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Influential Factors in Lexical Richness of Young Heritage Speakers' Family Language

Khadijeh Gharibi and Frank Boers

Abstract

Aims and objectives: This study investigates the extent to which young heritage speakers' oral narratives in L1 differ from monolinguals' narratives with regard to lexical richness (lexical diversity and lexical sophistication). It also explores which demographic factors (age, age at emigration and length of emigration) and/or sociolinguistic factors (frequency of heritage language use and parental attitudes towards heritage language maintenance) account for the differences.

Data and analysis: The participants were a group of 25 young speakers of Persian as a heritage language, who were either born in or emigrated to New Zealand, and a group of 25 monolingual counterparts in Iran. Demographic information about the heritage speakers as well as information about parental attitude and practices regarding heritage language acquisition and maintenance were collected through semi-structured interviews with their parents. A film-retelling task was used to elicit the oral narratives, and these were analyzed for lexical diversity (by means of the Measure of Textual Lexical Diversity—MTLD) and for lexical sophistication (by counting the incidence of low-frequency words).

Findings and conclusion: As expected, the monolinguals' narratives tended to manifest greater lexical richness than the heritage speakers', especially according to the measure of lexical sophistication. Against expectation, frequency of heritage language use and parental attitude towards heritage language acquisition and maintenance were not found to be significant predictors of the young heritage speakers' results. For the heritage speakers who were born in New Zealand, the results were predicted best by their age, while for those who arrived in New Zealand at a later age, the best predictors were both their age and how old they were at the time of emigration. This suggests that the demographic factors overrode the potential influence of the sociolinguistic variables examined.

Originality: This study sheds light on (factors that contribute to) young heritage speakers' L1 lexical competence, a topic which has hitherto been under-investigated.

Significance and implications: A major implication of this study is showing the association of age and heritage speakers' lexical richness. Although the statistical analyses did not show

the effect of sociolinguistic variables, this finding indirectly supports the effect of parental input on heritage language proficiency in young bilinguals.

Limitations: Limitations of the study include the relatively small number of participants, the use of only one task to elicit speech samples, and the reliance on parents' self-reported family language habits.

Keywords

Heritage Speakers, Simultaneous and Sequential Bilinguals, Incomplete Acquisition, First Language Attrition, Lexical Diversity, Lexical Sophistication

Introduction

Currently, children are more likely to grow up with more than one language due to increasing mobility around the world (Tucker, 1998). Among bilinguals, heritage speakers are bilinguals who were born in or emigrated during their childhood to an environment where the majority language is different from the language spoken in their family (Montrul, 2012) and they grew up hearing and possibly speaking that minority language (Polinsky, 2011). Heritage speakers' proficiency in their heritage language can vary considerably. Much of the research on such variation has concerned grammatical knowledge (Benmamoun, Montrul, & Polinsky, 2013, for review), but less systematic research has been concerned with differences between heritage speakers' vocabulary knowledge (Montrul, 2010). And yet, the lexicon is a promising area for the detection of differences between heritage speakers and monolinguals (Hutz, 2004; Unsworth, 2013), and may thus lend itself well to an investigation of the factors that may account for those differences.

Unlike simultaneous bilinguals, sequential bilinguals are exposed to the L2 after 'basic' knowledge of the first language has already been established (and this is estimated to have happened by around the age of three [McLaughlin, 1978; De Houwer, 1995; Genesee, Paradis & Cargo, 2004]). When a child arrives in the new linguistic environment with previously acquired L1 knowledge, then heritage language knowledge later on will logically reflect (i) maintenance of what was already acquired before arrival and (ii) any additional knowledge acquired – and maintained – afterwards. The older the child is on arrival in the new environment, the better developed their L1 lexicon is likely to be, and so age at emigration can be expected to play a part in L1 lexical knowledge differences among sequential

bilinguals who arrived in the new linguistic environment at different ages. In the case of simultaneous bilinguals, who were all born in the host country or arrived there as infants, other factors, including their parents' family language practices, stand a better chance of emerging as ones that help to account for individual differences in L1 competence.

Literature Review

Potential predictors of heritage speakers' L1 vocabulary knowledge

Studies of young heritage speakers have found that they manifest both attrition and incomplete acquisition (Montrul, 2002; Polinsky, 2007). Incomplete L1 acquisition occurs when some properties of the first language do not have time to reach "age-appropriate levels of proficiency" (Montrul, 2008, p. 21) before the intense exposure to the new majority language starts. By comparison, when a property of the first language has been fully mastered prior to emigration but is lost afterwards, this qualifies as a case of L1 attrition. In practice, it is not always easy to distinguish between incomplete acquisition and attrition, especially in the case of young heritage speakers. As Montrul (2008) argues, to tease apart incomplete first language acquisition and first language attrition one needs to carry out longitudinal studies, because, strictly speaking, a particular lacuna in a heritage speaker's resources can only be said to be the result of attrition if there is evidence that this speaker did have this knowledge at an earlier point in time. The extent to which one's current knowledge of a heritage language reflects a process of incomplete acquisition or a process of attrition is also bound to depend on individual circumstances. It may seem reasonable to expect attrition to play a greater part in sequential than in simultaneous bilinguals, on the grounds that the former would already have acquired a certain amount of L1 knowledge prior to arrival in the L2 environment. This difference between sequential and simultaneous and how it relates to what should be attributed to attrition rather than incomplete acquisition is overly simplistic, however. After all, a heritage speaker born after immigration may also be exposed intensively to the family language in the early years of life but this exposure or the opportunities to practice the language may later diminish due to changing circumstances, leading to attrition. Almost inevitably, then, the current state of a (young) heritage speaker's proficiency in the heritage language will to varying degrees reflect both incomplete acquisition and language attrition "simultaneously or sequentially" (Montrul 2008, p. 21).

Although she characterizes heritage speakers' knowledge of their family language as "incomplete", Montrul (2008) clarifies that this is for lack of a better term, and that this should not be interpreted as a value judgment (p. 7). Pascual y Cabo and Rothman (2012) also express dissatisfaction with the term and argue that heritage speakers' competence should not be considered incomplete but instead as different from monolinguals', where the difference may be due to the fact that the heritage speaker has been exposed to input from caregivers (usually the parents), whose L1 has already undergone attrition and whose L1 has not incorporated the changes undergone by the language spoken in their country of origin. In other words, heritage speakers are native speakers of their family language (Rothman & Treffers-Daller, 2014) and they may 'fully' acquire that family language that they are exposed to. However, the outcome of this acquisition process is nonetheless likely to be different from the language spoken by monolingual counterparts in the 'homeland' (Benmamoun, Montrul, & Polinsky, 2013).

As mentioned, among the factors that may impact heritage speakers' L1 knowledge is their age at the time of arrival in the new linguistic environment. This factor has been shown to be a very strong predictor of heritage language competence (Bylund, 2009a and Köpke & Schmid, 2004, for reviews). Heritage language competence tends to be weaker in individuals who moved to the new linguistic environment at a young age than in those who left their home country at a later age. Some researchers have referred to the Critical Period Hypothesis (Lenneberg, 1967) to account for this (e.g., Bylund, 2009b; Polinsky, 2011). Essentially, this hypothesis holds that children enjoy a window of opportunity where their developing linguistic competence is still quite malleable and particularly susceptible to cues in their linguistic environment. This window of opportunity closes after puberty, so the theory goes. However, while the Critical Age Hypothesis has been used to explain why post-puberty learners of a language are unlikely to reach native-like attainment in their mastery of, for example, segmental and/or suprasegmental phonology, it seems a less adequate explanation when it comes to vocabulary. After all, new words and expressions can be picked up throughout one's lifetime, provided sufficient opportunities for learning are present. Even though the ability for incidental vocabulary acquisition does seem to decline with age (Hoyer & Lincourt, 1998), this is unlike the more drastic closing of a window after puberty that is suggested by the Critical Period Hypothesis (e.g., Bahrlick, Hall, Goggin, Bahrlick & Berger, 1994).

A second factor that might help explain the extent to which heritage speakers' knowledge of their family language differs from that of monolingual counterparts is how long they have been living in the host country. The longer the time spent away from the environment where the heritage language is the societally dominant language, the greater the risk of heritage language attrition would seem to be (e.g., Soesman, 1997). Studies with adult heritage speakers have not always yielded compelling evidence of this, however, suggesting that attrition rates are subject to socio-linguistic factors such as frequency of heritage-language use and commitment to heritage language maintenance (Hutz, 2004; Köpke & Schmid, 2004; Schmid, 2002). In the case of young heritage speakers, it is not only maintenance of existing knowledge but also opportunities for further development in the heritage language that can be expected to mitigate the length-of-residence factor. An obvious place where such opportunities can be created is in the nuclear family (e.g., Fishman 1991; King, Fogle & Logan-Terry, 2008).

Indeed, a third factor likely to influence language development is quantity (and quality) of input (Montrul, 2008; Unsworth, forthcoming; Unsworth & Blom, 2010). While more input promotes more language use (Pearson, 2007), shortage of input not only compromises acquisition but it may also lead to attrition of items that are not yet well entrenched in memory. The role of frequency of use is a key feature of the Activation Threshold Hypothesis (Paradis, 2004), according to which frequently activated items are easily retrievable from memory, while retrieval of items that are rarely activated becomes laborious and may eventually fail. Receptive knowledge tends to be retained longer than productive knowledge, because production requires a higher level of activation (Hulsen, 2000; Montrul 2008, p. 81; Paradis, 2007, p. 125). O'Grady, Schafer, Perla, Lee and Weiting (2009) add that speakers are likely to feel reluctant to use less accessible linguistic items due to infrequent activation and this avoidance, in turn, leads to further language loss. This is consistent with the input-proficiency-use cycle proposed by Pearson (2007, p. 401). According to this proposal, increased input leads to better proficiency and consequently promotes more use of the language, which, in turn, creates more opportunities for learning and entrenchment of knowledge. Given these considerations, it is useful to complement tests of declarative knowledge by measures of procedural knowledge, since the latter may reveal differences between participants and effects of frequency of L1 use that are left undetected by the former. We return to this test or measurement issue further below.

The family has been shown to play a critical role in heritage speakers' minority language acquisition and maintenance (e.g., Fishman, 1991; King, Fogle & Logan-Terry, 2008; Schwartz, 2010, to name a few). As Spolsky (2012, p. 4) points out, it is within the family that natural intergenerational transmission of minority languages tends to occur. Therefore, a positive attitude on the part of the parents towards their family language is expected to exert a positive influence on their children's heritage language acquisition and maintenance. The more parents value and use the heritage language, the more their children tend to acquire and maintain it (e.g., De Houwer, 1999; Zhang & Slaughter-Dafoe, 2009, Daller & Ongun, 2017). However, as pointed out by Bennet (1997) and Cherciov (2012), a positive attitude towards one's language alone is not likely to suffice if it is not translated into effective family language practices.

An attempt at gauging the influence of aforementioned factors on young heritage speakers' L1 vocabulary knowledge was made in Authors (2017). In that study, young heritage speakers' ($n=30$) vocabulary knowledge was explored through a 48-item auditory picture-word matching test and through a verbal lexical fluency test which prompted participants to supply as many words related to two lexical fields (fruit and animals) as they could in a specific time. Their scores were then compared to the performance on the same tests by matched monolingual counterparts. The young heritage speakers' parents were interviewed to obtain demographic data and information on their family language practices and attitude towards heritage language maintenance. According to regression analyses, the children's age when they arrived in the host country was found to be the strongest predictor of their scores on vocabulary tests, with bilinguals with a younger age at arrival generally performing more poorly on the vocabulary tests than those who arrived in the L2 community at a later age. Family language practices and the parents' attitude toward heritage language maintenance were found to be additional predictors of vocabulary knowledge, but only so in the case of simultaneous bilinguals. As to the differences in lexical competence among the sequential bilinguals in the sample, however, it was age at arrival which emerged as the only significant predictor, while the role of family language practices and parents' attitudes to language maintenance seemed to be negligible.

In the present study, instead of using decontextualized tests, we elicited oral narratives from young heritage speakers to examine their lexical competence. More specifically, measures of lexical richness exhibited by the narratives were used to re-evaluate the influence of parents'

family language practices and attitudes towards heritage language maintenance on young heritage speakers' vocabulary development.

The Focus of This Study: Lexical Richness

The present study examines the lexical richness of L1 speech samples collected from young heritage speakers and compares this to samples collected from monolingual counterparts. Lexical richness refers to “the quality of vocabulary” (Malvern & Richards, 2013, p. 1) in language use. Read’s (2000) model of lexical richness includes lexical diversity, lexical sophistication (use of low-frequency vocabulary), lexical density (the ratio of content words to function words), and the frequency of lexical errors. The first two of these measures (i.e., lexical diversity and lexical sophistication) are the most commonly used in investigations of lexical richness (Malvern & Richards, 2013) and will also be the focus in the present study.

Studies by Crossley, Salsbury and Macnamara (2013, 2014), for example, have demonstrated the use of lexical diversity measures as an indicator of lexical competence. Lexical diversity (LD) refers to “the range and variety of vocabulary deployed in a text by either a speaker or a writer” (McCarthy & Jarvis, 2007, p. 459). The best known lexical diversity measure is type-token ratio (TTR), which is calculated by dividing the number of different words (types) by the total number of words (tokens) in a speech sample. Different type-token ratio computations have been proposed (see Duran, Malvern, Richards & Chipere, 2004), including the index of Guiraud (Guiraud, 1954; as cited in Treffers-Daller, Parslow & Williams, 2016), D (Malvern, Richards & Durán, 2004), HD-D (McCarthy & Jarvis, 2007) and MTL (McCarthy, 2005). MTL (Measure of Textual Lexical Diversity) is calculated “as the mean length of sequential word strings in a text that maintain a TTR value of .72” (McCarthy & Jarvis, 2010, p. 384). A problem with many of these measures is that they tend to be sensitive to text length. Koizumi (2012) compared four lexical diversity measures (TTR, Guiraud, D and MTL) in this regard, and found that MTL was the least susceptible to text length. That does not mean, however, that MTL is entirely immune to the influence of text length. Treffers-Daller (2013) found that, whereas D and HD-D tend to increase as texts get longer, MTL decreases. According to Treffers-Daller, Parslow & Williams (2016), “the search for a measure of LD which is not dependent on text length is still on” (p. 6).

The major objection to measures solely based on type-token ratios is that they do not distinguish between common words and less frequently used words (Vermeer, 2000, 2004),

where the use of the latter is more likely to come across as ‘sophisticated’ or as characteristic of higher proficiency. That is why, in addition to MTLT, the present study also uses a measure of ‘lexical sophistication’. Lexical sophistication can be defined as “the proportion of relatively unusual or advanced words” used by a speaker or a writer (Read, 2000, p. 203). Ideally, spoken or written samples can be evaluated for lexical sophistication against an external criterion such as corpus-frequency based word lists (e.g., Laufer & Nation, 1995; Nation, 2006). As will be explained further below, due to the fact that no suitable source of this kind is available for the language under examination here (Persian/Farsi), we needed to resort to a different procedure to compute degrees of lexical sophistication in the narratives.

Research Questions

The following are the primary research questions addressed in the present study:

1. Is the lexical richness of oral narratives produced by young heritage speakers different from that produced by monolingual counterparts, as assessed by means of (a) a lexical diversity measure and (b) a lexical sophistication measure?
2. Do simultaneous and sequential bilingual heritage speakers differ from each other in relation to their matched monolinguals in terms of the lexical richness of their oral narratives?
3. Which demographic factors (age, age at emigration and length of residence) and/or sociolinguistic factors (frequency of heritage language use and parental attitudes towards heritage language acquisition and maintenance) help to account for the variance in the degree of lexical richness of the oral narratives of these young heritage speakers?
4. Can the level of lexical richness of the oral narratives of simultaneous and sequential bilingual heritage speakers be accounted for by the same demographic and/or sociolinguistic factors?

A secondary research question is to examine whether the two measures of lexical richness, i.e., diversity or sophistication, are equally sensitive to detecting differences between young heritage speakers and matched monolingual counterparts. This comparison may contribute to a strand of work which assesses the relative merits of various test instruments and measures in this field of research (e.g., Schmid, 2007, Schmid & Keijzer, 2009; Schmid & Dusseldrop, 2010).

Method

Participants

The two groups of young participants (and their parents) were the same as in Authors (2017). One group included 30 Persian-English bilinguals (14 boys and 16 girls; age range 6-18; mean age: 10.3) who have been living in New Zealand for different lengths of time (mean: 6.9 years). Eleven of these participants were born in New Zealand or other countries where English is the societal language and four moved to New Zealand before the age of three. These will be considered simultaneous bilinguals. The other fifteen moved from Iran to New Zealand after the age of three, and will be considered sequential bilinguals.

Nine of these participants were only children, while the others had siblings (some of whom also participated in the study). Their first (or heritage) language was Standard Persian (also known as Farsi). Their parents were initially contacted through heads of Iranian communities in three main cities in New Zealand: Wellington, Christchurch and Auckland. Seven of the immigrant families that took part in the study had moved to New Zealand for educational purposes and they did not know whether they would return to Iran after their graduation, while the others had New Zealand residency. Informed consent was obtained for their participation in the study. Each informant received a small gift as a token of appreciation for their participation.

The use of cross-sectional comparisons between heritage speakers' L1 competence and that of matched monolingual counterparts is well established in studies of bilingual competence (e.g. Daller & Ongun, 2017). Following this design, a second group of young participants included 30 monolingual Persian speakers, each of whom was matched with one of the bilingual participants in New Zealand with regard to age, gender, number of siblings and family sociolinguistic status. This group of monolinguals served the purpose of obtaining 'baseline' data to help put the findings regarding the heritage speakers' vocabulary use into perspective. For example, given the age range of the participants, it is to be expected that age will emerge as a strong predictor of the monolinguals' lexical competence. It will be interesting to see how this compares to the group of heritage speakers.

Materials and procedures

In order to elicit speech samples, some researchers have used autobiographical interviews with participants (e.g., Yilmaz & Schmid, 2012; Schmid & Jarvis, 2014) or film and story retelling tasks (e.g., Schmid, 2007; Schmid & Fägersten, 2010; Schmid & Jarvis, 2014). We used a film-retelling task, because this keeps the variables of content and genre constant across the samples (Schmid & Fägersten, 2010). A considerable number of studies have used a Charlie Chaplin silent movie in the film-retelling task (Perdue, 1993; as cited in Schmid, 2011). For the purpose of the present study, however, the Charlie Chaplin movie was felt not to be an optimal choice of input as it might require particular historical/cultural background knowledge which the younger participants might not be able to rely on. Instead, a six-minute episode of “Tom and Jerry” was chosen. The episode is about a puppy that was found by Jerry. Jerry tries to take it into the house where Tom lives, but Tom keeps throwing them out. He eventually feels bad about what he has done and goes out to find them, but he falls into a river. Jerry and the puppy save him and Tom lets the puppy stay in his house. The participants were asked to watch the episode of “Tom and Jerry” and retell the story. No time or length was stipulated for this retell task. The same film-retelling task was used to collect the benchmark data from the monolingual participants in Iran.

The parents of the young heritage speakers were interviewed with the aid of a sociolinguistic questionnaire which comprised 68 items (including 5-point Likert scale items) to get information on the families’ background, language use and attitudes towards their heritage language. The questionnaire on which this was based was retrieved from the language attrition website (Schmid, n. d.) (for details see www.let.rug.nl/languageattrition/SQ). The semi-structured interview had five parts. The first elicited demographical information such as age, length of residence in New Zealand, the heritage speakers’ age at the time of emigration, and time spent in another country before moving to New Zealand. This also included questions on the frequency of visits to Iran and visits of friends and relatives from Iran. In the second part, the parents were asked if they and their children had had English education before coming to New Zealand. They were also asked to self-evaluate their proficiency in English and their children’s Persian proficiency over the years they have been living in New Zealand. Family language use was explored in the third part of the interview. Parents were asked to indicate in which language they habitually spoke to their spouse, children and friends. They were also asked how often they were in touch with relatives in Iran. This section was followed by questions on the children’s language use and choice in different situations in which they had the opportunity to develop and maintain their productive and

receptive abilities in Persian. In the last part, more factors associated in the literature with language attitude were explored. For example, parents were asked if they correct their children when they make mistakes in Persian. They were also asked to what extent they value heritage language maintenance in their children.

Both the interview and the film-retelling task took place in the families' homes or a place of their choice.

Data processing and analysis

All film-retellings were recorded and transcribed according to CHAT conventions (<http://childe.psy.cmu.edu/manuals/CHAT.pdf>). The narratives were then analyzed for 'lexical richness', a shorthand term in this article for both lexical diversity and sophistication. The way lexical competence was gauged in the present study it therefore different from what was done in Authors (2017), where 'controlled', decontextualized vocabulary tests served as the instruments. While these may be suitable for measuring declarative knowledge, they may not be as suitable for tapping procedural knowledge, that is, the knowledge speakers rely on when they engage in real-time, message-focused communication. It has indeed been argued that decontextualized vocabulary tests should be complemented by analyses of heritage speakers' vocabulary use in free speech, which is more likely to rely on procedural knowledge (Schmid, 2011, p. 194; Schmid, 2004; Schmid & Beers Fägersten, 2010; Yilmaz & Schmid, 2012).

Given the varying lengths of oral narratives in our sample (see below), we opted to use MTLN as the measure of lexical diversity. Before applying MTLN, the transcripts were checked for any inconsistencies in typing the same words. Base forms and their inflected forms are considered as different types in the analysis of MTLN, for example, the words *sag* 'a dog' and *sagha* 'dogs' or *khordam* 'I ate', *mikhorand* 'they eat' and *bokhor* 'eat, second person singular imperative' were counted as different types (while they were considered as the same lemma in the lexical sophistication analysis – see below). After checking the transcripts, MTLN was calculated using Gramulator (McCarthy, 2012).

In order to measure lexical sophistication, researchers tend to use representative corpora (e.g., British National Corpus and the Corpus of Contemporary American English) and corpus-based frequency lists (e.g., Laufer & Nation, 1995), to determine whether language samples

contain low-frequency words – and where inclusion of low-frequency words is taken to be a sign of lexical sophistication. However, in the case of languages for which no such corpora or frequency lists are available, a different procedure is necessary. There are some corpora available for Persia, but these are mostly compiled from newspapers (e.g., Bijankhan Corpus, Bijankhan, 2004). Considering the profile of the participants in this study and the nature of the narrative task, it was decided not to use these corpora for the current purpose. Facing the same problem in a study on Turkish as a heritage language, Yilmaz and Schmid (2012) measured lexical sophistication on the basis of a corpus consisting of the collective output of their monolingual and bilingual participants. The same approach was adopted in the present study. After lemmatizing all the narratives, the average frequency of all lemmas used by the participants was calculated. Lemmatization involves excluding function words and stripping content words of their inflectional morphemes (i.e., tense, number, person, case, etc.). Items which share the same root are counted as one lemma. To illustrate, the words *go*, *are going*, *went*, *has gone* and *had gone* are all coded as the lemma “go”. Accordingly, we manually excluded proper nouns (e.g., Tom & Jerry), function words (e.g., *Ma* ‘we’), and inflectional morphemes (e.g., *-am* ‘first person singular verbal suffix’) to arrive at lists of lemmas used in the transcripts. To exemplify, the word *raft* ‘s/he went’, *raftim* ‘we went’, *miravam* ‘I go’, *dashtand miraftand* ‘they were going’ and *boro* ‘go, second person singular imperative’ were all coded under the lemma *raft* ‘go’. For each participant, the frequency of every lemma in the film-retelling was then calculated in the corpus by using R, a programming language for statistics (<https://www.r-project.org/>) (also see Field, Miles & Field, 2012). Following this, the average frequency of all lemmas used by each participant in the corpus was assessed to show the level of their lexical sophistication compared to all other participants in the study. For example, the corpus contained two synonyms denoting ‘friend’. One of these, *dust*, occurred often (and was used by both bilinguals and monolinguals), while the other, *refight*, occurred seldom (and was used only by monolinguals).

In order to analyze the data elicited through the semi-structured interviews, the recorded interviews were transcribed and the questionnaire responses were codified according to guidelines on the language attrition website (Schmid, 2012). Following this, two composite variables (see Table 1) were created by using the IBM SPSS 20 function “Compute variable” (also see Schmid & Dusseldorp 2010). The first composite variable, the use of Persian (with a Cronbach’s alpha of .71), included the Likert scale responses concerning (a) the parents’ use of Persian with their children and with their spouse, (b) the young participants’ use of Persian

at home to communicate with their father and with their mother (c) the young participants' use of Persian to communicate with Iranian friends and acquaintances, and (d) the young participants' listening to Persian songs and watching movies in Persian. The second composite variable (with Cronbach's alpha .63) was made up of the Likert scale responses concerning the parents' attitude towards Persian and language maintenance. Similar to other studies on the role of attitude (e.g., Cherciov, 2012), the items included here were (a) visits to Iran, (b) the fostering of friendships with other Persian-speaking immigrants, (c) maintenance of contacts with relatives in Iran, (d) the parents' evaluation of the need for their children to master Persian, (e) the amount of encouragement they give to their children to speak Persian, (f) the inclination to correct their children's mistakes when they speak Persian, and (g) expressions of regret about their children's loss of Persian. In the interview, parents were also asked whether they encouraged their children to read and write in Persian, but this item was excluded from the composite variable because very few of the young participants turned out to be literate in Persian. For each, the parent's average response on the Likert scale items included in the given composite variable was used in the statistical analyses reported further below.

<Table 1 around here>

Results

One of the young heritage speakers felt too unconfident to retell the story in Persian and asked to be excused from the task. Four narratives had to be excluded from the analysis because they were too short to justify use of the MTLD measure (see Koizumi, 2012). It should be noted that all these five participants were simultaneous bilinguals, i.e., they were born in New Zealand or had arrived in NZ before the age of three. To preserve the comparability with the benchmark group of monolinguals in Iran, we also excluded the narratives from their matched counterparts. As a consequence, the actual number of narratives analyzed was reduced to 50. This corpus of 50 film-retellings consisted of 9,791 tokens, comprising a total of 509 different lemmas.

As can be seen in Tables 2 and 3, the heritage speakers' narratives tended to display less lexical diversity and lexical sophistication than the narratives collected from their

monolingual counterparts. Note that lower figures for the lexical sophistication measure indicate more use of low-frequency words, and thus greater lexical sophistication. The results of lexical diversity and lexical sophistication were highly correlated in both groups ($r = -.62$ in bilinguals and $r = -.70$ in monolinguals). At the same time, the correlations are clearly far from absolute, which confirms that the two measures highlight slightly different facets of the lexical richness construct, and thus that it is useful to include both in an investigation such as this.

<Tables 2 and 3 around here>

We subjected the bilingual and monolingual groups' lexical diversity and lexical sophistication scores to analyses of covariance (ANCOVA). The data satisfactorily met the criterion for normality. In Tables 4 and 5, "BiMo" stands for whether participants belonged to the group of heritage speakers (bilinguals) or the group of monolingual counterparts. After initially running a full model, non-significant interaction effects were removed. The final model is reported for each measure together with its interpretation. All main effects (age, gender, BiMo, having siblings) were included in all the models. Thus, when the effect of BiMo was tested in each model, we were controlling for these variables.

Regarding the Lexical Diversity data, the final model revealed that the difference between bilinguals and monolinguals is borderline significant ($F(1, 50) = 3.98, p = .051$). Additionally, age ($F(1, 50) = 34.57, p = .000$) was a significant predictor (see Table 4).

<Table 4 around here>

As to Lexical Sophistication, the analysis showed a clear significant difference between bilingual and monolingual participants ($F(1, 49) = 21.41, p < .001$). The effect of the covariate age was also significant again ($F(1, 49) = 33.88, p < .001$) (see Table 5)

<Table 5 around here>

A multivariate general linear model (MANOVA) was computed to explore the differences of the results of lexical diversity and lexical sophistication between the two groups of participants. Age, which was entered as a covariate, was significantly related to the outcome ($p = .000$). The only independent variable in the model was BiMo, which was significantly related to the results: $F(3, 50) = 18.6, p < .001$; Wilks' Lambda = .54; partial eta squared = .45.

The results of lexical diversity ($p = .02$, partial eta squared = .1) as well as lexical sophistication ($p = .000$, partial eta squared = .29) were significantly different between heritage speakers and matched monolinguals. From the partial eta squared effect sizes, it can be seen that the measure of lexical sophistication had greater distinguishing power than the measure of lexical diversity (see Tables 6 and 7).

<Tables 6 and 7 around here>

In order to know if the simultaneous' and sequential bilinguals' lexical diversity and lexical sophistication scores are significantly different from their matched monolingual counterparts, independent-samples t-tests were conducted for each subgroup. The results are summed up in Tables 8 and 9, respectively.

<Tables 8 and 9 around here>

While the difference in lexical diversity fell short of significance for both subgroups, the gap was wider in the case of the simultaneous bilingual subgroup (Table 8). The independent samples t-tests which were conducted on the results of lexical sophistication showed that both of the heritage speaker sub-groups were significantly different from their monolingual counterparts. However, as indicated in Table 9, the gap between the bilinguals' and the monolinguals' lexical sophistication results was similar in both subgroups.

The next question was which (if any) of the demographic factors (age, age at emigration and length of emigration) and/or sociolinguistic factors (frequency of Persian use and parents' attitude towards the heritage language and its maintenance) help to explain the variance in the lexical richness of the heritage speakers' oral narratives. To answer this question, regression analyses were carried out. Unfortunately, length of residence in New Zealand could not be entered into the models because of its collinearity with the participants' age at the time of testing and also with their age at emigration.

Regarding lexical diversity, age ($r = .74, p < .001$), age at emigration ($r = .62, p < .001$) and frequency of Persian use ($r = .34, p = .04$) were found to be significantly correlated to the results of the group of bilinguals as a whole. Because of the wide age range of the participants and the strong correlation of $r = .74$, age was entered as the first step into the hierarchical regression model. In this model, age alone predicted 53% of the results (Adjusted $R^2 = .53$). Age at emigration also contributed to the explanatory power of the model, but frequency of Persian use and attitude did not (see Table 10). According to the final regression model, $F(4, 20) = 11.3, p < .001$, age and age at emigration were thus the only variables that significantly predicted the variance in lexical diversity scores in the bilinguals.

<Table 10 around here>

In the regression model conducted on the lexical sophistication results for the whole group of heritage speakers, it was found that age ($r = -.65, p < .001$) and age at emigration ($r = -.34, p = .04$) were again significantly correlated to the results. Age by itself explained 40% of the variance in the lexical sophistication results (Adjusted $R^2 = .4$). The final hierarchical regression model, which reached statistical significance, ($F(4, 20) = 4.3, p = .01$), explained 36% of the variance (Adjusted $R^2 = .36$). The model confirms that the results of lexical sophistication were largely predicted by age (standardized coefficient Beta = $-.62, p = .002$). In fact, neither the socio-linguistic variables nor participants' age at emigration reached significance (Table 11).

<Table 11 around here>

So far, the results suggest that frequency of Persian use and parents' attitude to heritage language maintenance exert a non-significant influence on young heritage speakers' lexical richness, while age factors prevail. As discussed above, the relative contribution of these factors may differ between simultaneous and sequential bilinguals, however. Separate hierarchical regression analyses were therefore also conducted on the data of these two subgroups. In the subgroup of the ten simultaneous bilinguals whose narratives met the criteria for inclusion (see above), length of residence in New Zealand and age at emigration were not entered into the analyses, since their length of residence was the same as or very close to their age at the time of data collection. Therefore, the only variables that could be entered into the analyses for this subgroup were age at testing, frequency of Persian use and attitude. All three were found to correlate significantly with lexical diversity results, with age showing the strongest correlation ($r = .61$). Frequency of Persian use happened to be very strongly correlated with age ($r = .92$), and consequently collinearity prevented it from being entered into the regression model. Thus, a hierarchical regression analysis was performed to measure the explanatory power of a model including just the parents' attitude and the participants' age. Age was entered as the first step, and was found to predict 38% (Adjusted $R^2 = .38$, $p = .05$) of the variance in the lexical diversity results. The final model ($F(2, 7) = 2.8$, $p = .1$) showed that attitude did not contribute significantly to the model (see Table 12).

<Table 12 around here>

Turning to the subgroup of sequential bilinguals, since length of emigration in the host country was strongly correlated with age at testing, it could not be entered into the regression model. Age was therefore entered as the first block, and it explained 61% of the variance in the lexical diversity scores in the sequential bilinguals (Adjusted $R^2 = .61$, $p = .001$). Age at emigration was entered next. This model ($F(2, 12) = 36.4$, $p < .001$) significantly explained 85% of the variance with both age and age at emigration as significant predictors. Frequency of Persian use and attitude did not add any weight to the model, as is shown in Table 13.

<Table 13 around here>

In assessing the influence of the different variables on the lexical sophistication of the simultaneous bilinguals' narratives, age, frequency of Persian use, and attitude were all three found to correlate significantly with the lexical sophistication scores, with age showing the strongest correlation ($r = -.34$). Frequency of Persian use turned out to be strongly correlated with age ($r = .92$), again preventing its entry into the model together with age. Consequently, age was entered into the hierarchical regression analysis first, and it was found to explain 11% of the variance in the results. As shown in Table 14, adding attitude to the model ($F(2, 7) = .52, p = .6$) did not add much explanatory power ($r^2 = .13, p = .7$).

<Table 14 around here>

As regards the sequential bilinguals, significant correlations were observed between the results of lexical sophistication and age ($r = -.84, p < .001$) and age at emigration ($r = -.49, p = .03$), while the association with frequency of Persian use and attitude failed to reach significance. Age, which was entered first into the hierarchical regression model, explained 71% of the variance. Age at emigration did not add much to the strength of the model. The final model ($F(4, 10) = 6.8, p = .006$) explained 73% of the variance, with age as the significant predictor, as shown in Table 15.

<Table 15 around here>

Conclusions, implications and limitations

In this study, we have examined the lexical diversity and lexical sophistication of young heritage speakers' oral narratives in comparison with narratives elicited from monolingual counterparts, and we have tried to identify the demographic and sociolinguistic factors that help predict the lexical richness displayed by these speakers. Additionally, we were interested in exploring which of the two measures of lexical richness applied in the present study lends itself best to discovering differences between heritage speakers' and matched monolinguals' lexical competence.

Overall, the data revealed that the lexical richness of the heritage speakers' narratives differed from that of their monolingual counterparts on both measures – diversity (MTLD) and sophistication (a corpus-frequency-based measure). The heritage speakers were found to use less diverse vocabulary and more high-frequency words than their monolingual counterparts, which is likely due to a combination of incomplete acquisition and attrition. Age at testing turned out to play a significant role in the results of both monolingual and bilingual participants. If monolingual children develop a richer vocabulary as they grow older, the same appears to hold true for the heritage speakers examined in this study. Accordingly, the older heritage speakers in the sample generally displayed more diverse and sophisticated use of lexis than the younger ones. This finding suggests that these heritage speakers have continued to develop (or at least maintained) knowledge of the family language as they grew up, presumably thanks mostly to the input they receive from their parents.

While both the lexical diversity and the lexical sophistication measures revealed differences between the heritage speakers and the monolinguals, the gap was wider in the results of lexical sophistication, suggesting that the latter measure may be more sensitive in detecting differences between heritage speakers and matched monolinguals. This implies that studies of incomplete acquisition and attrition in young heritage speakers' family language should consider the frequency (lexical sophistication) in addition to the diversity of the lexical items they use. By extension, studies on language attrition in adult migrants may also benefit from including a lexical sophistication measure in their methodology.

The comparison of the subgroups of bilingual participants' difference in the lexical diversity relative to their monolingual benchmarks illustrated that, while the simultaneous bilinguals were significantly different from matched monolinguals, the difference between the sequential bilinguals and their matched controls did not reach significance. This finding, as in Authors (2017), is consistent with Montrul (2008). However, regarding the results of lexical sophistication, both subgroups were significantly different from their benchmarks. This finding may furnish additional support for the argument that the lexical sophistication measure is a better parameter for detecting differences between bilinguals and monolinguals.

Regarding the demographic or sociolinguistic factors that account for the variance in the heritage speakers' results, the hierarchical regression analyses conducted for the lexical diversity and sophistication measures yielded slightly different pictures: while both age and age at emigration were found the most influential factors in the lexical diversity of the

heritage speakers, their lexical sophistication was mainly associated with age. Furthermore, it was found that the heritage speakers' age correlated positively with their results of lexical diversity and sophistication in both simultaneous and sequential bilingual subgroups. This result confirms that these heritage speakers, even those who were born in or emigrated to the host country at a young age, seem to have continued to develop their vocabulary knowledge in Persian. The effect of age at emigration also confirms that the earlier the heritage speakers move to a second language environment, the lower their proficiency in their family language is likely to become in terms of lexical diversity. The observed effect of age at emigration is in line with some studies (e.g., Ammerlan, 1996; Pelc, 2001, Bylund, 2008, 2009) that showed its strong impact on incomplete acquisition and language attrition. However, this variable has received much less attention in studies of language attrition compared to its effect on second language learning (Bylund, 2009; Schmid, 2011).

Intriguingly, the families' frequency of heritage language use and their attitudes to heritage-language maintenance did not appear to exert much of an influence on the heritage speakers' lexical richness. These variables arguably stand a better chance of emerging as influential in the case of simultaneous bilinguals, where the age-at-arrival factor is ruled out. However, unlike Authors (2017), the data examined here furnish no confirmation of this. That neither the frequency of Persian use nor attitude appeared to play a significant role needs to be interpreted with caution, however, for at least three reasons. The first reason is it is possible that the 5-point Likert scale type of questions used in the sociolinguistic questionnaire were too blunt an instrument to reveal variation in Persian use and attitude in the participating families at a more subtle or finer-grained level. There may therefore be a need to amend the sociolinguistic questionnaire so that it can detect such finer-grained differences in heritage language use and parental attitude. The next reason is that the influence of these sociolinguistic variables in the statistical computation may simply be overridden by the stronger effect of the demographic variables. A larger sample might reveal a different picture, where factors such as frequency of heritage language use do reach the significance threshold. The third reason is that we based the statistics on the parents' self-reported data, and these may need to be interpreted cautiously, since the parents may have reported their desired beliefs rather than their actual daily practices and efforts in helping their children develop and maintain their heritage language. This reliance on self-reported data elicited from the participants' parents in the semi-structured interviews is definitely a limitation in this study. It

would be useful if the parents' responses to the interview questions were triangulated with observational data.

Perhaps most importantly, however, almost all of these parents reported high degrees of family language use and highly positive attitudes regarding language maintenance. This led to limited diversity in these socio-linguistic data (reflected in the relatively small standard deviations [see Table 1]), which, in turn, may have compromised the chances of these factors emerging as influential. If frequency of Persian use and attitude did not emerge as influential factors to explain the variance in the heritage speakers' lexical richness data, this does not at all mean that these factors play no part in family language acquisition and maintenance. After all, it would be hard to explain how these young bilinguals could have continued acquiring and/or maintaining their heritage language in the host country, if their parents had not provided them with sufficient input. In fact, the observation that almost all of these young bilinguals managed to produce a narrative in their heritage language testifies to the benefits of parental input for heritage language maintenance, which have widely been recognized (see Fishman, 1991; De Houwer, 2007; Daller & Ongun, 2017).

We do need to acknowledge, of course, that the number of participants in this study was relatively small, and this holds true especially for the subgroup of simultaneous bilinguals, where the narratives of five participants had to be discarded. This naturally reduces the likelihood for any trend to reach the significance threshold. However, despite the small sample, the findings of this study are meaningful in showing the strong role the demographic factors play in young heritage speakers' lexical competence. Further research with larger number of participants would yield a clearer and more definitive picture of heritage speakers' lexical richness in their family language. Another limitation to this study is that only two measures of lexical competence were used. In addition to lexical diversity and lexical sophistication, the study of lexical density and the frequency of lexical 'errors' (Read 2000) could provide a more comprehensive picture. Looking beyond single words into the domain of multiword expressions is yet another promising research avenue to reveal differences between heritage speakers and monolingual counterparts (Treffers-Daller, Daller, Furman, & Rothman, 2016). A third limitation is that only one speaking task was used in the study. It is likely that a more diverse set of speech samples elicited from the participants could help detect differences which the single film-retell task failed to reveal.

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Table 1: Compound variables extracted from the questionnaire

	Mean	SD.	Min.	Max.
Participants' Persian Use	8.01	1.54	4.25	10.25
Parents' attitude	5.13	1.11	2	6.5

Table 2: Lexical diversity in bilinguals and monolinguals per 100 words

	Mean	SD.	Min.	Max.
Bilinguals	51.2	25.1	17.1	110.0
Monolinguals	58.9	22.5	24.4	118.2

Table 3: Lexical sophistication in bilinguals and monolinguals

	Mean	SD.	Min.	Max.
Bilinguals	305.5	46.1	228.4	420.9
Monolinguals	253.3	59.1	139.7	377.9

Table 4: ANCOVA analysis of lexical diversity in bilinguals and monolinguals

		Mean± SD	F	P
Gender	Male	53.12± 3.6	1	.32
	Female	58.05± 3.5		
BiMo	Bilingual	50.6± 3.6	3.9	.05
	Monolingual	60.51± 3.5		
Sibling	Sibling	52.5±2.9	1.2	.27
	No Sibling	58.5±4.4		
Age	Coefficient	4.2± .72	34.5	.000

Table 5: ANCOVA analysis of lexical sophistication in bilinguals and monolinguals

		Mean± SD	F	P
Gender	Male	285.4± 8	.07	.78
	Female	282.4± 7.8		
BiMo	Bilingual	309.1±8.1	21.4	.000
	Monolingual	258.7±7.8		
Sibling	Sibling	279±6.5	.52	.47
	No Sibling	288.2±9.7		
Age	Coefficient	-9.2± 1.5	33.8	.000

Table 6: Multivariate tests of lexical diversity and lexical sophistication together

	Wilks' Lambda	F	P	Partial eta squared
Age	.54	18.6	.000	.45
BiMo	.7	9.3	.000	.29

Table 7: Multivariate tests of lexical diversity and lexical sophistication separately

	Tests	F	P	Partial eta squared
Age	LD	26.6	.000	.36
	LS	27.9	.000	.37
BiMo	LD	5.6	.02	.1
	LS	18.8	.000	.29

Table 8: Independent samples t-test in the subgroups and their controls on lexical diversity

Groups	Mean	SD.	t	df	P
Simultaneous Bilinguals	43.7	18.6	-1.7	18	.09
Controls	58.7	18.7			
Sequential Bilinguals	56.2	28.1	-.29	28	.7
Controls	59.1	25.4			

Table 9: Independent samples t-test in the subgroups and their controls on lexical sophistication

Groups	Mean	SD.	t	df	P
Simultaneous Bilinguals	312.6	48.1	2.1	18	.04
Controls	264.09	52.1			
Sequential Bilinguals	300.8	43.8	2.6	28	.01
Controls	246.2	64.09			

Table 10: Correlations and coefficients for lexical diversity in the heritage speakers

Variables	r	P	Beta	P
Age	.74	.00	.59	.00
Age at emigration	.62	.00	.41	.01
Persian use	.34	.04	-.1	.89
Parents' attitude	.03	.43	.1	.42

Table 11: Correlations and coefficients for lexical sophistication in the heritage speakers

Variables	r	<i>P</i>	Beta	<i>P</i>
Age	-.65	.00	-.6	.00
Age at emigration	-.34	.04	-.1	.41
Persian use	-.09	.33	.15	.41
Parents' attitude	.13	.25	.1	.54

Table 12: Correlations and coefficients for lexical diversity in the simultaneous bilinguals

Variables	r	<i>P</i>	Beta	<i>P</i>
Age	.61	.02	.41	.28
Persian use	.54	.05	-	-
Parents' attitude	.58	.03	.32	.39

Table 13: Correlations and coefficients for lexical diversity in the sequential bilinguals

Variables	r	<i>P</i>	Beta	<i>P</i>
Age	.78	.00	.52	.02
Age at emigration	.79	.00	.57	.04
Persian use	.1	.24	-.34	.88
Parents' attitude	-.03	.44	.004	.98

Table 14: Correlations and coefficients for lexical sophistication in the simultaneous bilinguals

Variables	r	<i>P</i>	Beta	<i>P</i>
Age	-.34	.16	-.43	.3
Persian use	-.19	.29	-	-
Parents' attitude	-.12	.36	.14	.7

Table 15: Correlations and coefficients for lexical sophistication in the sequential bilinguals

Variables	r	<i>P</i>	Beta	<i>P</i>
Age	-.84	.00	-.74	.02
Age at emigration	-.49	.03	-.18	.59
Persian use	.02	.4	.01	.96
Parents' attitude	.21	.2	.07	.76