of onset of second-language acquisition (Question 3), and based on majority vs. minority language status (Question 4).

Table 2

Correlations between all variables included in models (variables are described in the methodology section above).

	1. Vocabulary 3.5 years	2. Vocabulary 5 years	3. Vocabulary 6 years	4. Vocabulary 7 years	5. Vocabulary 8 years	6. Multilingual status	7. Majority multilingual	8. Minority multilingual	9. Simultaneous multilingual	10. Sequential multilingual	11. Sex of the child	12. Non-verbal cognition	13. Daycare attendance	14. Maternal education
1. Vocabulary 3.5 years	1.00													
2. Vocabulary 5 years	0.61*	1.00												
3. Vocabulary 6 years	0.53*	0.67*	1.00											
4. Vocabulary 7 years	0.51*	0.63*	0.69*	1.00										
5. Vocabulary 8 years	0.48*	0.60*	0.62*	0.74*	1.00									
6. Multilingual status	0.02	0.04	−0.03	0.04	−0.05	1.00								
7. Majority multilingual	0.02	0.08	0.11*	0.11*	0.11*	n/a	1.00							
8. Minority multilingual	−0.01	−0.08	−0.18*	−0.09	−0.20*	n/a	n/a	1.00						
9. Simultaneous multilingual	−0.08	−0.05	−0.10	−0.08	−0.14*	n/a	n/a	n/a	1.00					
10. Sequential multilingual	0.08	0.05	0.05	0.09	0.07	n/a	n/a	n/a	n/a	1.00				
11. Sex of the child	0.03	0.01	0.03	0.02	−0.02	0.09	0.10	0.01	0.04	0.07	1.00			
12. Non-verbal cognition	−0.08	−0.05	−0.07	−0.14	−0.10	−0.05	−0.03	−0.05	−0.02	−0.06	−0.08	1.00		
13. Daycare attendance	−0.08	−0.06	0.04	0.08	0.09	−0.13*	0.01	−0.21*	−0.18*	0.00	−0.05	−0.04	1.00	
14. Maternal education	0.19*	0.21*	0.21*	0.26*	0.24*	−0.09	0.12*	−0.01	0.10	0.04	0.04	0.14*	0.03	1.00
15. Family income	0.27*	0.23*	0.19*	0.16*	0.18*	−0.02	0.04	−0.08	−0.06	0.03	0.05	0.04	0.03	0.42*

Note: n/a: correlations are not possible since they represent mutually exclusive groups.

* $p < .05$.

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Table 3

Result from the three models of the development of vocabulary from 3½ to 8 years (N = 317): parameter estimates in comparison to monolingual children (b), standard error (SE), p-value (p).

	Growth 3½ to 6 years				Intercept (6 years or mean level)				Growth 6–8 years			
	b	**SE**	***b*/SE**	***p***	***b***	**SE**	***b*/SE**	***p***	***b***	**SE**	***b*/SE**	***p***
Multilingual model												
Multilingual/monolingual	−0.035	0.079	−0.441	.659	−0.043	0.063	−0.685	.493	0.017	0.096	0.178	.858
Sex of the child	0.012	0.074	0.16	.873	0.015	0.061	0.254	.799	−0.085	0.096	−0.885	.376
Non-verbal cognition	−0.011	0.087	−0.131	.896	−0.119	0.069	−1.741	.082	−0.094	0.1	−0.943	.346
Daycare attendance	**0.164**	**0.084**	**1.959**	**.05***	0.016	0.065	0.246	.806	0.097	0.101	0.961	.337
Maternal education	0.098	0.099	0.994	.32	**0.198**	**0.079**	**2.49**	**.013***	0.077	0.11	0.698	.485
Family income	−0.137	0.098	−1.387	.165	**0.138**	**0.065**	**2.14**	**.032***	−0.091	0.115	−0.789	.430
Age of onset of second language exposure model												
Simultaneous	−0.013	0.087	−0.148	.882	−0.11	0.069	−1.605	.108	−0.043	0.127	−0.342	.733
Sequential	−0.033	0.08	−0.409	.682	0.013	0.061	0.211	.833	0.043	0.087	0.498	.619
Sex of the child	0.013	0.074	0.174	.862	0.016	0.061	0.257	.797	−0.088	0.095	−0.919	.358
Non-verbal cognition	−0.011	0.088	−0.131	.896	−0.12	0.069	−1.741	.082	−0.098	0.099	−0.987	.323
Daycare attendance	**0.163**	**0.084**	**1.934**	**.053***	0.002	0.065	0.037	.97	0.088	0.101	0.877	.381
Maternal education	0.089	0.101	0.882	.378	**0.209**	**0.08**	**2.618**	**.009***	0.101	0.108	0.94	.347
Family income	−0.133	0.099	−1.348	.178	**0.127**	**0.064**	**1.993**	**.046***	−0.106	0.118	−0.904	.366
Sociolinguistic context model[a]												
Majority	0.076	0.082	0.923	.356	0.061	0.057	1.08	.280	−0.003	0.092	−0.036	.971
Minority	**−0.191**	**0.071**	**−2.683**	**.007***	**−0.168**	**0.07**	**−2.384**	**.017***	0.037	0.112	0.332	.740
Sex of the child	0.002	0.072	0.033	.974	0.006	0.06	0.1	.921	−0.08	0.093	−0.856	.392
Non-verbal cognition	−0.014	0.084	−0.172	.863	−0.118	0.067	−1.779	.075	−0.088	0.097	−0.906	.365
Daycare attendance	0.126	0.082	1.54	.124	−0.015	0.063	−0.24	.810	0.095	0.1	0.952	.341
Maternal education	0.091	0.096	0.94	.347	**0.192**	**0.076**	**2.511**	**.012***	0.069	0.107	0.647	.517
Family income	−0.145	0.1	−1.451	.147	**0.125**	**0.063**	**1.984**	**.047***	−0.082	0.112	−0.734	.463

Notes: Significant results (i.e. $p < .05$) are identified in bold and by an asterisk.

Standardized coefficients provided. Model fit: multilingual model: $\chi^2(17) = 20.84$, CFI = .99, TLI = .99, RMSEA = .03, SRMR = .03; age of onset of second-language acquisition model: $\chi^2(19) = 21.73$, CFI = .99, TLI = .99, RMSEA = .02, SRMR = .03; sociolinguistic context model: $\chi^2(19) = 24.25$, CFI = 0.99, TLI = .98, RMSEA = .03, SRMR = .03.

Note on interactions: No interactions reached significance, in separate models or in a model where all interactions were entered simultaneously.

[a] The effect of minority speakers remain present if we control for simultaneous learning, which is no longer significant in this model.