Journal of Child Language (2022), **49**, 114–130
doi:10.1017/S030500092000077X

CAMBRIDGE UNIVERSITY PRESS

ARTICLE

Multilingual toddlers' vocabulary development in two languages: Comparing bilinguals and trilinguals

Stephanie L. CÔTÉ[1,2], Ana Maria GONZALEZ-BARRERO[1,2], and Krista BYERS-HEINLEIN[1,2]

[1]Department of Psychology, Concordia University, Canada and [2]Centre for Research on Brain, Language and Music, Concordia University, Canada
Address for correspondence: Ana Maria Gonzalez-Barrero, Concordia University, Department of Psychology, 7141 Sherbrooke St. West Montreal, Québec, Canada, H4B 1R6
E-mail: anamaria.gonzalezbarrero@mail.concordia.ca

(Received 27 January 2020; revised 1 July 2020; accepted 23 November 2020;
first published online 10 February 2021)

Abstract

Many children grow up hearing multiple languages, learning words in each. How does the number of languages being learned affect multilinguals' vocabulary development? In a pre-registered study, we compared productive vocabularies of bilingual ($n = 170$) and trilingual ($n = 20$) toddlers aged 17–33 months growing up in a bilingual community where both French and English are spoken. We hypothesized that because trilinguals have reduced input in French and English due to time spent hearing their third language, they would have smaller French–English vocabulary sizes than bilinguals. Trilinguals produced on average 2/3 of the number of words in these languages that bilinguals did: however, this difference was not statistically robust due to large levels of variability. Follow-up analyses did, however, indicate a relationship between input quantity and vocabulary size. Our results indicate that similar factors contribute to vocabulary development across toddlers regardless of the number of languages being acquired.

Keywords: Multilinguals; Vocabulary Development; Language Input

Introduction

Two-year-olds Luca and Elena are learning French and English at their daycare and in their community, where both languages are spoken regularly. Their situation is not unique, as migration and globalization have increased the number of children growing up multilingual (Surrain & Luk, 2019). However, Luca's parents also speak French and English to him at home, while Elena's parents speak Spanish to her at home. Increasing research has investigated the language development of bilingual children like Luca, but very little research has studied trilinguals like Elena (Hoffmann, 2001; Unsworth, 2013b). In a unique approach, the current study compared bilingual and trilingual toddlers aged 17–33 months growing up in

Montréal, where both French and English are widely spoken. This bilingual community context enabled us to compare French–English vocabularies of bilinguals learning only these two languages ($n = 170$), with the French–English vocabularies of trilinguals who were also learning a third language ($n = 20$). Our main research question was how exposure to a third language would impact French–English vocabulary size in trilinguals compared to bilinguals.

Contributors to Multilingual Vocabulary Development

Vocabulary size is an important and widely used measure of language development in toddlers. Vocabulary at this age is readily measured via parent-report questionnaires, which have a high degree of reliability and validity (Dale, 1991; Fenson et al., 2007). Understanding early vocabulary development is important, as vocabulary size has been shown to predict later academic achievement (Bleses, Makransky, Dale, Højen & Ari, 2016; Marchman & Fernald, 2008).

Vocabulary size is highly variable across children, whether they are from monolingual or multilingual backgrounds (De Houwer, Bornstein & Putnick, 2014; Frank, Braginsky, Marchman & Yurovsky, in press). While not all of this variability has been explained, two robust predictors are age and sex: older children know more words than younger children (e.g., Fenson et al., 2007; Rescorla & Achenbach, 2002), and girls know more words than boys (e.g., Andersson et al., 2011; Huttenlocher, Haight, Bryk, Seltzer & Lyons, 1991).

There is mounting evidence that vocabulary size is tightly coupled with the amount of language input that children receive (Cattani, Abbot-Smith, Farag, Krott, Arreckx, Dennis & Floccia, 2014; Floccia, Sambrook, Delle Luche, Kwok, Goslin, White, Cattani, Sullivan, Abbot-Smith, Krott, Mills, Rowland, Gervain & Plunkett, 2018; Gonzalez-Barrero & Nadig, 2018; Thordardottir, 2011). Amongst monolingual children, those who hear more home language input have larger vocabularies and show steeper growth in vocabulary (Bee, Van Egeren, Pytkowicz Streissguth, Nyman & Leckie, 1969; Pan, Rowe, Singer & Snow, 2005; Song, Spier & Tamis-Lemonda, 2014). Children of higher socioeconomic status (SES) tend to have larger vocabularies than those of lower SES, likely due to higher quantity and quality of language input (Fernald, Marchman & Weisleder, 2013; Qi, Kaiser, Milan & Hancock, 2006).

Language input is particularly relevant to understanding vocabulary development in multilingual children. Monolingual children encounter all words in a single language, but multilinguals' time is divided across their languages. As a result, multilingual children hear individual words, on average, less frequently than monolinguals. For example, a monolingual child will hear the word "dog" every time they encounter the four-legged pet; a French–English bilingual child will hear "dog" or "chien"; and a French–English–Spanish trilingual child will hear "dog", "chien", or "perro" (Unsworth, 2013b).

Studies that have compared monolingual to bilingual children support the link between amount of input and vocabulary size. When their vocabulary is measured in a single language (for example, just English), bilinguals know fewer words than monolinguals (Hoff, Welsh, Place & Ribot, 2014; Pearson, Fernández & Oller, 1993). Bilinguals' single-language vocabulary appears highly associated with input, in that the greater the proportion of time a bilingual hears a particular language, the more words they will know in that language and the more their single-language vocabularies will approach those of monolinguals (Byers-Heinlein, 2013; De Houwer,

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

2007; Place & Hoff, 2011). Although research on trilinguals' vocabulary development is quite limited (e.g., Albin & Gershkoff-Stowe, 2016; Arnaus Gil, Müller, Sette & Hüppop, 2020; Chevalier; 2015; De Houwer, 2004; Montanari, 2010; Quay, 2011), extant studies indicate that the more trilingual children are exposed to one language, the more their vocabulary develops in that language compared to the other two (Montanari, 2010; Oller, 2010; Potgieter, 2016). There is little evidence that multilingualism reduces children's overall rate of word learning, given that monolinguals and bilinguals have similar vocabulary sizes when words from both languages are considered (Core, Hoff, Rumiche & Señor, 2013; De Houwer et al., 2014; Gonzalez-Barrero, Schott & Byers-Heinlein, 2020; Pearson et al., 1993).

However, there are other aspects of multilinguals' experience beyond amount of input that might contribute to vocabulary size. For example, there is some evidence that language balance (i.e., whether the languages are heard in similar or different proportions) contributes to vocabulary outcomes in bilinguals, although language balance is dynamic and often changes over time (Barnes & Garcia, 2013; De Houwer, 1995, 2007; Hoff et al., 2012; Pearson, Fernández, Lewedeg & Oller, 1997; Place & Hoff, 2011; Thordardottir, 2011; Unsworth, 2013b).

Moreover, multilinguals often learn languages that are of unequal sociolinguistic status, and a language's sociolinguistic status may contribute to its acquisition. For example, in a study of Welsh–English bilingual children, the acquisition of Welsh (the minority language) was dependent on the amount of Welsh input, while the acquisition of English (the majority language) was robust across different levels of input (Gathercole & Thomas, 2009). In one of the few studies that included monolinguals (English), bilinguals (English–Polish), and trilinguals (English–Polish–Other), multilingual children growing up in the United Kingdom produced a similar number of English words (the majority language) as monolingual children (Mieszkowska, Łuniewska, Kołak, Kacprzak, Wodniecka & Haman, 2017). However, they produced fewer Polish words (a minority language) than Polish monolinguals. These studies suggest that quantity of input may be more tightly coupled to vocabulary size for minority languages than for majority languages.

The Current Study

The current study used a novel approach to test the effects of input on majority language vocabulary size in multilinguals. While most studies investigating this question have compared monolinguals and bilinguals, we extended this approach by comparing bilinguals and trilinguals. All children were growing up in Montréal, a bilingual community where French and English are both spoken widely and have majority language status relative to other languages. Many Montréal children grow up bilingual in French and English, and, due to the city's cultural diversity, others grow up trilingual, hearing a third minority language at home. We compared bilinguals' and trilinguals' dual-language vocabulary in the two majority languages.

Bilinguals received all their input in French and English, while trilinguals received less total input in these two languages because they sometimes heard their third language. We hypothesized that the amount of French–English input would be linked to toddlers' French–English vocabulary size, and thus predicted that trilinguals would have smaller French–English productive vocabularies than bilinguals. Roughly, we expected that trilinguals' French–English vocabulary would be proportional to their exposure to these two languages. Thus, if a trilingual was exposed to each of

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

their three languages 1/3 of the time, we expected that their French–English vocabulary size would be 2/3 (1/3 + 1/3) that of a French–English bilingual. However, an alternate possibility was that because both French and English are majority languages in the Montréal context, bilinguals and trilinguals could have similar French–English vocabulary size, despite trilinguals' reduced input in these languages.

In order to isolate the potential effects of trilinguals' reduced exposure to French and English, we used two analytic approaches that a) matched and b) statistically controlled for effects of age, sex, socioeconomic status, and balance of exposure to English versus French. Finally, we limited our investigation to French–English vocabulary size, as vocabulary data were not available in trilinguals' third language due to the archival nature of our dataset.

Method

This study was approved by the Concordia University Human Research Ethics Board (approval #10000439). All parents provided written and verbal consent prior to participation. The hypotheses and analysis plan for the current study were pre-registered in the Open Science Framework. The raw data and analysis scripts can be found at https://osf.io/us27h/.

Participants

Archival data from 215 multilingual toddlers (age range: 17–33 months) who had participated in studies at an infant research laboratory between January 2010 and May 2019 and met the trilingual or bilingual exposure criteria (described below) were available for the present study. Data from 25 of these toddlers were excluded due to premature birth (< than 37 weeks of gestation; $n = 6$), low birthweight (< 2500 grams; $n = 10$), reported health or developmental issues ($n = 6$), or missing information on one or more of the key variables ($n = 3$). Therefore, the final sample included data from 20 trilingual toddlers and 170 bilingual toddlers, for a total of 190 participants who met the inclusion criteria. Of these children, 24 (1 trilingual and 23 bilinguals) contributed vocabulary data at more than one age. Thus, there were a total of 217 sets of vocabulary data available for analysis (21 trilingual, 196 bilingual). Sample sizes reported in the remainder of this paper will reflect the number of these vocabulary data sets, rather than the number of individual children.

All participants were growing up in the Montréal area, a multicultural city in the province of Québec (Canada) where French and English are commonly used in everyday life and share similar sociolinguistic status. Fifty-four percent of Montrealers report being bilingual in English and French, and 25% have a first language other than English or French (Schott, Kremin & Byers-Heinlein, 2019; Statistics Canada, 2017).

All participants were exposed to both French and English, and some participants (trilinguals) were exposed to a third language. These third languages varied across children: Arabic ($n = 3$), Chinese ($n = 1$), Creole ($n = 1$), German ($n = 3$), Italian ($n = 1$), Portuguese ($n = 1$), Romanian ($n = 1$), Russian ($n = 1$) and Spanish ($n = 8$). Bilingual participants were exposed to each of their two languages (French and English) between 25% to 75% of their lifetime and had no exposure to a third language, following guidelines from previous studies (Pearson et al., 1997). Similar to Byers-Heinlein and Werker (2009), minimum exposure criteria for trilinguals were

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

Table 1. Demographic Characteristics of the Trilingual and Bilingual Groups

	Trilinguals	Bilinguals	*p* value
	(*n* = 21) M ± SD	(*n* = 196) M ± SD	
Age in months	21.67 ± 3.41	23.62 ± 4.68	.153
Sex	62% female	47% female	.106
Maternal education in years	16.86 ± 2.41	16.38 ± 2.21	.469
Language exposure English (%)	43.50 ± 10.64	51.36 ± 15.04	.033
Language exposure French (%)	29.83 ± 9.06	48.66 ± 15.04	<.001
Language exposure Other (%)	26.80 ± 9.02	N/A	N/A

Note. Here, sample size (*n*) reflects number of French–English vocabulary datasets, which is greater than the number of participants as some participants contributed datasets at multiple ages. *p* value reflects *t*-tests (for continuous variables) or chi-square results (for categorical variables) comparing the two groups, using one datapoint per participant (youngest datapoint) for those who contributed data at more than one age.

somewhat relaxed compared to the bilingual criteria, as even perfectly balanced trilingual exposure would yield only 33% exposure to each language. Thus, trilingual participants included in the study were exposed to each of their three languages (English, French, and one other) at least 15% of their lifetime. Most children had been acquiring French and English simultaneously from birth (trilinguals = 55%, bilinguals = 84%), and the vast majority of others had an early onset of exposure (between 2 to 18 months). In addition, most trilingual children (90%) had been acquiring their third language since birth.

We defined language dominance as the language to which the child had the highest lifetime exposure. By definition, all of the bilinguals were dominant in either French or English, and in our sample the vast majority of the trilinguals were also dominant in one of these two languages. Of the 190 participants, 104 (55%) were dominant in English, 83 (44%) were dominant in French and three (2%) were dominant in their third language. For children who contributed data at multiple ages, this reflects their dominance at their first visit, and we note that four bilingual children's dominance changed across ages. Participants were recruited through government birth lists, daycares, and community organizations. Participants' demographic characteristics (i.e., age, sex, and maternal education) were not statistically significantly different between groups. Children received a t-shirt and an honorary diploma as compensation for their participation. Participants' demographic characteristics are presented in Table 1.

Measures

MacArthur-Bates Communicative Development Inventories: Words and Sentences

The MacArthur-Bates Communicative Development Inventories: Words and Sentences (CDI) questionnaire was used to gather data on children's expressive vocabulary. The CDI is a parent-report instrument that assesses expressive language development in children aged 16 to 30 months. This study focused on the vocabulary checklist of the questionnaire, where parents check off words their child can say (e.g., *car*, *mommy*, *shirt*). Caregivers completed the American English (Fenson et al., 2007) and Québec French (Trudeau, Frank & Poulin-Dubois, 1999) versions of the CDI. Vocabulary

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

data were not gathered in trilinguals' third language, as the data used for this study were archival data collected as part of unrelated experimental studies not specifically focused on trilingual development.

Single-language vocabulary scores in French (with a range of scores from 1 to 664; Trudeau et al., 1999) and English (with a range of scores from 1 to 680; Fenson et al., 2007) were calculated by counting the number of words produced in each language. Our primary measure, however, was total words known in both French and English. This was calculated by summing the French and English vocabulary scores. We note that some studies of multilingual children have focused on concept vocabulary, which counts the number of concepts lexicalized rather than total number of words produced (e.g., translation equivalents "dog" and "chien" are counted as one concept, rather than two words; Pearson et al., 1993). However, we opted to focus on word vocabulary rather than concept vocabulary for two reasons. First, all toddlers' vocabularies were measured in the same two languages (unlike typical studies that use this approach, where monolinguals' vocabularies are measured in one language, but bilinguals' vocabularies are measured in two). Second, we were not able to assess concepts that trilinguals might have only known in their third language.

Language Exposure Questionnaire using the MAPLE approach

Language exposure was measured with the Language Exposure Questionnaire (LEQ; Bosch & Sebastián-Gallés, 2001) using the Multilingual Approach to Parent Language Estimates (MAPLE; Byers-Heinlein et al., 2019). Parents were interviewed about their child's language exposure, providing estimates of how many hours per day the child was exposed to each language across different periods of their lifetime. We computed a percentage estimate of the cumulative exposure, from birth, to each language heard. These estimates were used to classify children as trilingual or bilingual. As expected, trilinguals had significantly less exposure to both French and English than bilinguals, due to their exposure to their third language (see Table 1 and 2). Additionally, we computed a language exposure ratio score for French and English in order to quantify balance of exposure, by dividing participants' percentage of lifetime exposure to English by their percentage of lifetime exposure to French. For instance, if a bilingual child was exposed to 67% English and 33% French, then their English–French language exposure ratio would be 67/33 = 2. If a trilingual child was exposed to 50% English, 25% French, and 25% to their third language, then their English–French language exposure ratio would also be 50/25 = 2, and thus equated to that of the bilingual child despite reduced exposure to English and French. We note that, for trilinguals, this score did not reflect their absolute dominance across their three languages, as only English and French were used for the calculation. As discussed further below, this ratio score was used to match bilinguals and trilinguals, but not for statistical analyses.

Demographic Questionnaire

Parents completed a demographic questionnaire which included information about the child's age, sex, health history, and maternal education. Information from this form was used to identify the children who met the inclusion criteria and to calculate maternal education in years, which was used as a proxy for socioeconomic status (Hoff & Tian, 2005).

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

Procedure

Parents were given the Language Exposure Questionnaire and the demographic questionnaire during their children's participation in one of various experimental studies on language development at the laboratory. The caregiver most familiar with each language was asked to fill out that language's version (French or English) of the CDI. The majority of caregivers completing the questionnaire were mothers (69.4%), followed by fathers (5.8%), both parents (3.2%), and other family members (.5%). Some caregivers did not indicate who completed the questionnaire (21.2%). The vocabulary checklists were completed by the parents within the two weeks prior to their visit to the lab or during their visit. Parents completed the questionnaire either via an iPad or on paper forms. Paper forms were later double-entered into a digital file and checked for accuracy.

Results

Pre-registered analyses

Our confirmatory analyses were pre-registered via the Open Science framework prior to analysis, https://osf.io/us27h/.

Our research goal was to compare the effects of trilingualism versus bilingualism on the acquisition of French and English vocabulary size. As discussed above, vocabulary size is known to be correlated with a range of other factors, including age (Rescorla & Achenbach, 2002), sex (Andersson et al., 2011; Hyde & Linn, 1988; Rescorla & Achenbach, 2002), SES (Bates et al., 1994; Fernald et al., 2013; Hoff, 2003), and, for bilinguals, their ratio of exposure to each language (Barnes & Garcia, 2013; De Houwer, 1995, 2007; Hoff et al., 2012; Pearson et al., 1997; Thordardottir, 2011). Thus, we pre-registered two analytic strategies to control for these potentially confounding factors. First, we selected a subsample (i.e., matched sample) of the full bilingual sample that was closely matched to our trilingual sample on these variables, and compared the two groups' mean vocabulary sizes. As there is disagreement in the literature as to whether matched samples of this nature should be considered statistically independent, our pre-registered analysis plan included both independent and repeated measures samples t-tests, as well as non-parametric Mann-Whitney-Wilcoxon and Wilcoxon Signed Rank tests in the case of non-normal data. Second, we analyzed the full sample ($n = 217$) with a regression model that statistically controlled for the potential confounding variables by including them in the model as predictors.

Matched sample

Matching process

Under the matched sample approach, trilingual toddlers were matched with bilingual toddlers on age, sex, socioeconomic status, maternal education and language exposure ratio. This was done with the Optimal Matching method (i.e., minimizing the average absolute distance between all matched pairs) from the Optmatch package in the R software (Hansen & Klopfer, 2006; R Core Team, 2013). First, Optmatch generated 13 trilingual data points matched to 13 bilingual data points on exact age in months, sex and maternal education along with the closest match on language exposure ratio. This left eight trilingual data points without exact matches on the first three variables. Next, these eight data points were matched by exact age and sex

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

Table 2. Demographic Characteristics of the Trilingual and Bilingual Pairwise Matched Groups

	Trilinguals	Bilinguals	*p* value
	(*n* = 20) M ± SD	(*n* = 20) M ± SD	
Age in months	21.8 ± 3.44	21.8 ± 3.44	N/A[a]
Sex	65% female	65% female	1
Maternal education in years	16.65 ± 2.28	16.10 ± 1.65	.157
Language exposure English (%)	43.92 ± 10.73	55.51 ± 13.38	.001
Language exposure French (%)	29.62 ± 9.25	44.49 ± 13.38	<.001
Language exposure Other (%)	26.59 ± 9.20	N/A	N/A
Language exposure ratio (English to French)	1.67 ± 0.74	1.42 ± 0.63	

Note. Dataset with 18-month-old observation and its bilingual match.
p value reflects t-tests (for continuous variables) or chi-squared results (for categorical variables) comparing the two groups.
[a]Age in months matched exactly between the trilingual and bilingual group.

with Optmatch to multiple comparison individuals. Finally, the authors hand-selected the closest bilingual match for each trilingual data point first on maternal education and then on language exposure ratio for the matches generated by this package. Researchers were blind to children's vocabulary size during the matching process. Paired sample *t*-tests and a chi-squared test showed that there were no statistically significant differences between the trilingual and bilingual group on age, sex and maternal education. Furthermore, we note that one trilingual toddler contributed data at two time points: at age 18-months and at age 19-months. For this child we selected a different bilingual data point that matched at each age and ran all analyses twice (once with the data at the younger time point, once with the data at the older time point). We report the analyses with the younger time point in the main text and the older time point in the supplemental materials, as the pattern of results was highly similar in both cases. See Table 2 for participants' characteristics for the matched sample.

Mean comparisons

The trilingual group had a mean vocabulary size of 180 words ($SD = 188$) and the matched bilingual group had a mean vocabulary size of 252 words ($SD = 206$). Thus, trilinguals had a smaller French–English vocabulary size, knowing 71% as many words as bilinguals. The difference between these matched groups was, however, not statistically significant with either the independent *t*-test, $t(38) = 1.15$, $p = .257$, $d = .36$, or the repeated measures *t*-test, $t(19) = 1.32$, $p = .202$, $d = .28$, mean difference = 71.8. Because the data were skewed, planned non-parametric tests were also conducted. We report Cohen's *d* as effect size for parametric tests, and *r* as effect size for non-parametric tests. A Mann-Whitney-Wilcoxon test for independent data again indicated that the difference between trilinguals and bilinguals was not statistically significant: trilinguals had a median score of 87 words while bilinguals had a median score of 184 words ($U = 146$, $p = .148$, $r = .23$). Similarly, a Wilcoxon Signed Rank test for paired data showed no statistically significant differences

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

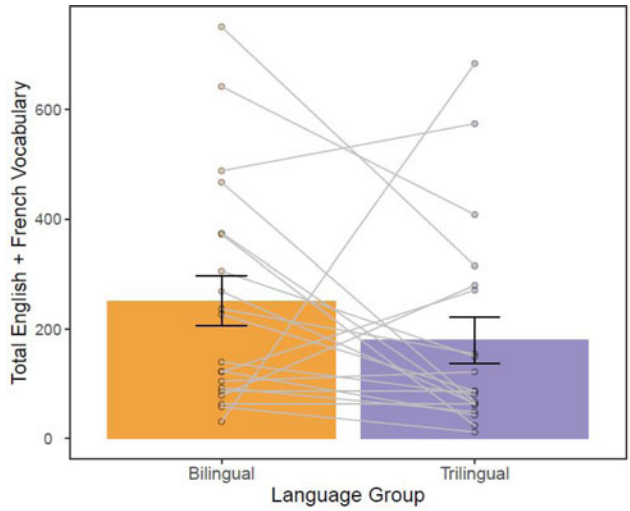

Figure 1. Bar graphs showing total vocabulary scores (English + French) across pairwise-matched trilinguals and bilinguals with data from 18-month-old trilingual toddler who participated in two studies. Lines connect matched participants.

between trilinguals and bilinguals ($Z = -1.77$, $p = .079$, $r = .40$). Total vocabulary scores for the trilingual and bilingual matched sample are presented in Figure 1.

Full Sample

A regression including all participants was used as a second planned approach to control for potential confounds between bilinguals and trilinguals. Moreover, this approach allowed us to directly examine the magnitude of the effect of language group (bilingual vs. trilingual) compared to other predictors including age, sex and maternal education on vocabulary size. Because in our full data set some participants contributed data at multiple ages, we explored the use of linear mixed-effects models, rather than traditional linear regression, to account for these correlated data points (Tabachnick & Fidell, 2013). To determine whether this type of model was necessary, we fit an intercept-only mixed model, which included the intercept (grand mean of vocabulary score) as a fixed effect, and the participants (variance of participants' average vocabulary score) as a random effect. This model showed a significant random effect and an intraclass correlation coefficient with a medium effect (ICC = .55, $p = .003$), supporting the use of a linear mixed-effects model instead of a simple regression model.

Next, we added our main variable of interest – language group (trilingual or bilingual) – and our covariates – age, sex and maternal education – to our model as predictors. Results showed that maternal education was not a significant predictor in the model ($\beta = 2.30$, $p = .674$): thus, following our pre-registered analysis plan, it was removed to retain power before rerunning the analysis with the more parsimonious model. The final model included language group, age, and sex as predictors, and was a good fit to the data: the fixed effects explained 49% of the variance, and the combination of fixed and random effects explained 89% of the variance (the full

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

Table 3. Results from the Final Linear Effects Mixed Model Including all Bilingual and Trilingual Vocabulary Data Sets

	Total Vocabulary		
Predictors	Estimates	CI	P
(Intercept)	−507.08	−622.34 – 391.82	<0.001*
Language Group (Trilingual)	−72.20	−155.69 – 11.30	0.090†
Age in Days	1.17	1.02 – 1.32	<0.001*
Sex (Male)	−88.63	−139.37 – 37.89	0.001*
Random Effects			
σ^2	7141.45		
$\tau_{00\ Sub\_ID}$	24753.71		
ICC	0.78		
$N_{\ Sub\_ID}$	190		
Observations	217		
Marginal R^2/Conditional R^2	0.486/0.885		

Note: † $p < .10$; * $p < .05$

model is reported in Table 3). Addressing our main research question, being trilingual was associated with producing 72 fewer words than being bilingual, although this difference failed to reach statistical significance. Replicating previous findings, age and sex were statistically significant predictors, where each additional day of age was associated with one more word produced (e.g., a 28-month-old child produced approximately 30 words more than a 27-month-old), and being female was associated with producing 89 more words on average.

Exploratory Analyses

Two exploratory analyses, which were not pre-registered, were conducted to further investigate vocabulary development in the two multilingual groups. First, two-tailed Pearson product-moment correlation coefficients were computed to assess the relation between amount of French and English exposure (measured as proportion exposure to each language) and total vocabulary size in French and English. These correlation analyses were conducted to compare the current study's results with those of past studies evaluating language exposure and vocabulary size, particularly in terms of trilingual vocabulary development (e.g., Mieszkowska et al., 2017). All data points ($n = 434$) were included in the correlation analyses (trilingual $n = 21$ and bilingual $n = 196$ for each language).

The first analysis explored the relation between English language exposure and number of English words for the full sample. Results showed that children with more exposure to English produced significantly more English words, $r(216) = .37$, $p < .001$. This correlation had similar magnitude for the bilingual, $r(195) = .36$, $p < .001$, and trilingual subsamples, $r(20) = .41$, $p = .064$, although it did not reach statistical significance in the trilingual group, possibly due to the smaller sample size. A similar pattern was observed for the correlation between language exposure in French and

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

number of French words with the full sample, $r(216) = .36$, $p < .001$, and the bilingual subgroup, $r(195) = .33$, $p < .001$. However, for the trilingual sample this correlation was near-zero and not statistically significant, $r(20) = -.14$, $p = .533$.

The second exploratory analysis examined whether age moderated the relation between language group (trilingual or bilingual) and total vocabulary size in the community languages (French and English) observed in the main analyses. Based on previous research, it was predicted that language group differences might attenuate with age, as children spend more time in the community: for example, by attending daycares and joining social events such as play groups. This was examined by running the mixed linear model with the full sample and adding an interaction term between age and language group. Results showed no statistically significant interaction between age and language group ($\beta = -0.53$, $p = .172$). We also conducted an exploratory analysis including language exposure ratio in the linear mixed model; however, it was not a significant predictor and was thus not included in the final model.

Discussion

The objective of the current study was to better understand multilingual vocabulary development by comparing productive vocabulary size in the two community languages (French and English) across bilingual and trilingual toddlers. We hypothesized that trilinguals' reduced exposure to French and English (due to time spent hearing their third language) would lead to reduced French–English vocabulary size relative to bilinguals who were learning only those two languages. Descriptively, our results were in line with our prediction. On average, bilinguals produced 252 words, while trilinguals produced 180 words. That is, trilinguals produced 29% fewer words than bilinguals did, although, as a reminder, vocabulary in trilinguals' third language was not measured. What is striking is that trilinguals were exposed to French and English 73% of the time (with the remaining 27% exposure to their third language). Thus, trilinguals' vocabularies in those two languages strongly tracked their exposure. In fact, within each language, our exploratory analyses showed a positive correlation between language exposure and total number of words, further supporting the input–vocabulary link that has been suggested by previous research (e.g., David & Wei, 2008; Gathercole & Thomas, 2009; Goodman, Dale & Li, 2008; Oller, 2010; Scheele, Leseman & Mayo, 2010; Thordardottir, 2011; Unsworth, 2013a).

We expected this relation between exposure and vocabulary size to be borne out by a statistically significant difference in vocabulary size between trilinguals and bilinguals. Instead, of the five pre-registered ways in which we tested this prediction, none were statistically significant, although two approached significance ($p = .079$, $p = .090$) and all effect sizes were in the expected direction. We had a relatively small sample of trilingual data points available for analysis ($n = 21$) and this limited our statistical power. In addition, even monolingual children show highly variable vocabulary sizes across the first few years of life (Frank et al., in press), and the substantial variability amongst our participants may have prevented us from detecting a statistically robust difference between trilinguals and bilinguals in most of our analyses. However, our analyses did statistically replicate previous findings that older children produce more words than younger children, and girls produce more words than boys.

Our results support the position that, for a complete picture of multilinguals' vocabulary development, each of the languages must be assessed (Paradis, Genesee & Crago, 2011). It has been well-demonstrated that measuring bilinguals' vocabularies

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

in only one language results in an under-assessment of their full capacities (Thordardottir, Rothenberg, Rivard & Naves, 2006). In line with this finding, our results suggest that assessing trilinguals in only two of their three languages will similarly put them at a disadvantage. These results extend the recommendation that bilinguals should be assessed in both of their languages (Hamers & Blanc, 2000; Hoff et al., 2012) by indicating that trilinguals likely need to be assessed in all three of their languages. We acknowledge that assessing a child's three languages might be difficult in clinical practice; however, it appears important in order to gather comprehensive information on trilingual children's language skills. While the current study did not have data available in trilinguals' third language to directly test whether three-language vocabulary scores can equate development across children learning different numbers of languages, it will be important for future research to test this directly, and the use of new technologies (e.g., web-based CDI; see Frank et al., in press) might be a helpful avenue to accomplish this goal. Moreover, some studies with bilinguals have suggested that children do achieve similar vocabulary scores to monolinguals when the exposure to their dominant language is over 60% (Cattani et al., 2014; Thordardottir, 2011). Future studies could examine if similar thresholds exist for trilinguals.

On the surface, our results differ from a previous study (Mieszkowska et al., 2017) comparing trilingual with bilingual and monolingual children in the United Kingdom, where trilinguals and bilinguals showed similar productive vocabulary size in the majority language (i.e., English). However, these findings can be reconciled when examining the relative input that the different samples had in each of their languages (although we note that the two studies differed somewhat in how they measured exposure). In Mieszkowska and colleagues' study, bilingual and trilingual participants had similar exposure to the community language (English): 36% at home and 53% outside home for trilinguals, and 30% at home and 58% outside home for bilinguals. Exposure to the community language was similar, and bilinguals and trilinguals knew similar numbers of words. However, in our study, the two groups differed importantly in their cumulative lifetime exposure to both French and English. Bilinguals in our study heard French and English 100% of the time, while trilinguals only heard these languages 73% of the time. In our case, trilinguals had less exposure to the community language than bilinguals, and they produced fewer words. Thus, both studies are consistent with the hypothesis that vocabulary development and input are tightly linked. At least at younger ages, effects of a language's sociolinguistic status on development might be mediated by differences in amount of language input, rather than direct effects of language status on learning.

Our study suggests that trilingualism does not seem to disadvantage children's vocabulary trajectory beyond what would be expected by differences in input that stem from having their time divided across multiple languages. That is, there is no evidence that learning three languages from an early onset results in confusion or in difficulties in acquiring new words. Findings from the present study could further encourage parents and schools to foster vocabulary development in all three languages in early childhood, rather than solely focusing on one language (i.e., the school's language). Despite common concerns related to all types of multilingual children's linguistic (King & Fogle, 2006) and intellectual development, including those with speech and language delays (e.g., the widespread negative attitude regarding development when learning more than one language; Gonzalez-Barrero & Nadig, 2018; Paradis, 2007), multilingualism itself does not negatively affect school

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

performance (Collier & Thomas, 2004; Oller & Eilers, 2002), and instead may put children at an advantage in school readiness tasks (McLeod, Harrison, Whiteford & Walker, 2016). Although young multilingual children tend to have a smaller vocabulary size relative to their monolingual peers when considering only the majority language, these children appear to eventually catch up to their peers in the school years (Grosjean, 2010; Mieszkowska et al., 2017).

Limitations

A common challenge in studying multilingual development is that multilingual children are a difficult population to recruit, and this difficulty is particularly acute for trilinguals. Indeed, most past research on young trilinguals has consisted of case studies (Albin & Gershkoff-Stowe; Chevalier, 2015; Montanari, 2010; Quay, 2011), or small samples (Mieszkowska et al., 2017). Our sample was the largest to date of trilingual toddlers ($n = 21$), but nonetheless was smaller than ideal, which reduced our statistical power. We made use of an archival dataset, and thus did not have control over the sample of trilinguals, but future studies should expressly recruit larger samples.

A second common challenge in studies of multilinguals is that children's language background cannot be randomly assigned, leaving open the possibility for confounds between groups. We made several efforts to minimize potential confounds between our bilingual and trilingual groups, through a careful matching approach and a regression model that controlled for known contributors to vocabulary development, such as age, sex and socioeconomic status. Nonetheless, we cannot fully rule out that unmeasured factors contributed to trilingual–bilingual differences. For example, some studies have found that overheard speech plays a role in bilingual vocabulary development (Floccia et al., 2018; however, see Oller, 2010). We did not measure overheard speech in our study, and it is possible that this differed between trilinguals and bilinguals.

Finally, as previously discussed, while bilinguals' vocabularies were assessed in both of their languages, trilinguals' vocabularies were only assessed in two of their three languages. Our research question and discussion have carefully taken this limitation into account. Nonetheless, it will be important for future research to measure trilinguals' vocabularies in all three of their languages. Future studies could also expand the research to investigate concept vocabulary (i.e., the number of concepts lexicalized), since the current study focused on word vocabulary.

Conclusion

This study quantitatively measured the amount of words that young multilingual children know in order to determine the extent that trilingual vocabulary and bilingual vocabulary differed across two community languages. In line with past evidence of the relation between language input and vocabulary acquisition (De Houwer, 2007; Place & Hoff, 2011), trilingual toddlers had vocabulary sizes in French and English that were proportional to their exposure, but the difference between their knowledge and that of their French–English bilingual peers was not always statistically robust. This is likely due to the relatively small size of our trilingual sample, together with the high variability in vocabulary development seen across children. Vocabulary size in trilinguals appears to be largely determined by the same factors that explain monolingual and bilingual vocabulary development, particularly the amount of input that is encountered in each language.

https://doi.org/10.1017/S030500092000077X Published online by Cambridge University Press

Acknowledgements. We are grateful to all the families who participated in this research. This work was funded by a grant from the Natural Sciences and Engineering Research Council of Canada (NSERC 2011-402470, 2018-04390), a National Institutes of Health grant (NIH R03HD079779), and a Fonds de Recherche du Québec-Société et Culture grant (FQRSC 2012-NP-145009) to Byers-Heinlein, and by a FQRSC (2018-B3-205717) postdoctoral fellowship to Gonzalez-Barrero. Krista Byers-Heinlein holds the Concordia University Research Chair in Bilingualism.

Supplementary Material. For supplementary material accompanying this paper, visit http://doi.org/10.1017/S030500092000077X

References

Albin, A., & Gershkoff-Stowe, L. (2016). Rapid word learning in trilingual children: One spurt or three? In D. Stinger *et al.* (Eds.), *Proceedings of the 13th Generative Approaches to Second Language Acquisition Conference* (pp. 14–30). Somerville, MA: Cascadilla.

Andersson, I., Gauding, J., Graca, A., Holm, K., Öhlin, L., Marklund, U., & Ericsson, A. (2011). Productive vocabulary size development in children aged 18–24 months – Gender differences. *Proceedings from Fonetik* 2011: *Speech, Music and Hearing: Quarterly Progress and Status Report*, *51*, 109–112.

Arnaus Gil, L., Müller, N., Sette, N., & Hüppop, M. (2020). Active bi-and trilingualism and its influencing factors. *International Multilingual Research Journal*, 1-22. https://doi.org/10.1080/19313152.2020.1753964

Barnes, J., & Garcia, I. (2013). Vocabulary growth and composition in monolingual and bilingual Basque infants and toddlers. *International Journal of Bilingualism*, *17*(3), 357–374. https://doi.org/10.1177/1367006912438992

Bates, E., Marchman, V., Thal, D., Fenson, L., Dale, P., Reznick, J. S., Reilly, J., & Hartung, J. (1994). Developmental and stylistic variation in the composition of early vocabulary. *Journal of Child Language*, *21*(1), 85–123. https://doi.org/10.1017/S0305000900008680

Bee, H. L., Van Egeren, L. F., Pytkowicz Streissguth, A., Nyman, B. A., & Leckie, M. S. (1969). Social class differences in maternal teaching strategies and speech patterns. *Developmental Psychology*, *1*(6, Pt.1), 726–734. https://doi.org/10.1037/h0028257

Bleses, D., Makransky, G., Dale, P. S., Højen, A., & Ari, B. A. (2016). Early productive vocabulary predicts academic achievement 10 years later. *Applied Psycholinguistics*, *37*(6), 1461–1476. https://doi.org/10.1017/S0142716416000060

Bosch, L., & Sebastián-Gallés, N. (2001). Evidence of early language discrimination abilities in infants from bilingual environments. *Infancy*, *2*(1), 29–49. https://doi.org/10.1207/S15327078IN0201_3

Byers-Heinlein, K. (2013). Parental language mixing: Its measurement and the relation of mixed input to young bilingual children's vocabulary size. *Bilingualism: Language and Cognition*, *16*(1), 32–48. https://doi.org/10.1017/S1366728912000120

Byers-Heinlein, K., Schott, E., Gonzalez-Barrero, A. M., Dubé, D., Jardak, A., Laoun-Rubenstein, A., Mastroberardino, M., Morin-Lessard, E., Iliaei, S. P., Salama-Siroishka, N., & Tamayo, M. P. (2019). MAPLE: A multilingual approach to parent language estimates. *Bilingualism: Language and Cognition*. https://doi.org/10.31234/osf.io/r2q3u

Byers-Heinlein, K., & Werker, J. F. (2009). Monolingual, bilingual, trilingual: Infants' language experience influences the development of a word-learning heuristic. *Developmental Science*, *12*(5), 815–823. https://doi.org/10.1111/j.1467-7687.2009.00902.x

Cattani, A., Abbot-Smith, K., Farag, R., Krott, A., Arreckx, F., Dennis, I., & Floccia, C. (2014). How much exposure to English is necessary for a bilingual toddler to perform like a monolingual peer in language tests?: Language exposure and bilingual screening. *International Journal of Language & Communication Disorders*, *49*(6), 649–671. https://doi.org/10.1111/1460-6984.12082

Chevalier, S. (2015). *Trilingual language acquisition*: *Contextual factors influencing active trilingualism in early childhood*. Amsterdam, Netherlands: John Benjamins.

Collier, V. P., & Thomas, W. P. (2004). The astounding success of dual language immersion for all. *NABE Journal and Research*, *2*(1), 1–20.

Core, C., Hoff, E., Rumiche, R., & Señor, M. (2013). Total and conceptual vocabulary in Spanish-English bilinguals from 22 to 30 months: Implications for assessment. *Journal of Speech, Language, and Hearing Research: JSLHR*, *56*(5), 1637–1649. https://doi.org/10.1044/1092-4388(2013/11-0044)

Dale, P. S. (1991). The validity of a parent report measure of vocabulary and syntax at 24 months. *Journal of Speech, Language, and Hearing Research*, *34*(3), 565–571. https://doi.org/10.1044/jshr.3403.565

David, A., & Wei, L. (2008). Individual differences in the lexical development of French–English bilingual children. *International Journal of Bilingual Education and Bilingualism*, *11*(5), 598–618. https://doi.org/10.2167/beb478.0

De Houwer, A. (1995). Bilingual language acquisition. In P. Fletcher & B. MacWhinney (Eds.), *The handbook of child language* (pp. 219–250). Oxford: Blackwell.

De Houwer, A. (2004). Trilingual input and children's language use in trilingual families in Flanders. In C. Hoffmann & J. Ytsma (Eds.), *Trilingualism in the individual, family and society* (pp. 118–138). Clevedon: Multilingual Matters.

De Houwer, A. (2007). Parental language input patterns and children's bilingual use. *Applied Psycholinguistics*, *28*(3), 411–424. https://doi.org/10.1017/S0142716407070221

De Houwer, A., Bornstein, M. H., & Putnick, D. L. (2014). A bilingual–monolingual comparison of young children's vocabulary size: Evidence from comprehension and production. *Applied Psycholinguistics*, *35*(6), 1189–1211. https://doi.org/10.1017/S0142716412000744

Fenson, L., Marchman, V. A., Thal, D. J., Dale, P. S., Reznick, J. S., & Bates, E. (2007). *MacArthur-Bates Communicative Development Inventories: User's guide and technical manual* (2nd ed.). Baltimore, MD: Brookes.

Fernald, A., Marchman, V. A., & Weisleder, A. (2013). SES differences in language processing skill and vocabulary are evident at 18 months. *Developmental Science*, *16*(2), 234–248. https://doi.org/10.1111/desc.12019

Floccia, C., Sambrook, T. D., Delle Luche, C., Kwok, R., Goslin, J., White, L., Cattani, A., Sullivan, E., Abbot-Smith, K., Krott, A., Mills, D., Rowland, C., Gervain, J., & Plunkett, K. (2018). Vocabulary of 2-year-olds learning English and an additional language: Norms and effects of linguistic distance. *Monographs of the Society for Research in Child Development*, *83*(1), 7–29. https://doi.org/10.1111/mono.12348

Frank, M. C., Braginsky, M., Marchman, V. A., & Yurovsky, D. (in press). *Variability and consistency in early language learning: The wordbank project*. Cambridge, MA: MIT Press.

Gathercole, V. C. M., & Thomas, E. M. (2009). Bilingual first-language development: Dominant language takeover, threatened minority language take-up. *Bilingualism: Language and Cognition*, *12*(2), 213–237. https://doi.org/10.1017/S1366728909004015

Gonzalez-Barrero, A. M., & Nadig, A. (2018). Bilingual children with autism spectrum disorders: The impact of amount of language exposure on vocabulary and morphological skills at school age. *Autism Research*, *11*(12), 1667–1678. https://doi.org/10.1002/aur.2023

Gonzalez-Barrero, A. M., Schott, E., & Byers-Heinlein, K. (2020). Bilingual adjusted vocabulary: A developmentally-informed bilingual vocabulary measure. https://doi.org/10.31234/osf.io/x7s4u

Goodman, J. C., Dale, P. S., & Li, P. (2008). Does frequency count? Parental input and the acquisition of vocabulary. *Journal of Child Language*, *35*(03), 515–531. https://doi.org/10.1017/S0305000907008641

Grosjean, F. (2010). *Bilingual: Life and Reality*. Cambridge, MA: Harvard University Press. https://doi.org/10.4159/9780674056459

Hamers, J. F., & Blanc, M. H. A. (2000). *Bilinguality and bilingualism* (2nd ed.). Cambridge, UK: Cambridge University Press.

Hansen, B. B., & Klopfer, S. O. (2006). Optimal full matching and related designs via network flows. *Journal of Computational and Graphical Statistics*, *15*(3), 609–627. JSTOR. https://doi.org/10.1198/106186006X137047

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development*, *74*(5), 1368–1378. https://doi.org/10.1111/1467-8624.00612

Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language*, *39*(1), 1–27. https://doi.org/10.1017/S0305000910000759

Hoff, E., & Tian, C. (2005). Socioeconomic status and cultural influences on language. *Journal of Communication Disorders*, *38*(4), 271–278. https://doi.org/10.1016/j.jcomdis.2005.02.003

Hoff, E., Welsh, S., Place, S., & Ribot, K. M. (2014). Properties of dual language input that shape bilingual development and properties of environments that shape dual language input. In T. Grüter & J. Paradis (Eds.), *Input and experience in bilingual development* (pp. 119–140). Amsterdam: John Benjamins. https://doi.org/10.1075/tilar.13.07hof

Hoffmann, C. (2001). Towards a description of trilingual competence. *International Journal of Bilingualism*, *5*(1), 1–17. https://doi.org/10.1177/13670069010050010101

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, *27*, 236–248. https://doi.org/10.1037/0012-1649.27.2.236

Hyde, J. S., & Linn, M. C. (1988). Gender differences in verbal ability: A meta-analysis. *Psychological Bulletin*, *104*(1), 53–69. https://doi.org/10.1037/0033-2909.104.1.53

King, K., & Fogle, N. (2006). *Raising bilingual children: Common parental concerns and current research*. Center for Applied Linguistics. http://www.cal.org/resource-center/resource-archive/digests

Marchman, V. A., & Fernald, A. (2008). Speed of word recognition and vocabulary knowledge in infancy predict cognitive and language outcomes in later childhood. *Developmental Science*, *11*(3), F9–16. https://doi.org/10.1111/j.1467-7687.2008.00671.x

McLeod, S., Harrison, L. J., Whiteford, C., & Walker, S. (2016). Multilingualism and speech-language competence in early childhood: Impact on academic and social-emotional outcomes at school. *Early Childhood Research Quarterly*, *34*, 53–66. https://doi.org/10.1016/j.ecresq.2015.08.005

Mieszkowska, K., Łuniewska, M., Kołak, J., Kacprzak, A., Wodniecka, Z., & Haman, E. (2017). Home language will not take care of itself: Vocabulary knowledge in trilingual children in the United Kingdom. *Frontiers in Psychology*, *8*, 1–11. https://doi.org/10.3389/fpsyg.2017.01358

Montanari, S. (2010). Translation equivalents and the emergence of multiple lexicons in early trilingual development. *First Language*, *30*(1), 102–125. https://doi.org/10.1177/0142723709350528

Oller, D. K. (2010). All-day recordings to investigate vocabulary development: A case study of a trilingual toddler. *Communication Disorders Quarterly*, *31*(4), 213–222. https://doi.org/10.1177/1525740109358628

Oller, D. K., & Eilers, R. (2002). *Language and literacy in bilingual children*. Clevedon, UK: Multilingual Matters.

Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child Development*, *76*(4), 763–782. https://doi.org/10.1111/1467-8624.00498-i1

Paradis, J. (2007). Bilingual children with specific language impairment: Theoretical and applied issues. *Applied Psycholinguistics*, *28*(3), 551–564. https://doi.org/10.1017/S0142716407070300

Paradis, J., Genesee, F., & Crago, M. B. (2011). *Dual language development and disorders* (2nd ed.). Baltimore, MD: Paul H. Brookes Publishing Co.

Pearson, B. Z., Fernández, S. C., Lewedeg, V., & Oller, D. K. (1997). The relation of input factors to lexical learning by bilingual infants. *Applied Psycholinguistics*, *18*(01), 41–58. https://doi.org/10.1017/S0142716400009863

Pearson, B. Z., Fernández, S. C., & Oller, D. K. (1993). Lexical development in bilingual infants and toddlers: Comparison to monolingual norms. *Language Learning*, *43*(1), 93–120. https://doi.org/10.1111/j.1467-1770.1993.tb00174.x

Place, S., & Hoff, E. (2011). Properties of dual language exposure that influence two-year-olds' bilingual proficiency. *Child Development*, *82*(6), 1834–1849. https://doi.org/10.1111/j.1467-8624.2011.01660.x

Potgieter, A. P. (2016). Lexical and grammatical development in trilingual speakers if ixiXhosa, English and Afrikaans. *South African Journal of Communication Disorders*, *63*(2), a141. http://doi.org/10.4102/sajcd.v63i2.141

Qi, C. H., Kaiser, A. P., Milan, S., & Hancock, H. (2006). Language performance of low-income African American and European American preschool children on the PPVT–III. *Language, Speech, and Hearing Services in Schools*, *37*(1), 5–16. https://doi.org/10.1044/0161-1461(2006/002)

Quay, S. (2011). Trilingual toddlers at daycare centres: The role of caregivers and peers in language development. *International Journal of Multilingualism*, *8*(1), 22–41. https://doi.org/10.1080/14790711003671853

R Core Team. (2013). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. http://www.R-project.org/

Rescorla, L., & Achenbach, T. M. (2002). Use of the Language Development Survey (LDS) in a national probability sample of children 18 to 35 months old. *Journal of Speech, Language, and Hearing Research*, *45*(4), 733–743. https://doi.org/10.1044/1092-4388(2002/059)

Scheele, A. F., Leseman, P. P. M., & Mayo, A. Y. (2010). The home language environment of monolingual and bilingual children and their language proficiency. *Applied Psycholinguistics*, *31*(1), 117–140. https://doi.org/10.1017/S0142716409990191

Schott, E., Kremin, L. V., & Byers-Heinlein, K. (2019). *Child Bi- and Multilingualism in the Home in Canada: Rates and Language Pairs* [Poster]. International Symposium on Bilingualism 12, Edmonton, Canada. https://files.osf.io/v1/resources/2gzfw/providers/osfstorage/5d13d2a6e200da00197266cd?pid=2gzfw&direct&public_file=True&version=1&mode=render&action=download

Song, L., Spier, E. T., & Tamis-Lemonda, C. S. (2014). Reciprocal influences between maternal language and children's language and cognitive development in low-income families. *Journal of Child Language*, *41*(2), 305–326. https://doi.org/10.1017/S0305000912000700

Statistics Canada. (2017). *Montréal [Census metropolitan area], Quebec and Nova Scotia [Province]* (Table 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001). https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E

Surrain, S., & Luk, G. (2019). Describing bilinguals: A systematic review of labels and descriptions used in the literature between 2005–2015. *Bilingualism: Language and Cognition*, *22*(2), 401–415. https://doi.org/10.1017/S1366728917000682

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). Boston, MA: Pearson.

Thordardottir, E. (2011). The relationship between bilingual exposure and vocabulary development. *International Journal of Bilingualism*, *15*, 426–445. https://doi.org/10.1177/1367006911403202

Thordardottir, E., Rothenberg, A., Rivard, M.-E., & Naves, R. (2006). Bilingual assessment: Can overall proficiency be estimated from separate measurement of two languages? *Journal of Multilingual Communication Disorders*, *4*(1), 1–21. https://doi.org/10.1080/14769670500215647

Trudeau, N., Frank, H., & Poulin-Dubois, D. (1999). Une adaptation en français Québécois du MacArthur Communicative Development Inventory. *La revue d'orthophonie et d'audiologie*, *23*(2), 61–73. https://cjslpa.ca/detail.php?ID=81&lang=fr

Unsworth, S. (2013a). Assessing the role of current and cumulative exposure in simultaneous bilingual acquisition: The case of Dutch gender. *Bilingualism: Language and Cognition*, *16*(01), 86–110. https://doi.org/10.1017/S1366728912000284

Unsworth, S. (2013b). Current issues in multilingual first language acquisition. *Annual Review of Applied Linguistics*, *33*, 21–50. https://doi.org/10.1017/S0267190513000044

Cite this article: Côté SL, Gonzalez-Barrero AM, Byers-Heinlein K (2022). Multilingual toddlers' vocabulary development in two languages: Comparing bilinguals and trilinguals. *Journal of Child Language* **49**, 114–130. https://doi.org/10.1017/S030500092000077X