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Language and Cognitive Predictors of Lexical Selection in Storytelling for Monolingual and Sequential Bilingual Children

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ABSTRACT
The primary purpose of the present study was to test language and cognitive predictors of lexical selection in the storytelling of monolingual and bilingual children. Measures of language proficiency and cognitive ability were assessed with both English- and Mandarin-speaking monolinguals and Mandarin-English bilinguals aged 4 to 6 years old. To elicit stories, children watched a cartoon and told the story back. Bilinguals did these tasks in both of their languages. The results showed that the bilinguals told stories with as many different words as monolinguals of both languages but scored lower on measures of vocabulary. For monolinguals, vocabulary score was an important predictor of lexical variety even after controlling for age. For bilinguals, attentional control was a significant predictor of lexical variety in their second language, English. These results suggest that for monolingual children, vocabulary size is an important predictor of lexical variety in stories, while bilingual children might rely more on cognitive abilities to lexicalize concepts.

When talking about an unfamiliar German Shepherd that stopped in the street to lick her hand, a speaker could refer to it as “a German Shepherd,” “a dog,” or even “this huge hairy beast of an animal.” Research has shown that speakers often activate multiple ways of speaking about a referent before making a selection (Levelt, Roelofs, & Meyer, 1999; Peterson & Savoy, 1998). Lexical selection refers to the mental process involved in choosing words to speak about concepts (Levelt, 2001). To study lexical selection in both children and adults, researchers have largely relied on experimental tasks eliciting single words, such as picture naming (Levelt, 2001; Poulin-Dubois, Bialystok, Blaye, Polonia, & Yott, 2013). In such tasks, speakers prefer to produce words that are easy to access and/or say, such as high-frequency words (Bates et al., 2003; Caramazza, Costa, Miozzo, & Bi, 2001; Oldfield & Wingfield, 1965) or monosyllabic words rather than multisyllabic words (Bates et al., 2003).

The primary purpose of the present study was to test the language and cognitive predictors of children’s lexical selection in stories. Few studies have addressed the question of how speakers choose the words to tell a story. It is possible that lexical selection in storytelling may be similar to the process shown in experimental tasks. In support of that possibility, Downing (1980) found that adults often chose basic-level kind words when telling a story. These results suggest that speakers may prefer to select words that are easy to access when telling a story, as has been shown with experimental tasks.
For children, both age and vocabulary likely affect lexical selection. The variety of words that children use in telling a story increases with age (Barbosa et al., 2016; Berman, 1988). These age-related changes are likely linked to changes in vocabulary size. Berman (1988) argued that one of the reasons preschoolers’ stories were composed of so few words was that their vocabulary skills were still developing. Vocabulary size has been shown to predict lexical selection in toddlers performing a picture-naming task (Poulin-Dubois et al., 2013). There is, however, little research testing whether vocabulary predicts lexical selection in children’s storytelling. Some studies have shown that vocabulary is, at best, a weak predictor of some aspects of storytelling ability (Fiorentino & Howe, 2004; Norbury & Bishop, 2003; Oppenheim, Emde, & Warren, 1997). However, none of these studies focused exclusively on lexical selection. In the present study, we tested whether vocabulary scores predict children’s lexical selection in stories.

If within-language vocabulary is an important predictor of lexical selection, bilingual children might use fewer different words to tell stories than monolinguals. Bilingual children often score below monolinguals on standardized tests of both receptive and expressive vocabulary in one or both of their languages (Gross, Buac, & Kaushanskaya, 2014; Morales, Calvo, & Bialystok, 2013; Oller, Pearson, & Cobo-Lewis, 2007; Scheele, Leeman, & Mayo, 2010; Smithson, Paradis, & Nicoladis, 2014; see review in Bialystok, 2009). In addition to having lower within-language vocabulary scores than monolinguals, bilinguals also tend to have greater difficulty accessing known words for production compared with monolinguals (Gibson, Oller, Jarmulowicz, & Ethington, 2012; Gollan, Montoya, Fennema-Notestine, & Morris, 2005; Klassert, Gagarina, & Kauschke, 2014; Yan & Nicoladis, 2009; cf. Poulin-Dubois et al., 2013).

Do bilingual children’s lower vocabulary scores and higher lexical access difficulty lead to less lexical diversity in telling a story compared to monolinguals? Some studies have shown that, indeed, bilingual children do perform worse on language-specific aspects of storytelling (such as sentence structure and lexical variety) than monolingual children of the same age and/or that their performance is linked to their proficiency in that language (Montanari, 2004; Paradis & Kirova, 2014; Pearson, 2002; Severing & Verhoeven, 2001; Simón-Cereijido & Gutiérrez-Clellen, 2009). However, surprisingly, other studies have shown that bilingual children can sometimes show equivalent performance on these aspects of storytelling to monolingual children (Barbosa et al., 2016; Nicoladis, Palmer, & Marentette, 2007; Pearson, 2002; Peets & Bialystok, 2015; Uccelli & Páez, 2007) and equivalent performance in both languages (Laurent, Nicoladis, & Marentette, 2015).

These results point to the possibility that vocabulary size might not necessarily predict bilingual children’s lexical selection, at least in the context of telling a story. For picture-naming tasks, several studies have shown that vocabulary scores predict accuracy for bilingual children (Poulin-Dubois et al., 2013; Sheng, 2014; Yan & Nicoladis, 2009). In contrast, for storytelling tasks, studies to date have shown no relationship between bilingual children’s within-language vocabulary and measures of their language use, such as number of different words (Kang, 2012; Uccelli & Páez, 2007). For example, Peets and Bialystok (2015) showed that bilingual children scored significantly lower on an English vocabulary test compared with English monolingual children and yet produced an equivalent total number of words and number of different words to that of monolingual children.

This pattern of results leads to the possibility that monolingual and bilingual children might rely on different language and cognitive resources when selecting words to tell a story.
Storytelling is a complex activity, involving sensitivity to lexical choice, story structure, causality, perspective, and listener knowledge, among other abilities (Downing, 1980; Levy & McNeill, 2015; Mallan, 1996; McCabe & Peterson, 1991; Reilly, Zamora, & McGivern, 2005; Trabasso & Van Den Broek, 1985). Storytelling is also a flexible medium: Storytellers can select different words to convey a message. The flexibility of storytelling might allow bilinguals to rely more heavily on some cognitive abilities in lexical selection compared to monolinguals. In doing so, they might sometimes be able to compensate for their lower vocabulary sizes compared with monolinguals to produce just as many different words in their stories.

In the present study, we considered the possibility that bilinguals can allocate their cognitive resources differently than monolingual children in selecting words to tell a story. To test for this possibility, we included two measures of cognitive abilities that have been linked to storytelling and have, at least in some studies, shown a bilingual advantage: attentional control and visuospatial working memory.

Attentional control refers to the ability to switch the focus of attention to relevant task dimensions, particularly in the context of conflicting cues (Diamond, Carlson, & Beck, 2005). For example, in a Dimensional Change Card Sort task, children are asked to sort pictures first according to one rule about some dimensions of the pictures (e.g., color) and then according to another (e.g., shape; Bialystok & Martin, 2004). To change rules, children have to inhibit the no-longer-relevant rule and attend to the relevant rule (Diamond et al., 2005). Attentional control is likely involved in lexical selection. Recall that speakers activate multiple ways of conveying a message (Levelt et al., 1999). Selecting apt words may involve attending to the relevant dimensions of communication. For example, children may have to attend to whether information has already been mentioned in the discourse to choose a pronoun or a full noun phrase to refer to an object. Although we know of no studies directly linking attentional control to lexical selection, children’s ability to control their attention to relevant information has been strongly linked with their ability to produce narratives (Ketelaars, Jansonius, Cuperus, & Verhoeven, 2011).

Some studies have shown that bilinguals score higher on tests of attentional control than do monolinguals (Bialystok, 2011; Bialystok & Martin, 2004; White, 2014), while other studies have not (Duñabeitia et al., 2014; Morton & Harper, 2007). Regardless of capacity differences, attentional control might be more strongly related to bilingual children’s word use in stories than to that of monolinguals. As noted earlier, bilingual children have a harder time accessing words than do monolingual children. Higher reliance on attentional control could allow bilingual children to shift their attention to an alternative selection of word(s) if they cannot immediately access target words.

Another cognitive variable that could be related to lexical diversity in stories is visuospatial memory. When recalling a story, storytellers rely heavily on visuospatial imagery (Mallan, 1996; Rubin, 1995). Children’s development of storytelling abilities is related to their ability to hold experienced events in their memories in order to make sense of them (Levy & McNeill, 2015). Pazzaglia, Toso, and Cacciamani (2008) showed that visuospatial memory was a significant predictor of children’s ability to reconstruct the structure of what they had experienced. Bilingual children can outperform monolingual children on some measures of visuospatial working memory (Blom, Küntay, Messer, Verhagen, & Leseman, 2014). For example, one study showed that Spanish-English bilingual children were better than English monolingual children on a task requiring them to imitate hand positions (Garratt & Kelly, 2007). Children have to remember the visuospatial configuration of the experimenter’s hands to imitate them correctly. Visuospatial memory capacity could be important for lexical selection in recounting a cartoon,
because children have to remember what they saw to select appropriate words to express that memory. Bilingual children might rely heavily on visuospatial memory in retelling a story to keep in mind what they wish to communicate as they select appropriate words.

If bilingual children rely more heavily on attentional control and/or visuospatial memory in storytelling, they might select different words from monolinguals. In support of this prediction, Barbosa et al. (2016) found that 8- to 10-year-old French-English bilinguals did not necessarily produce the same words for target words in the story as French or English monolinguals did. However, the bilinguals were adept at selecting words to convey the key concepts to tell the story (e.g., they might call a clock “a tick-tock thing”). In the present study, we tested the possibility that bilinguals were selecting simpler words in English than monolinguals. We included two operationalizations of simplicity: frequency and monosyllabic status. Bilingual children might produce more monosyllabic words and words of higher frequency compared to monolinguals.

**This study**

The primary purpose of the present study was to test language and cognitive predictors of the lexical variety in stories of both monolingual and bilingual children. We predicted that vocabulary would be a significant predictor of monolingual children’s lexical variety in stories even after controlling for age. The children who participated in this study were aged 4 to 6 years old, a relatively wide age range when studying language, cognitive, and narrative development. We expected age to be a significant predictor, and so, we controlled for age statistically.

If vocabulary is also an important predictor of lexical variety for bilingual children, we expected bilingual children to score lower on vocabulary tests and produce fewer word types in telling a story than monolinguals. The bilinguals in the present study were sequential bilinguals, with earlier and greater exposure to Mandarin Chinese than English. We expected the bilinguals to perform much lower on measures of English vocabulary compared to monolinguals and only somewhat lower than monolinguals in Mandarin.

We also tested the possibility that attentional control and visuospatial memory would be more important predictors of lexical diversity for bilingual children than for monolingual children. Bilingual children might be able to compensate for low vocabulary by holding a visuospatial representation of what they wish to convey in their minds while shifting their attention to alternative ways of phrasing a message. Some studies have shown bilingual advantages in attentional control and visuospatial memory. In the present study, we compared bilingual and monolingual children’s performance on these tasks to test for a bilingual advantage. This comparison allowed us to speculate as to whether bilinguals are better at these cognitive abilities because they rely on them more in storytelling.

Not all the bilingual children opted to tell the story in English. This fact allowed a further way of testing the importance of the predictors of bilinguals’ lexical variety. We compared the language and cognitive abilities of the bilingual children who told the story in English to those of the children who did not. The differences may shed light on what variables are important for children to use a wide variety of words in telling a story.

Finally, we tested the possibility that bilinguals might select more words that were easier to access or say (e.g., several one-syllable words, high-frequency words) than would monolinguals. We carried out these analyses only in English because we have found no measures of input frequency for children in Mandarin Chinese.
Methods

Participants

Forty Mandarin-English bilingual children (15 girls) living in Edmonton, Alberta, Canada participated in this study. The children ranged in age from 4;0 to 6;8 with an average age of 5;4 (SD = 9.4 months). All the children had started learning Mandarin at home from their parents before they started learning English in daycare or school. The age of onset of exposure to English varied: Eight children had been exposed to English before 12 months of age, 8 children had been exposed to English when they were 1 to 2 years old, 10 children were exposed when they were 2 to 3 years old, and 14 children were exposed to English after 3 years of age. The children had an average of 1.5 years of exposure to English. At the time of participating in this study, the children were still speaking Mandarin at home with their parents and spoke English primarily outside the home. The parents of the bilingual children had come to Canada for either work or advanced education so were likely to be from a high socioeconomic status (SES; see also the discussion in Morton & Harper, 2007, showing that Canadian immigration policy favors people from high-SES backgrounds). Twelve of the bilingual children did not tell the story in English (2 said in English that they did not remember what happened, 1 responded in Chinese, and the 9 others simply did not speak). We compared the bilinguals who told the story in both languages versus those who told the story only in Mandarin.

We included two age-matched monolingual comparison groups: 40 English monolingual children (25 girls) and 38 Mandarin monolingual children (19 girls). The English monolingual children ranged in age from 4;3 to 6;3, with an average age of 5;2 (SD = 7.5 months). The Mandarin monolingual children ranged in age from 4;3 to 6;3, with an average age of 5;3 (SD = 7.8 months). There was no significant difference in age between any of the groups when all children were included (Fs < 1). The English monolingual children were living in Canada, the same city as the bilinguals, and they were recruited from day cares close to the university, so they were likely to have parents with similar levels of education to those of the bilingual children. All the Mandarin monolingual children were living in China and were recruited from one day care in a community in which many parents are highly educated. Although we had no direct measures of SES and it is difficult to compare SES across cultures (see Tudge et al., 1999), our recruitment methods in both Canada and China were designed to include families who were most likely from upper middle-class backgrounds.

The data for this study came from a larger study in which a battery of language and cognitive tasks was administered to these children. Data from these children’s vocabulary scores and verbal and visuospatial memory have been published (Barbosa, Jiang, & Nicoladis, 2017), but the main statistical analyses did not repeat the already-published results. The analyses on the children’s storytelling have not been published elsewhere. We included here only the variables from the battery that addressed our research questions.

Materials, administration, and coding

Receptive vocabulary test

To assess the children’s receptive vocabulary in English, we used the Peabody Picture Vocabulary Test (PPVT) Version IIIA (Dunn & Dunn, 1997). Because we were not familiar with an equivalent measure designed for this dialect of Mandarin, to assess the children’s receptive vocabulary in Mandarin, we used Version IIIB in translation. Translations of the
PPVT into minority languages have been used before in research (e.g., Davidson & Tell, 2005). Because the translation has not been standardized and because we were interested in individual differences between children, we included the raw scores in our analyses. We had no a-priori reason to know if the translated vocabulary test would be a valid measure of individual differences in children’s Mandarin vocabulary. A previous publication showed that the monolingual children’s raw scores correlated with age (Barbosa et al., 2017), suggesting some degree of validity of this measure. The PPVT was administered and scored according to the examiner’s manual (Dunn & Dunn, 1997). We calculated the children’s raw PPVT scores as recommended in the tester’s manual (Dunn & Dunn, 1997).

Expressive vocabulary
To measure the children’s expressive vocabulary abilities, we invited the children to complete a verbal semantic fluency (SF) task (Ardila, Ostrosky-Solís, & Bernal, 2006). We asked children to generate as many exemplars of clothes, animals, and food/drinks as they could within 30 s. A stopwatch was used to time the children. Note that many studies allow participants 60 s to generate exemplars, but one study showed that children within the age range of our study did not generate many more exemplars after 30 s (Hurks et al., 2010). Previous studies have shown that bilinguals generally generate fewer exemplars on SF tasks within a language than do monolinguals (e.g., Portocarrero, Burright, & Donovick, 2007), consistent with the argument that this task measures expressive vocabulary. This task has been shown to be reliable across languages (Ardila et al., 2006; Matute, Rosselli, Ardila, & Morales, 2004). We therefore administered this task in both English and Mandarin. While SF taps expressive vocabulary, there may also be a degree of executive functioning required to generate many exemplars (Ardila et al., 2006; Shao, Janse, Visser, & Meyer, 2014), a point we will revisit in the discussion of our results.

The SF task was introduced as follows: “I am going to tell you a word, and I’d like you to think of as many examples of that word as you can in 30 s. So, if I said ‘clothes,’ how many examples of ‘clothes’ can you think of?” The timing began from the first word that the child said. If the child did not speak, the experimenter offered up to two examples (i.e., dog and lion for animals, bread and milk for food/drinks, and shoes and pants for clothes). The order of the three categories (animals, clothes, and food/drinks) was counterbalanced across participants. This task was videotaped to allow for later transcription and coding.

For the SF task, we counted the number of unique and valid exemplars that the child said and summed across all three categories. The number of exemplars generated by the children ranged from 0 to 30 in English and 2 to 33 in Mandarin.

Attentional control
To assess the children’s attentional control, we used the Dimensional Change Card Sort task (DCCS) from Bialystok and Martin (2004); however, our task was on paper rather than computerized. Bialystok and Martin used this task with children in a similar age group to that of the children in the present study. The design of this task was to give children cards with pictures varying in different dimensions to sort according to a particular designated rule. The task includes four different sets of 10 cards, each of which gets sorted twice, once according to one rule and then according to another rule. The task is designed to get increasingly difficult across the four sets of cards. Here, we used only the results of the fourth and hardest task following the switch in rules because the children scored at ceiling at all three of the easier levels. The 10 cards...
for this task had pictures of a bike, a skateboard, a pail and shovel, a skipping rope, a kite, slippers, a nightgown, a bib, ballet shoes, and pajamas. The initial rule for this task was to sort the cards according to things to play with versus things to wear. The next rule was to sort according to things that go outside versus things that go inside. This task was not administered to the Mandarin monolinguals; it was only administered in English. We therefore could not attempt to replicate the results of Sabbagh, Xu, Carlson, Moses, and Lee (2006), who showed that Chinese children outperformed English-speaking children on a similar attentional control task.

For the DCCS, at the start of a sort, children were given 10 cards decorated with pictures. They were then asked to sort according to one rule and were then given the same cards and asked to sort according to another rule. We followed the procedure of Bialystok and Martin (2004) by giving children four different sets of cards to sort. Because the children were at ceiling on the first three sorts, we included the results only for the fourth and hardest sort. For that sort, children were asked to sort the cards according to a semantic category, with, “Put all the things to play with on the teddy bear and all the things to wear on the winter jacket.” The experimenter then shuffled the cards and handed them back to the child, while instructing him or her, “Put all the things that go inside a house on the teddy bear and all the things that go outside a house on the winter jacket.”

For the DCCS, the dependent variable we used was the number of cards correctly sorted (out of 10) following the fourth and hardest switch of sorting rules. The children’s scores varied from 0 to 10. Scores less than 5 suggested that the children were perseverating, or continuing to use the preswitch rule (Bialystok & Martin, 2004).

**Visuospatial working memory**

To measure the children’s visuospatial working memory, we asked children to perform a hand-shape imitation task (HSI). This task was modeled on a subtest of the NEPSY-II (A Developmental NEuroPSYchological Assessmen) (Korkman, Kirk, & Kemp, 2007). There were 18 different hand shapes to be imitated, 6 one-handed and 12 two-handed. Children have to hold in memory the visuospatial image of what they have seen so they can produce it themselves.

For the HSI, children were shown pictures of the hand shapes on a computer screen and were asked to produce the same hand shapes themselves. This task was videotaped to allow for later coding and was done in the English session for the bilingual children.

For the HSI, each hand shape was scored as either correct or incorrect and the number of correct hand shapes was summed. All children attempted all items. The English monolingual children’s scores varied from 6 to 18, the bilingual children’s varied from 7 to 18, and the Mandarin monolingual children’s scores varied from 10 to 18.

**Storytelling task**

In both the English and the Mandarin sessions, the participants watched a 4-min segment of a Pink Panther cartoon titled, “In the Pink of the Night.” In the segment, the cuckoo in a cuckoo clock tries to wake up the Pink Panther, who ends up throwing the cuckoo bird off a bridge into a river to get rid of it. Then, feeling guilty, the Pink Panther tries to rescue the bird, which has, in the meantime, returned to the Pink Panther’s house. Both the cuckoo bird and the Pink Panther go to sleep together in the Pink Panther’s bed. When the bedside alarm clock rings, the bird smashes it with a wrench. The Pink Panther pats the bird on the head and they both go back to sleep.
To administer this task, an experimenter told the children to watch the cartoon so they could tell her the story, and she explained that she had not seen the cartoon before. The children watched the cartoon on a portable computer with the screen turned away from the experimenter. Then, the experimenter asked them to tell her what they had seen in the cartoon. If the children hesitated for a noticeable length of time or ceased talking, the experimenter prompted with open-ended questions such as, “Was there anything else?” or “What happened next?” or “Was that the end?” as appropriate. The children’s retellings were videotaped to allow for later transcription.

To count word types, we counted the number of different words the children produced during the course of telling the study. In English, a word corresponded to an orthographic word. In Mandarin, a word is difficult to define due to no space between orthographic words. We used a word-parsing app developed by the Institute of Applied Linguistics (free access on http://www.cncorpus.org), which has been verified as demonstrating high accuracy (i.e., more than 90%) in counting words in Mandarin (Hang Xiao, personal communication, January 15, 2018).

For the lexical characteristics of the words the children produced, we calculated each child’s percentage of one-syllable words and two measures of word frequency (median frequency and percentage of low-frequency words). To calculate the percentage of one-syllable words, we counted the number of one-syllable word tokens out of all the tokens the child produced. The frequency measures were based on frequency measures per 2.6 million word tokens in adult–child conversations (Li & Shirai, 2000) from CHild Language Data Exchange System (MacWhinney, 2000). Of the 633 different words produced by the children in English, 22 (or 3.5%) did not appear in the corpus (10 words used only by the monolingual children and 12 words used only by the bilingual children) and were not included in the analyses. Because word frequency is a skewed distribution, for each child, we calculated the median frequency out of the total number of word types. We also calculated for each child the percentage of his/her word types that occurred 100 times or fewer in the corpus. The number 100 was chosen arbitrarily to capture very low-frequency words. The word frequency for the words used by the children varied from 1 to 81,029 with a median of 3,728.

Procedure

As noted earlier, this study was based on data collected through a battery of tests completed by these children. The order of administration of the tasks within the battery varied according to an individual child’s interest level and engagement. The experimenters generally included tasks tapping receptive abilities (e.g., the PPVT) earlier in a session rather than later to allow children to warm up to the experimenter. A native speaker of the target language of the session administered all the tests. The bilinguals participated in two language sessions, with the order of the languages counterbalanced and approximately a week between language sessions. No differences based on order of language sessions were found for any of our variables of interest.

Analytic approach

Because we could not be sure that all our measures reflected the same underlying constructs in both languages, our comparisons focused on within-language comparisons.
(i.e., monolinguals in English and bilinguals in English on the one hand and monolinguals in Mandarin and bilinguals in Mandarin on the other).

**Results**

Figure 1 summarizes the number of word types used by the participants to tell the story. Given that the bilinguals’ first language was Mandarin, it was not surprising that there was no difference between bilinguals and monolinguals on the number of word types in Mandarin \((F < 1, \eta^2_p = .004)\). However, there was also no difference on the number of word types between bilinguals and monolinguals in English, \(F(1, 66) = 2.36, p = .13, \eta^2_p = .038\).

**Comparisons between bilinguals and monolinguals in Mandarin predictor variables**

Table 1 summarizes the averages (and standard deviations) of the predictor variables under study. As would be expected given the differences in exposure time to Mandarin, the monolinguals scored significantly higher than the bilinguals on measures of language proficiency, both the PPVT, \(F(1, 76) = 45.84, p < .001, \eta^2_p = .376\), and SF, \(F(1, 76) = 20.44, p < .001, \eta^2_p = .212\). While previous studies have shown a bilingual advantage on visuospatial working memory, the Mandarin monolinguals in this study scored higher than the bilinguals on the HSI, \(F(1, 75) = 9.60, p = .003, \eta^2_p = .113\).

**Comparisons between bilinguals and monolinguals in English predictor variables**

As predicted, in English, the monolinguals scored higher than the bilinguals on the vocabulary measures, both the PPVT, \(F(1, 78) = 124.47, p < .001, \eta^2_p = .618\), and SF, \(F(1, 78) = 7.75, p = .007, \eta^2_p = .090\). The monolinguals also scored higher on the PPVT than

![Figure 1](image-url)  
**Figure 1.** Average number of word types used by monolingual and bilingual children. Error bars indicate mean standard error.
did the 28 bilinguals who told the story in both languages, $F(1, 66) = 86.45, p < .001, \eta^2_p = .571$, but they did not differ on the SF, $F(1, 66) = 2.20, p = .14, \eta^2_p = .033$.

While some previous studies have shown bilingual advantages on attentional control, there were no differences between language groups on the DCCS, either when all the bilinguals were included or when only the bilinguals who told the story in both languages were included ($F$s < 1). As for visuospatial memory, the bilinguals scored higher than the monolinguals on the HSI—both all the bilinguals, $F(1, 77) = 5.44, p = .022, \eta^2_p = .066$, and just those who told the story in both languages, $F(1, 66) = 8.36, p = .005, \eta^2_p = .112$.

### Predictors of word types in stories

The first-order correlations between variables are summarized in Table 2 (Mandarin) and Table 3 (English). As shown in these tables, there were many intercorrelations between the variables of interest in this study.

We ran hierarchical regressions to test the possible predictors of children’s word types in their stories. The dependent variable was word types (in English or Mandarin). The PPVT,
SF, DCCS (for the children who spoke English), and HSI were used as the predictor variables for word types after controlling for age in months. Therefore, age was always entered in the first step, and the other variables were entered in the second step.

The results for the regression on word types are summarized in Table 4 (see Appendix for further details). For the monolingual English children, PPVT was a significant predictor. For the bilingual children in English, both SF and DCCS approached significance. Note that SF was a negative predictor of the children’s word types in English. We will address this puzzling finding in the Discussion.

For the monolingual Mandarin children, PPVT was the only predictor variable that approached significance in Step 2 after controlling for age ($p = .051$). For the bilingual children in Mandarin, the second model also reached significance ($\Delta R = .164$, $p = .035$). However, none of the individual variables reached significance.

**Comparisons between bilinguals who told the story in Mandarin only or in both languages**

Table 5 summarizes the data on the bilinguals by whether they told a story in Mandarin only or also in English. As can be seen in this table, the bilinguals who told the story in both languages differed from the bilinguals who told the story only in Mandarin on a

### Table 4. Predictors of word types in monolingual and bilingual children.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>English monolinguals</th>
<th>Bilinguals (English)</th>
<th>Bilinguals (Mandarin)</th>
<th>Mandarin monolinguals</th>
</tr>
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<td>$\beta$</td>
<td>$p$ value</td>
<td>$\beta$</td>
<td>$p$ value</td>
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<tr>
<td>Step 1</td>
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<td></td>
<td></td>
<td></td>
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<td>Age (months)</td>
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<td>.906</td>
<td>.516**</td>
<td>.005</td>
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<tr>
<td>Step 2</td>
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<td></td>
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<td></td>
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<td>PPVT</td>
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<td>.017</td>
<td>.096</td>
<td>.602</td>
</tr>
<tr>
<td>SF</td>
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<td>.597</td>
<td>-.481*</td>
<td>.050</td>
</tr>
<tr>
<td>DCCS</td>
<td>-.085</td>
<td>.615</td>
<td>.508*</td>
<td>.048</td>
</tr>
<tr>
<td>HSI</td>
<td>.106</td>
<td>.555</td>
<td>.293</td>
<td>.123</td>
</tr>
</tbody>
</table>

Note. PPVT = Peabody Picture Vocabulary Test (receptive vocabulary); SF = semantic fluency; DCCS = Dimensional Change Card Sort task; HSI = hand-shape imitation task.

** $p < .01$. * $p \le .05$. † $p < .06$. 

### Table 5. Average (SD) scores for bilingual children who told the story in both languages and those who told the story only in Mandarin.

<table>
<thead>
<tr>
<th>N</th>
<th>Bilinguals who told the story in both languages</th>
<th>Bilinguals who told the story only in Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average (SD) age in months 66.6 (9.3)</td>
<td>56.3 (4.7)</td>
</tr>
<tr>
<td></td>
<td>Age range (months) 48–80</td>
<td>51–65</td>
</tr>
<tr>
<td></td>
<td># Girls/Boys 10/18</td>
<td>5/7</td>
</tr>
<tr>
<td></td>
<td>PPVT-English 34.7 (22.2)</td>
<td>30.5 (11.7)</td>
</tr>
<tr>
<td></td>
<td>SF-English 13.8 (6.4)</td>
<td>8.1 (6.6)</td>
</tr>
<tr>
<td></td>
<td>DCCS 7.2 (2.7)</td>
<td>4.4 (3.0)</td>
</tr>
<tr>
<td></td>
<td>PPVT-Mandarin 106.4 (15.6)</td>
<td>102.2 (14.9)</td>
</tr>
<tr>
<td></td>
<td>SF-Mandarin 12.5 (6.0)</td>
<td>9.5 (5.4)</td>
</tr>
<tr>
<td></td>
<td>Word types-Mandarin 55.4 (26.4)</td>
<td>33.3 (15.9)</td>
</tr>
</tbody>
</table>

Note. PPVT = Peabody Picture Vocabulary Test (receptive vocabulary); SF = semantic fluency; DCCS = Dimensional Change Card Sort task.
number of variables: They were older, produced more words on the SF task in both English and Mandarin, scored higher on the DCCS, and produced more word types in their Mandarin stories. In contrast, the children who told a story in both languages scored similarly on receptive vocabulary tests in both languages to the children who told the story in Mandarin. It was difficult to tease out which of these variables were the most important. The groups differed significantly in age, \( F(1, 38) = 13.27, p = .001, \eta^2_p = .259 \). Once age was controlled for, there were no differences between the groups on any of the remaining variables.

**Lexical characteristics in English**

Among all the children, 633 different words were used in the English stories. Of these, 249 words (about 40%) were used by both bilingual and monolingual children. There were 215 different words used uniquely by bilingual children and 169 used uniquely by monolingual children. The median frequency of the unique words was 140.0 by the bilingual children and 148.1 by the monolingual children. The bilingual children used 464 different words in total (a ratio of 16.6 per child), while the monolingual children used 418 different words in total (a ratio of 10.5 per child).

The bilingual children used significantly more one-syllable words (\( M = 82.3\% \), \( SD = 7.0\% \)) compared with the monolingual children (\( M = 78.3\% \), \( SD = 6.5\% \)), \( F(1, 66) = 5.87, p = .018, \eta^2_p = .082 \). The bilinguals’ mean word-frequency median (\( M = 5,073.0 \), \( SD = 4,086.2 \)) did not differ significantly from that of the monolinguals (\( M = 4,633.0 \), \( SD = 2,863.9 \); \( F < 1, \eta^2_p = .004 \)). Note that while the variance among the bilinguals was higher than that of the monolinguals, the variances did not differ when compared on Levene’s test of equality of error variances (\( p = .21 \)). The average percentage of low-frequency words used by the bilinguals (\( M = 9.4\% \), \( SD = 5.7\% \)) did not differ from that of the monolinguals (\( M = 10.7\% \), \( SD = 6.2\% \); \( F < 1, \eta^2_p = .011 \)).

**Table 6** summarizes the correlations between the children’s use of these lexical characteristics and their PPVT and DCCS measures. As can be seen in this table, none of these correlations reached significance for the monolinguals, but the DCCS was highly correlated to the bilingual children’s median frequency (the negative correlation meaning that the lower the frequency, the higher the DCCS score) and their percentage of low-frequency words.

**Table 6.** Pearson correlations between lexical characteristics in English and children’s vocabulary (PPVT) and executive functions (DCCS).

<table>
<thead>
<tr>
<th></th>
<th>PPVT Monolingual</th>
<th>PPVT Bilingual</th>
<th>DCCS Monolingual</th>
<th>DCCS Bilingual</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-syllable words</td>
<td>-.284</td>
<td>-.241</td>
<td>-.284</td>
<td>-.279</td>
</tr>
<tr>
<td>Median-frequency words</td>
<td>-.172</td>
<td>-.383*</td>
<td>-.098</td>
<td>-.595**</td>
</tr>
<tr>
<td>Low-frequency words</td>
<td>.216</td>
<td>.348</td>
<td>.001</td>
<td>.555**</td>
</tr>
</tbody>
</table>

*Note. PPVT = Peabody Picture Vocabulary Test; DCCS = Dimensional Change Card Sort task.

*p < .05.

**p < .01.
Discussion

This study showed that vocabulary size was an important predictor of monolingual children’s lexical diversity in their stories, even after controlling for age. This result held for both English and Mandarin Chinese monolingual children, suggesting some cross-linguistic generalizability. This result supports Berman’s (1988) argument that vocabulary size is an important predictor of the variety of words children use when telling stories. As children’s vocabulary increases, they can select from a greater number of different words to tell a story.

If vocabulary size was also an important predictor of bilingual children’s lexical diversity, bilingual children might produce fewer different words than monolinguals. In this study, as in many other studies (see a review in Bialystok, 2009), the Mandarin-English bilingual children tended to score lower on vocabulary measures than did monolingual children. However, surprisingly, they used just as many different words to tell what happened in a cartoon as did same-aged monolingual children in both languages. Moreover, vocabulary scores were not a positive predictor of bilingual children’s word types. These results replicate and extend those of Peets and Bialystok (2015). This replication is remarkable in that the bilinguals in our study had only been learning English for an average of 1.5 years and had scored about 40% of the English monolinguals’ PPVT scores on average. The bilingual children in Peets and Bialystok averaged 92% of the English monolinguals’ PPVT scores. Therefore, the results of the present study, along with the results of other studies (Barbosa et al., 2016; Nicoladis et al., 2007; Pearson, 2002; Peets & Bialystok, 2015; Uccelli & Páez, 2007), demonstrate that bilingual children can sometimes tell stories with just as many word types as monolinguals, despite having smaller vocabularies.

We argue that some bilingual children can allocate their cognitive resources strategically to produce many different words to convey their meaning within the context of a story. For the bilingual children in English (their second language), attentional control was a significant predictor of lexical diversity, even after controlling for age. Semantic fluency approached significance as a negative predictor. Bilingual children, due to both lower vocabularies and greater difficulties with lexical access, can perhaps deploy their selective attention strategically by choosing words that they can say in English that are adequate to convey important concepts. The finding that the bilinguals used more different words per child than the monolinguals is consistent with this explanation: The bilingual children’s lexical selection was more idiosyncratic than that of the monolinguals. For example, one bilingual child referred to the Pink Panther as a raccoon and another referred to him as a kitten. These words are both low-frequency words that monolinguals never selected. While the Pink Panther is neither a raccoon nor a kitten, in the context of telling a story about the Pink Panther’s adventures, these words are adequate to refer to the main character. If our reasoning is thus far correct, the reason that SF scores were a negative predictor for word types in English for bilingual children is because high SF scores reflect both lexical access and executive functions to attain a narrowly defined goal (e.g., the names of only food and drinks). In other words, SF does not allow for and may even impede the same kind of flexibility in lexical access as storytelling does.

Some previous studies have shown bilingual advantages on the cognitive predictors we included in our study. If so, then bilingual children might have relied more on these cognitive abilities than monolingual children because they were better at them. However, we did not replicate a bilingual advantage on attentional control (cf. Bialystok & Martin, 2004). We found that the bilingual children did show higher visuospatial working memory than English monolingual children (as found in Garratt & Kelly, 2007), but it was lower than that of Mandarin
monolingual children. The Mandarin monolingual children scored higher than the English monolingual children on our measure of verbal working memory. Working memory is often considered an executive function (Diamond & Lee, 2011). Thus, it is possible that the Mandarin-speaking children’s advantage over English-speaking children is an example of the executive function advantage previously reported for Chinese children (Sabbagh et al., 2006). In any case, if and when bilinguals show advantages on cognitive tasks has received considerable attention in the literature (e.g., Paap & Greenberg, 2013) and was not the focus of the present study. For the purposes of the present study, we can conclude that the reason bilingual children relied on attentional control more was not because they were better at it than monolingual children.

It is important to keep in mind that not all bilingual children showed evidence of flexible use of cognitive strategies in the storytelling task: Some of the bilingual children opted not to tell the story in English at all. The children who told the story in both languages were older and tended to score higher on language production measures in both languages and higher on our measure of attentional control. The combination of being able to tell a story with varied word choice in one language and the acquisition of age-related cognitive abilities might have given these bilingual children a greater understanding of what they might want to articulate in one language and so they found a way to do so in English. Some previous studies have shown that bilingual children perform more poorly than monolinguals on language-related aspects of storytelling, such as word choice (e.g., Paradis & Kirova, 2014). These studies did not consistently control for the children’s cognitive abilities and language production abilities in their other language. It is therefore possible that bilingual children have to reach a critical phase in cognitive development before they can deploy their cognitive resources strategically to produce a high degree of lexical diversity in stories (see the discussion along these lines in Cummins, 2008).

Finally, we tested the possibility that bilingual children might produce easier words than monolinguals. Consistent with this possibility, bilingual children produced more one-syllable words than did monolingual children. In contrast, bilingual children used just as many low-frequency words as monolinguals, although they produced many words that the monolinguals did not, showing a higher degree of idiosyncrasy in word choice. The bilinguals’ use of low-frequency words was highly correlated with their attentional control. Taken together, these results suggest that the bilingual children were not necessarily accessing simpler words but were using their attentional control to select words that they knew in English and that were adequate to convey their message. These results are in line with the findings of Barbosa et al. (2016), who showed that older (8- to 10-year-old) bilingual children tended to use a greater variety of linguistic constructions to convey concepts compared with same-aged monolinguals.

This study included a small sample size, particularly for the bilingual children who told a story in English. This sample size limits generalizability. This study also included children from a wide age range, including preschool children and children who had already started school. Although we controlled for age statistically in this study, it is possible that the onset of story-related activities in school could change children’s lexical selection. Another limitation of this study is the lack of reliably comparable measures in both English and Mandarin. It is not clear whether children’s performance can be meaningfully compared across the two languages. Future studies might include language pairs for which extensive cross-linguistic validation has already taken place, in addition to larger sample sizes with greater homogeneity with regard to school attendance.
Conclusion

We have shown that vocabulary scores were a strong predictor of monolingual children’s lexical diversity in telling a story, even after controlling for age. Moreover, we have shown that these results generalize to two groups of monolingual children from different language and cultural backgrounds: English-speaking children in Canada and Mandarin Chinese-speaking children in China.

Although the Mandarin-English bilingual children scored lower on vocabulary tests in both languages relative to monolinguals, they could tell stories with just as many varied word choices as monolingual children in both languages. Vocabulary was not a significant predictor of the bilingual children’s storytelling abilities in either language, while some cognitive measures were more highly predictive (particularly in the children’s second and weaker language). These results suggest that bilingual children might use different strategies for word choice in the context of a story than compared with monolinguals. We argue that bilinguals can rely more heavily on attentional control to shift their attention to alternative lexicalizations for conveying their message.

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Appendix

The results for the regression on word types are summarized in Table 4. For the monolingual English children in both languages, age was not a significant predictor in Step 1, but the second model neared significance ($\Delta R = .453, p = .112$). The Peabody Picture Vocabulary Test (PPVT) was a significant predictor for the English monolinguals in Step 2. For the bilingual children in English, age was a significant predictor in Step 1 and the second model also reached significance ($\Delta R = .163, p = .013$), with both semantic fluency (SF) and the Dimensional Change Card Sort task approaching significance. Note that SF was a negative predictor of the children’s word types in English. For the bilingual children in Mandarin, age was a significant predictor in Step 1 and the second model also reached significance ($\Delta R = .164, p = .035$). However, none of the individual variables reached significance. For the monolingual Mandarin children, age was a significant predictor in Step 1 and the second model also reached significance ($\Delta R = .136, p < .001$). The individual variable in Step 2 that was the closest to significance for the Mandarin monolinguals was PPVT.