Language development in Mandarin heritage language children

by

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ABSTRACT

This dissertation examines the heritage language (HL) ability of school-aged Mandarin HL children (age range = 6;5 – 10;10) living in Edmonton, a Canadian English majority city, and the factors contributing to their HL development and maintenance. Children's language data were collected via various tasks, including comprehension, production, grammaticality judgment, psycholinguistic experiments, and narratives. A parental questionnaire was also included to collect Mandarin HL children's information about the onset of English exposure, home language use, the richness of language environment, and the maternal education level. The results from three independent studies showed that Mandarin HL children were different from their monolingual peers regarding acquiring the lexically-driven classifier system and aspect morphemes. However, they were comparable to monolingual norms in comprehending and producing various syntactic structures (e.g. post-verbal clauses, relative clauses). These results indicate that the phenomenon of incomplete acquisition does not occur in every linguistic subdomain. Moreover, the longitudinal results revealed that Mandarin HL children's L1 was convergent with the target grammar over time, suggesting that the reduced exposure to the HL does not necessarily lead to incomplete acquisition and attrition in the HL. Regarding various language environmental factors, the results demonstrated that older age of arrival, a rich and diverse HL environment, higher maternal education level and bilingual education contribute to stronger HL abilities, pointing to an important role for input in HL acquisition.

Taken together, this dissertation offers insights relating to the debates between incomplete acquisition, attrition and the protracted acquisition in the acquisition of the HL during the early developmental stages. The research has practical contributions regarding the implications for policy and pedagogical decision-makings on HL education.

PREFACE

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CHAPTER 1. Introduction

Heritage language (HL) speakers are defined as those who are exposed to their first language (L1) from birth and raised in the L1 environment exclusively in the first years of their life. Later on, as they start (pre)school and socialization outside the home environment, they gradually shift towards the societal language (L2) that becomes their dominant language. In general, both children of immigrant parents who learn the L1 from their parents and immigrant children who arrive in a host country at a young age are defined as heritage language (HL) speakers (Valdés, 2001). Thus far, the majority of studies on the acquisition of the L1 have been focused on adult rather than child HL speakers (Au, Knightly, Jun & Oh, 2002; Cuza, 2012; Montrul, 2002, 2004, 2005, 2006a; Montrul & Ionin 2012; Polinsky, 1997, 2006, 2008a, 2008b, 2011; Pires & Rothman, 2009; Rothman, 2007). These studies found that, in comparison to monolingual speakers, adult HL speakers tend to be divergent from monolingual norms in the domains of phonology, the lexicon, morphology, and syntax, which could be the consequence of incomplete acquisition and L1 attrition during the early developmental stages. A numbers of studies on HL children have found evidence of incomplete acquisition and attrition (Anderson, 1999, 2001, 2004; Cuza, Pérez-Tattam, Barajas, Miller & Sadowski, 2013, Silva-Corvalán, 2014). However, recent research on the acquisition of the L1 in HL children showed that protracted acquisition could be another outcome (Flores & Barbosa, 2014; Hoff, Core, Place, Rumiche, Señor, & Parra,

2012). Evidence of protracted L1 acquisition by HL children indicates that the process of HL acquisition during the early developmental stages cannot be simply predicted by studies only focused on adult HL speakers. More direct studies with HL children are needed to enhance our understanding of how HL develops and is maintained during early childhood and why adult HL speakers are similar or different from monolingual speakers.

In addition to the phenomenon of incomplete acquisition, attrition and protracted acquisition of the L1, crosslinguistic influence from the dominant societal L2 should also be considered in the study of L1 acquisition in HL children, as a large body of research on bilingualism in children has showed that the language dominance could result in non-target-like use of the weaker language to some extent (Döpke, 1998; Foroodi-Nejad & Paradis, 2009; Gathercole & Hoff, 2007; Nicoladis, 2002; Paradis, 2010; Serratrice, Sorace, Filiaci & Baldo, 2009; Yip & Matthews, 2007). For HL children, given that their L1 is usually a weaker language, there is potential for L2 influence on their L1. However, due to insufficient direct research on HL children, whether influence from the societal L2 would lead to incomplete acquisition, attrition or protracted acquisition of the L1 in HL children is less well understood.

The studies reported on in this dissertation included both cross-sectional and longitudinal designs, and seek to address the following questions: (1) Do HL children show incomplete acquisition, attrition or protracted acquisition in the domain of morphology, morphosyntax, and the morphosyntax-pragmatics interface in their L1? (2) Which linguistic subdomains are more vulnerable to reduced L1 input and L2 interference? (3) Does crosslinguistic influence from the dominant societal L2 lead to incomplete acquisition, attrition or protracted acquisition? (4) What factors account for the variation among individual differences in HL children?

The following subsections describe the relevant body of literature of HL acquisition. The existing studies on incomplete acquisition, attrition and protracted acquisition in HL speakers are

presented in Section 1.1. The review of crosslinguistic studies on bilingual children is then

provided in Section 1.2. The theoretical approaches to L1 acquisition in HL speakers are

discussed in Section 1.3. Section 1.4 introduces the factors accounting for the individual

differences in HL acquisition. The issues related to Mandarin as a HL are presented in Section

1.5. The chapter concludes with a brief synopsis of the three papers contained in this dissertation.

1.1   Incomplete acquisition, attrition and protracted acquisition of the

heritage language

Thus far, the majority of research on adult HL speakers has examined phonology, morphology,

and syntax in Chinese, Japanese, Korean, Portuguese, Russian, and Spanish (Anderson, 1999,

2001, 2004; Au *et al.*, 2002; Kondo-Brown, 2005; Montrul, 2002, 2005, 2006a, 2008, 2009;

Montrul & Ionin, 2012; Polinsky, 1997, 2006, 2008a, 2008b; Rothman, 2007; Schmid, 2007;

Silva-Corvalán, 1991, 1994). These studies found that adult HL speakers' L1 tends to be

divergent from native norms, which might be due to incomplete L1 linguistic knowledge carried

over from childhood into adulthood, or deterioration of the grammatical system of L1 over time

(attrition) as the L1 exposure decreases after HL children started L2 schooling. Both incomplete

acquisition and L1 attrition assume that HL speakers are not able to fully develop or maintain

their L1 grammar. For example, in the study of Russian and Spanish adult HL speakers' oral

production of verbal agreement and the aspect morpheme, Polinsky (1997, 2008a) and Silva-

Corvalán (1991, 1994) found that, in comparison to their monolingual peers, these adult HL

speakers simplified the aspect and gender morphological systems in their L1. It was argued that

there might be language loss since speakers were exposed to an L2 environment intensively but

received limited L1 support in a host country. Alternatively, the simplified grammar could be the

result of incomplete acquisition in childhood whose effect extends into adulthood. Moreover, in

the examination of the acquisition of subjective and indicative verb morphology in adult Spanish heritage speakers, Montrul (2007) found that adult HL speakers not only had problems with subjunctive morphology in production, but also they could not discriminate the subtle meaning differences between subjunctive and indicative in a comprehension task. This finding indicated that incomplete acquisition or L1 attrition might affect both receptive and expressive skills of HL speakers.

Some studies on HL children have confirmed the evidence of incomplete acquisition and attrition during the early developmental stages. For example, Li and Lee (2001) investigated the acquisition of specific classifiers and the quantifier *dou1* in thirty-four Cantonese HL speakers living in Britain (aged from five to sixteen years old). The data from a tape-recorded conversation and a narrative task showed that these children overgeneralized classifiers. Moreover, they did not use the quantifier *dou1* in the required context. Given that Cantonese monolingual children at the age of four already know the meaning of quantifier *dou1,* and they already used half as many specific classifiers as Cantonese adults, the study suggested that these Cantonese HL children might have incomplete knowledge of Cantonese classifier and quantifier system. Another study conducted by Anderson (1999, 2001) examined the acquisition of morphological markings in two Spanish heritage child speakers who immigrated to the United States when they were 4;7 and 6;7 years old. The results showed that, at the beginning of L1 recordings, the two siblings showed 0% and 8% errors respectively in gender agreement in Spanish. However, after two years of intense contact with English at school, the errors increased to 6% and 18% respectively. Moreover, the recordings of these children's speech samples revealed that, for one affix that indicates mood in Spanish, the two siblings had errors across all the recording sessions. Anderson argued that because of the limited Spanish exposure and the intensive access to English at school,

for the Spanish morphological system, both siblings displayed attrition for gender agreement and incomplete acquisition for the mood affix.

Some studies on HL children have also suggested that the effects of incomplete acquisition and L1 attrition might only occur in production rather in comprehension. For example, Merino (1983) examined both the production and comprehension abilities of forty-one Spanish HL children who were attending English-only school (range from Kindergarten to fourth grade). The study examined a variety of morphosyntactic features in Spanish (gender and number, tense, word order, relative clause, conditional and subjunctive), and only found some degree of language loss in production (from 84% in first grade to 65% in fourth grade) but not in comprehension. Another study conducted by O'Grady, Kwak, O. Lee and M. Lee (2011) examined how Korean HL children interpreted disjunction in negated clauses. The results showed that Korean HL children had the same interpretive preferences as Korean monolingual children and adult native speakers.

The studies discussed above showed that, like the adult heritage speakers, incomplete acquisition and language attrition could affect the acquisition of the L1 in HL children. One reason for this could be that some linguistic knowledge cannot be fully acquired due to the restricted input and use of L1. Also, perhaps some linguistic features can only be mastered and become stable through explicit teaching at school. Although HL children are exposed to naturalistic L1 input from their parents, they often lack formal schooling and literacy support in the HL. Thus, this may prevent them from acquiring some subtle or complex aspects of L1 grammar (Montrul, 2008; Rothman, 2007). Both restricted input and lack of schooling could be factors underlying incomplete acquisition. In addition, the limitations found in HL children's L1 could be because they lost the linguistic knowledge they established at an early age, i.e., attrition. For example, as children begin schooling in the L2, they are exposed to both spoken and written

input in the L2. Therefore, this intensive L2 input and use in school could affect the stability of the L1 system acquired in early childhood, and thus be a cause of L1 attrition.

Recently, research on HL children have found that, in addition to the phenomenon of incomplete acquisition and L1 attrition, protracted acquisition could be another outcome (Flores & Barbosa, 2014; Rinke & Flores, 2014). In a study on the acquisition of clitic placement by twelve Portuguese HL children aged between seven and fifteen years old living in Germany (Flores & Barbosa, 2014), the results showed that the errors made by the younger HL children can also be found in the early developmental stages of monolingual children. Moreover, although the HL children aged seven years old did not have comparable performance to seven-year-old monolinguals, the older HL children's L1 was convergent with the target grammar. Flores and Barbosa argued that given that these Portuguese HL children were exposed to reduced L1 input in Germany, they required a longer time to have a critical mass of input to enable them acquire complex properties of the L1. It is worth pointing out that Flores and Barbosa's proposal is in line with other studies on simultaneous and sequential bilingual children (Gathercole & Hoff, 2007; Hoff, 2006; Hoff, Core, Place, Rumiche, Señor & Parra, 2012; Paradis, 2010; Paradis, Tremblay & Crago, 2014). These studies have shown that bilingual children lag behind monolingual age peers in acquiring some morphosyntactic structures in the non-dominant language. Given that HL children's L1 is a weaker language, it is possible that they may lag behind their age-matched monolingual peers for acquiring certain properties of the L1; however, as long as their L1 exposure is maintained, they should have sufficient L1 exposure to acquire those properties in a target-like way eventually, according to Flores and Barbosa's proposal.

In sum, the existing studies on HL children have shown evidence of incomplete acquisition, attrition and protracted acquisition, but they have several limitations. First, existing studies on HL children have been primarily focused on the domain of morphology (except see

O'Grady *et al.* 2011). We still have little knowledge about whether other domains of the HL are likely to exhibit incomplete acquisition, attrition or protracted acquisition. Second, in the discussion of incomplete acquisition and attrition in HL children, not all previous studies included a monolingual comparison group (Flores & Barbosa, 2014; O'Grady *et al.* 2011). Their conclusions would have been more persuasive if the researchers discussed HL acquisition with reference to the language developmental trajectory of monolingual children. Doing this would show to what extent HL children's L1 grammar is deviant from that of their monolingual peers. Moreover, longitudinal examination of HL development in children is still insufficient. Only Anderson' studies (1991, 2001) examined the development of the L1 in two Spanish HL children over time. It is still difficult to differentiate whether some non-target-like structures used by HL children at some point are because they maintained the incomplete L1 grammatical knowledge over time or because their L1 grammar underwent L1 attrition. Alternatively, perhaps they would acquire these structures at a later developmental stage as compared to monolingual peers. Furthermore, not all previous studies have investigated both receptive and expressive skills of HL children for the same linguistic domain (except see Merino, 1983). It is uncertain whether incomplete acquisition, L1 attrition or protracted acquisition affect the production only or whether they affect both comprehension and production of HL children.

1.2   Crosslinguistic influence

Crosslinguistic influence means that a person's knowledge of one language influences that person's knowledge or use of another language. Studies focused on two developing languages of simultaneous bilingual children have shown that crosslinguistic influence can occur in the phonology, morphology, and syntax, and language dominance is an important factor accounting for crosslinguistic influence (Döpke, 1998; Foroodi-Nejad & Paradis, 2009;

Nicoladis, 2002; Paradis, 2010; Yip & Matthews, 2007). For example, Döpke (1998) investigated word order in the verb phrase of three simultaneous German-English bilingual children aged from two to five years old. The study found that, due to the dominance of English in three bilingual children, they transferred the English verb phrase word order to German. Similarly, Yip and Matthews (2007) examined spontaneous speech data from six simultaneous Cantonese-English bilingual children aged from one to four years old in a Cantonese majority context. The results showed a number of transfer phenomena with Cantonese as the dominant language influencing English syntactic areas: wh-in-situ questions, null objects, and prenominal relative clauses. It should be pointed out that although studies have found that crosslinguistic influence could affect the acquisition of the weaker/minority language in bilingual children, its effects are not pervasive. For instance, Serratrice and her colleagues (2009) found that due to crosslinguistic influence from English to Italian, English-Italian bilingual children tended to accept ungrammatical bare NPs used in a generic context in Italian. However, they did not reject the grammatical use of plural NPs with a definite article in Italian.

With respect to the effects of crosslinguistic influence on the comprehension and production of the weaker language in bilingual children, studies have shown conflicting findings. Nicoladis's study (2002) suggested that L2 influence might only affect the level of production. In a study of acquisition of novel deverbal compounding words in thirty-six French-English bilingual children aged from three to four years old, Nicoladis found that in comprehension, the bilingual children performed on a par with monolingual children in both French and English. In production, bilingual children were more likely to reverse compound nouns in English when compared to English monolingual children. The different results from the comprehension and production tasks suggested that language transfer may only occur at the level of production rather than comprehension. However, Kidd, Chan and Chiu's (2014) study on the comprehension of

Cantonese relative clauses (RCs) in twenty simultaneous Cantonese-English bilingual children living in Australia showed that the influence from the L2 could affect the level of comprehension. The study found that when comprehending object-type Cantonese RCs, bilinguals wrongly assumed the RC subject was the head referent. The head referent in English RCs appears in the clause-initial position, whereas the head referent in Cantonese RCs appears in the clause-final position. Thus, it was argued that the errors made by bilinguals in comprehending object-type Cantonese RCs were attributed to the influence from their English.

Thus far, studies on adult HL speakers have shown that the influence from the L2 could lead to an incomplete or attrited L1 grammar. Sharwood Smith (1983) and Pavlenko (2000) have pointed out that in the reduced L1 context, the L2 rules which are less complex and have wider semantic function would replace L1 rules which are more complex and have narrow semantic function. As a result, it would lead to linguistic changes in the L1 over time and then result in attrited L1 grammar. This hypothesis has been confirmed by some empirical studies on the lexical-semantic domain of the HL (Altenberg, 1991; Kaufman & Aronoff, 1991). Studies on Spanish adult heritage speakers have also shown that dominant L2 transfer could be one of the reasons accounting for incomplete acquisition of the L1 (Cuza, 2012; Montrul, 2002; Montrul & Ionin, 2012).

Regarding crosslinguistic influence in the acquisition of the L1 in HL children, there has been little discussion about whether the L2 influence is a possible cause accounting for incomplete acquisition, L1 attrition and protracted acquisition the L1. One exception is Cuza, Pérez-Tattam, Barajas, Miller and Sadowski's study (2013), where the researchers argued that the semantic transfer from English might result in an incomplete or attrited Spanish tense-aspect grammar found in Spanish HL children. This dissertation examines the L2 influence in the domains of morphology and morphosyntax. The phenomena of incomplete acquisition, L1

attrition or protracted acquisition are discussed as related to L2 interference.

1.3   Theoretical approaches to L1 acquisition in heritage language children

In the field of child language acquisition, two main theoretical approaches have been used by scholars to explain the language acquisition process: the generative approach (Chomsky, 1981, 1988; Guasti, 2002) and the usage-based approach (Bybee, 2007; Langacker, 1988; Tomasello, 2000, 2003). The generative approach assumes that children are equipped with abstract linguistic categories and features from birth (e.g. nouns, verbs, tense, aspect, gender, etc.). Language acquisition is the process of mapping the language input onto pre-given, abstract categories (i.e. Universal Grammar). The usage-based approach assumes that grammatical categories are not innate. On this approach, abstract linguistic knowledge is acquired through the process of analyzing and generalizing constructions from the language input. Although both approaches acknowledge that language input is important in children's language development, they view the role of the language input differently. For the generative approach, given that children are born with abstract innate grammatical knowledge (e.g. tense, aspect, agreement, etc.), the input data mainly triggers the operation of the linguistic constraints (Chomsky, 1981, 1988; Guasti, 2002). In contrast, the usage-based approach argues that language input is the primary source of grammatical knowledge. The emergence of grammatical knowledge depends on the language use in the context of social interactions and cognitive processes, such as analogy and statistical learning (Bybee, 1995, 2007; Goldberg, 1995; Langacker, 1988; Tomasello, 2000, 2003).

Thus far, most of HL acquisition research has taken on the generative perspective (Cuza *et al.*, 2013; Flores & Barbosa, 2014; Montrul, 2002, 2004, 2006a, 2009; Polinsky, 2006, 2008b, 2011; Rothman, 2007). It has been argued that, like monolingual speakers, HL speakers have the

knowledge of Universal Grammar and parameter setting in initial development. Thus, some core linguistic knowledge is resilient to L1 attrition (Montrul, 2006a), because the parameters underlying these areas of grammatical knowledge were already set at very early stages. This could explain that HL speakers are comparable to monolinguals regarding the acquisition of some grammatical knowledge in the L1. For example, Montrul's studies (2004, 2005) showed that Spanish adult heritage speakers were not different from their monolingual peers in terms of the knowledge of unaccusativity, null subject expression, and verb movement in Spanish. The reason why HL speakers display deficits in some grammatical areas of their HL is that reduced L1 input and use affect their acquisition of some interface areas, such as, between verb morphology and semantics, pragmatics and discourse (Montrul, 2006b, 2015).

For instance, in the study of the acquisition of tense-aspect morphology in Spanish adult heritage speakers, Montrul (2002) found that their tense-aspect grammatical knowledge was divergent from the target grammar. According to generative theory, there is an abstract functional category AspP represented in speakers' mind, and it is associated with interpretable semantic features, [+perfective] or [-perfective]. Speakers acquire aspectual properties by checking these features through overt aspect morphology (Montrul, 2002). The feature composition and values of the AspP category are crosslinguistically different. In English, it has been assumed that all eventive predicates, such as activities, accomplishments and achievements, are inherently associated with the feature value [+perfective]. The feature value [-perfective] is irrelevant in English (Giorgi and Pianesi, 1997). For example, the sentence *John reads a book right now* is not available in English, given that English present tense verbs only encode boundedness (i.e. perfective) but not a continuous (i.e. imperfective) interpretation. In Spanish, AspP associates with both [+perfective] and [-perfective] features. Spanish speakers acquire these aspectual properties by checking [+perfective] and [-perfective] features through Preterite and Imperfect

tense morphology (i.e. preterite: *-ó*; imperfect: *-ba* or *–ía*). In Montrul's study (2002), the results demonstrated that Spanish adult heritage speakers tended to overuse the Preterite form in contexts where the Imperfect form should have been used, suggesting that the [-perfective] semantic feature is vulnerable in Spanish HL speakers. It was argued that, given that English lacks the [-perfective] feature in the functional AspP category, the non-target use of the imperfect aspect by Spanish HL speakers was probably because influence from English prevented them from acquiring that negative feature value.

Regarding the usage-based approach, it has not been widely used by researchers to explain the acquisition of the L1 in HL speakers. Only O'Grady *et al.* (2011) adopted an emergentist approach, which is related to the usage-based approach, to explain why HL speakers are comparable to monolingual norms in some grammatical areas but exhibit deficits in other grammatical areas. According to the emergentist approach, language acquisition involves various types of form-meaning mappings. Input-related factors (i.e. frequency and transparency) and general cognitive processing constraints (i.e. processor) facilitate the mapping between form and meaning in a given language. In the case of lexical and morphological acquisition in the HL, given that HL speakers often lack L1 exposure, it causes problem for the processor to compute the form-meaning associations. For example, the phonetic profile of the form and the semantic function associated with that form are difficult to discern based on low-frequency instantiations in the L1 input. As a result, HL speakers display incomplete acquisition or L1 attrition in the domain of the lexicon and morphology in their HL. However, the processor not only accounts for the failure of acquisition of the HL, it also offers an explanation of the success of acquiring some infrequently occurring structures in heritage speakers' L1. O'Grady *et al.* (2011) argued that, although the processor is sensitive to the clarity and frequency of the form-meaning mapping relationship, its operation is also restricted by limited working memory resources. Namely,

speakers prefer to place fewer demands on the processor. In the study of how Korean heritage speakers interpret *not-all* sentences in Korean (O'Grady *et al.*, 2011), the results showed that child and adult heritage speakers were like their native speaker peers in the full set interpretation of *not-all* sentences in Korean. There was no sign of incomplete acquisition, L1 attrition and L2 influence in that 'scope' interpretation. The comparable performance between heritage speakers and their monolingual peers was because the full set interpretation requires fewer demands on processing resources than the partitioned set interpretation in Korean. The study concluded that, in this regard, the successful target-like interpretation is independent from the sparse L1 input relevant to that structure (O'Grady *et al.*, 2011).

In sum, given the present state of HL research, researchers have been focused on different grammatical areas in typologically distinct languages. It seems that each theoretical framework discussed above could offer explanations of why HL acquisition succeeds in some domains but fails in other domains. In this dissertation, the studies do not adopt a particular theoretical framework *a priori*. Instead, results will be considered in terms of how either framework could explain them.

1.4   Individual differences in heritage language acquisition

Studies on HL speakers have indicated that HL abilities vary considerably among individuals. Several relevant variables have emerged as having a significant impact on HL development and maintenance in the long term. These factors are described in below.

Age-related factors Age of arrival in the host country has been revealed to be a predictive variable of HL maintenance. A number of long-term attainment studies have documented an increased likelihood of rapid dominant-language shift among immigrants who arrived in a host country at an early age. For instance, G. Jia and Aaronson (2003) found that Chinese immigrants

who immigrated to the United States before 9 years old switched their preferred language from Chinese to English within a year of English immersion. Some studies also showed that younger age of arrival was associated with lower levels of HL proficiency in pronunciation, lexical, and morphosyntactic ability (Anderson, 1999, 2001; G. Jia, Aaronson, Young, Chen, & Wagner, 2005; Montrul, 2002; Shi, 2011). It is worth pointing out that the HL children's chronological age should also be considered in the study of the HL acquisition, as older HL children may have a larger cumulative amount of L1 input than younger HL children. For example, Flores and Barbosa's study (2014) revealed that older Portuguese HL children showed higher levels of accuracy than younger Portuguese HL children for clitic placement, because the older Portuguese tended to have more L1 experience as compared to the younger ones.

Socioeconomic status (SES) SES background is a broad environmental factor that predicts developmental outcomes, including language, and is typically measured by family income or maternal education (Hoff, 2006). Previous studies on Spanish HL speakers have reported conflicting evidence for the role of SES in HL maintenance. On one hand, Sánchez (1983) found that among Mexican-Americans in Texas, those with lower SES used Spanish more than those with higher SES, presumably because those with higher SES were more assimilated into the mainstream English culture. Similarly, Bohman, Bedore, Peña, Mendez-Perez and Gillam's (2010) large-scale study found that low-SES background was associated with a higher likelihood of speaking Spanish among kindergarteners in the United States. On the other hand, other researchers have found that immigrants with higher SES value using the HL more (Amastae, 1982) and have a greater awareness of the importance of the heritage culture and language (G. Jia, 2008). Hammer, Komaroff, Rodriguez, Lopez, Scarpino and Goldstein (2012) found that higher maternal education was associated with higher story recall scores in Spanish among Spanish HL children in the United States. The studies contained in this dissertation used mother's level of

education as the indicator of SES.

Language environment Children use their languages differentially with various people in their lives and are exposed to several sources of language input. Both the quantity and the quality of the HL input are crucial for language development and maintenance (Kondo-Brown, 2005; G. Jia, 2008). Quantity of language input is measured based on the amount of exposure time to the HL at home or school, whereas quality of the language input is measured on the basis of the rich and complex input gained through activities like reading or engaging in media in the HL (Paradis, 2011). Examples of the quantitative and qualitative properties necessary to facilitate HL learning and maintenance include: (1) the percentage of time spent speaking the HL (G. Jia, 2008; G. Jia & Aaronson, 2003; L. Jia & Bayley, 2008), (2) the number of different people with whom they speak the HL (G. Jia 2008; G. Jia & Aaronson, 2003), (3) the percentage of time that the HL is used in leisure activities (G. Jia, 2008; Kondo-Brown, 2005), such as reading books and magazines, or watching TV and movies, and (4) the frequency with which they attend activities conducted in the HL (G. Jia, 2008; G. Jia & Aaronson, 2003; Kondo-Brown, 2005), such as swimming class, piano class, or weekend HL school.

The factors discussed above are considered in the studies in this dissertation to obtain a better understanding of what combination of factors can best explain success or deficits in the acquisition of the HL in children.

1.5   **Mandarin as a heritage language**

Similar to studies on Spanish and Russian heritage speakers, studies on Mandarin HL children have found evidence of incomplete acquisition in the domain of morphology. (L. Jia & Bayley, 2008; Li & Lee, 2001). For example, Li and Lee (2001) found Chinese HL children were not comparable to monolinguals in terms of using diverse classifiers and the quantifier *dou1* in

required contexts in narratives. L. Jia and Bayley (2008)'s study showed that Mandarin HL children who were born in U.S. and children who arrived the U.S. before the age of six were not able to use the aspect morpheme *le* appropriately in obligatory contexts.

However, a detailed description and documentation of the grammatical knowledge that Mandarin HL children can acquire or partially acquire in other linguistic domains is still limited. Moreover, the existing studies on Mandarin HL children only used the cross-sectional design. Not enough known about how Mandarin HL children's L1 develops and maintains over time. Furthermore, while studies on L1 acquisition in Mandarin HL children living in the U.S. and Britain have been done (L. Jia & Bayley, 2008; Li & Lee, 2001), to the best of my knowledge, studies on the acquisition of the L1 in Mandarin HL children living in Canada is still scarce (G. Li, 2006). According to the most recent Canadian Census (2011), among the immigrants whose mother tongue was other than English or French, Chinese languages were the most common mother tongues, and 24.6% of a total of 852,700 Chinese-language speaking individuals said Mandarin was their mother tongue. These Mandarin immigrants comprise valuable human capital because their Mandarin-English bilingual skills would contribute to Canadian cultural diversity and economic prosperity. Therefore, it is necessary to know how Mandarin immigrant children develop and maintain their L1 abilities within a multilingual/multicultural society like Canada, so that we can help them to preserve their Mandarin abilities while effectively learning the societal language (e.g. English in Western Canada).

1.6   Synopsis of dissertation

This dissertation is focused on the L1 abilities of Mandarin HL children and the factors contributing to their L1 development and maintenance. Three studies are presented as separate journal-style papers. Below is a brief description of each study.

Chapter 2 presents the first study, which is focused on the Mandarin HL children's use of referring expressions in first mentions in narratives. Referring expressions in first mentions are the linguistic devices a speaker uses to introduce participants or entities when telling a story, for example, names, definite/indefinite NPs or NP-modifying relative clauses. The use of referring expressions in first mentions requires convergent knowledge of the lexicon, morphology and syntax, and, thus, can reveal a child's linguistic abilities across multiple linguistic subdomains. This study examines how Mandarin HL children apply their linguistic knowledge in first mentions, whether their first mention abilities are different from those of their monolingual peers, and what language environment factors account for individual differences in HL children's Mandarin abilities. Results showed that HL children were different from monolinguals in terms of classifier use and vocabulary knowledge. However, HL children did not differ from monolinguals in their use of relative clauses and post-verbal NP placement to mark first mentions. These results suggest that incomplete acquisition of the HL may vary across different linguistic subdomains (Montrul, 2008); specifically, domains requiring a great deal of input to acquire (i.e. the large repertoire of classifiers) might be more vulnerable in HL speakers than syntax. Moreover, the study revealed that older age of arrival, higher maternal education level, and a rich and diverse Mandarin environment predicted stronger narrative outcomes, pointing to an important role for input in HL acquisition.

The second study, found in Chapter 3, examined the phenomena of incomplete acquisition, attrition, and protracted acquisition of the L1 in HL children by focusing on comprehension and production of subject-type and object-type relative clauses (RCs) in twenty-nine Mandarin HL children. Moreover, given that there is typological differences between Mandarin and English, and both Kidd, Chan, and Chiu (2015) and Yip and Matthews (2007) observed crosslinguistic influence in the acquisition of Cantonese RCs in Cantonese-English

bilingual children, the study also examines whether crosslinguistic influence from English leads to incomplete acquisition, attrition or protracted acquisition of RCs in Mandarin HL children. The study includes a cross-sectional design (study 1) and a longitudinal design (study 2), and fifteen age-matched Mandarin monolingual children were also included as a comparison group. The study found that for the comprehension of Mandarin RCs, HL children were comparable to monolinguals in processing subject-type and object-type RCs, and they all performed at ceiling in both study 1 and study 2. For the production of RCs, although monolinguals outperformed HL children for both subject-type RCs and object-type RCs in study 1, HL children's production of both types of RCs was convergent with native-like levels over time (study 2). These findings suggest that the reduced L1 input HL children receive in the host country does not necessarily lead to deficient acquisition of the L1. Perhaps for some complex structures in the L1, e.g. RCs, HL children may require a longer time to accumulate the critical mass of input needed to acquire them.

The final study is presented in Chapter 4, which examines the acquisition of two imperfective and one perfective aspect morpheme in twenty-nine Mandarin HL children through a production and a grammaticality judgment task. Studies on HL speakers have already shown that aspect morphology is a vulnerable area for both adult and child HL speakers, and it tends to exhibit incomplete acquisition, L1 attrition or crosslinguistic influence from the dominant L2 (Cuza *et al.*, 2013; Montrul, 2002, 2009). However, researchers have different perspectives on the sources of non-target use of aspect morphology in the L1. This study examines how Mandarin HL children use aspect morphemes with different verb types*,* whether their performance is the same or different from monolingual norms, and whether their non-target-like performance can be attributed to reduced L1 input only or English interference. The results revealed that Mandarin HL children were able to use aspect morphemes with various verb types, but they made errors

regarding the imperfective aspect morpheme *zai* paired with achievement verbs and postural stative verbs in the production and grammaticality judgment task. The finding suggests that the L2 influence is the main source of non-target use of aspect morphology in Mandarin HL children, but it does not cause a deficient acquisition of all aspect morphemes in Mandarin HL children.

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CHAPTER 2. The use of referring expressions in narratives by Mandarin heritage language children and the role of language environment factors in predicting individual differences[1]

2.1 Introduction

Heritage language (HL) children refers to those who are raised in homes where they hear and use their first language (L1) with their parents and grandparents. Later on, they are exposed to the societal language (L2) that eventually becomes their dominant language (Valdés, 2001). While HL children usually achieve native-like or near native-like L2 ability, their HL can show deficits that could be the result of incomplete acquisition or attrition (Polinsky 2006; Montrul 2008; Anderson, 2004). Incomplete acquisition of the L1 means that HL speakers fail to reach age-appropriate levels of proficiency for certain grammatical structures, possibly in other linguistic domains (e.g., lexicon, phonology). L1 attrition means that the grammatical system of the speakers' L1 had a chance to develop initially, but later some grammatical aspects began to deteriorate. Both incomplete acquisition and attrition point to the presence of differences between the lexicon and grammar of HL speakers and that of monolingual speakers of the same language

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in the heritage country.

To date, a number of studies examining the acquisition of L1 phonology, morphology, and syntax in adult HL speakers of Spanish, Russian and Korean have found that adult HL speakers show deficits in their HL, possibly due to incomplete acquisition/attrition (Anderson, 1999, 2001; Montrul, 2002, 2005, 2009; O'Grady, Lee & Choo, 2001; Polinsky, 2006, 2008a; Silva-Corvalán, 1991, 1994). Adult HL speakers in these studies include those who were either born in a host country or who immigrated to the host country at a young age. By contrast, there has been relatively less research focusing on HL development and maintenance in school-aged children, i.e., on HL speakers who are in the process of acquiring both their L1 and the predominant societal language (L2) in a host country. The research with adults suggests that HL children are at risk for incomplete acquisition or attrition, primarily due to the fact that, in general, they receive insufficient L1 input in the host country (Anderson, 2004; Montrul, 2008; Polinsky, 2008a; Schmid, 2004, 2007) and they use the HL in limited contexts (i.e., home, community). However, it is not well known in which linguistic subdomains HL children differ from their monolingual peers, and what the influence of different language environmental factors is on HL development and maintenance. Research identifying the most vulnerable linguistic domains for HL children could inform whether the deficits found in adult HL speakers' L1 are the result of incomplete acquisition or attrition. For example, if studies find both adult and child HL speakers do not reach native-like levels in the same linguistic subdomains, it is likely the limitations found in adult HL speakers are due to not having fully acquired that L1 knowledge in childhood. By contrast, if HL children display more native-like abilities in a subdomain than adult HL speakers, this would suggest attrition. Furthermore, the study of the language environment factors that contribute to the processes of L1 development could inform educational programs for children aimed at promoting HL maintenance, as well as improve advice given to parents. As immigrant

populations are growing in many multilingual/multicultural countries like Canada, preserving immigrants' HLs would offer many benefits. At the individual level, the continued development of L1 in immigrant children can help them understand their heritage culture and be able to communicate with their family members. At the societal level, the bilingual skills of heritage speakers would contribute to both cultural diversity and global economic opportunities.

The present study investigated Mandarin HL children's use of referring expressions in first mentions in narratives. Referring expressions in first mentions are the linguistic devices a speaker uses to introduce participants or entities when telling a story, for example, names, definite/indefinite NPs or NP-modifying relative clauses. The use of referring expressions in first mentions requires convergent knowledge of the lexicon, morphology and syntax, and, thus, can reveal a child's linguistic abilities across multiple linguistic subdomains. Since Mandarin–English bilingual programs exist in the city where the present study was conducted, we recruited the children from both English-only schools and Mandarin–English bilingual schools. Our objectives were to find out how Mandarin HL children apply their linguistic knowledge in first mentions, whether their first mention abilities are different from those of their monolingual peers, whether the children from different types of schools perform differently in first mentions, and what language environment factors account for individual differences in HL children's Mandarin abilities.

2.2   Research with HL children

In comparison to the extensive research on adult HL speakers, fewer studies have examined HL development in children (Anderson, 1999, 2001; Kaufman, 2005; Kaufman & Aronoff 1991; Li & Lee, 2001). Studies on HL children have found that morphology and the lexicon are two domains vulnerable to incomplete acquisition/attrition. For example, Li and Lee (2001)

investigated the acquisition of specific classifiers and the quantifier *dou1* in thirty-four Cantonese

HL children living in the UK, 5–16 years old. Data from conversational and narrative tasks

showed that these children overgeneralized classifiers and did not use the quantifier *dou1* in the

required context. Given that 4-year-old Cantonese monolingual children already know the

meaning of quantifier *dou1,* and already use half as many specific classifiers as Cantonese adults,

this study suggested that the difficulties in classifier and the quantifier use displayed by the

Cantonese HL children could be due to incomplete knowledge of Cantonese when it is acquired

in an English majority context. Also focusing on morphology, Anderson (1999, 2001) conducted

a longitudinal study of two Spanish HL children who immigrated to the United States when they

were 4;7 and 6;7. At the beginning of L1 recording, the two siblings showed 0% and 8% errors,

respectively, in gender agreement in Spanish. However, after two years of intense contact with

English at school, the errors increased to 6% and 18%, respectively. In contrast, for verb

morphology marking mood, the two siblings had errors across all the recording sessions.

Anderson argued that gender showed signs of attrition and mood showed more of an incomplete

acquisition profile.

Kaufman's (2005) study examined lexical choice for introducing referents in narratives by

Hebrew HL children, 6;2–13;11, living in the United States. The results showed that the children

had poor lexical abilities when referring to the animate referents in their story telling. For

example, when naming the specific animate beings such as the *frog, deer,* and *owl*, the children

preferred code-mixed L2 words. Moreover, children also used demonstratives to describe the

animate referents when they did not know how to name the animate referents in Hebrew.

Kaufman (2005) concluded that the various lexical choices used by these children were

constrained by diminishing productive knowledge of their L1. However, this study only

examined the lexical ability of these Hebrew HL children when they introduced animate referents

in story telling, and not morphological markings or syntactic structures. Therefore, whether HL children are able to master the convergence of lexical, morphological and syntactic knowledge required for first mentions in narratives remains unknown.

2.3   Sources of individual differences in HL acquisition

Studies of adult HL speakers have indicated that HL abilities vary considerably among individuals. Several relevant variables have emerged as having a significant impact on HL maintenance and loss in the long term. The impact of these factors on HL acquisition by children in the shorter term was examined in the present study.

Age of Arrival Age of arrival (AOA) in the immigrant country is a significant predictor of HL maintenance (Montrul, 2008). Studies have also shown that younger AOA is associated with lower levels of HL proficiency in pronunciation, the lexicon and morphosyntax (G. Jia, Aaronson, Young, Chen & Wagner, 2005; Montrul, 2008). Long-term attainment studies have documented an increased likelihood of rapid dominant-language shift from L1 to L2 among immigrants who arrived in a host country at an early age. G. Jia and Aaronson (2003) found that Chinese immigrants who arrived in the United States before 9 years old switched their preferred language from their Chinese language to English within a year of English immersion. Because AOA signals a change in a child's language environment, it is a contributing factor to HL development and maintenance.

Socioeconomic status (SES) SES background is a broad environmental factor that predicts developmental outcomes, including language, and is typically measured by family income or maternal education (Hoff, 2006). Regarding HL children, research has shown some conflicting findings about the role of SES background on children's development of the HL. On the one hand, Sánchez (1983) found that among Mexican–Americans, those with low-SES

backgrounds used Spanish more than those with high-SES backgrounds, presumably because those with high-SES backgrounds were more assimilated into the mainstream English culture. Similarly, Bohman, Bedore, Peña, Mendez-Perez and Gillam's (2010) large-scale study found that low-SES background was associated with a higher likelihood of speaking Spanish among kindergarteners in the United States. On the other hand, researchers have found that immigrants with high- SES backgrounds value using the HL more (Amastae, 1982) and have a greater awareness of the importance of the heritage culture and language (G. Jia, 2008). Hammer, Komarooff, Rodriguez, Lopez and Goldstein (2012) found that higher maternal education was associated with higher story recall scores in Spanish among Spanish HL children in the United States.

Language environment Bilingual children, including HL children, hear and use their languages differentially with various people and in various contexts (Paradis, 2011). Both the quantity and the quality of HL input are crucial for HL development and maintenance (G. Jia, 2008; Kondo-Brown, 2005). Quantity of language input typically refers to the amount of input received in a language, while quality of language input typically refers to the RICHNESS, i.e., complexity and diversity, of input received (G. Jia & Aaronson, 2003; Paradis, 2011). Examples of the quantitative and qualitative properties necessary to facilitate HL learning and maintenance include: (1) the percentage of time spent speaking the HL vs. the L2 (G. Jia, 2008); (2) the number of different people with whom the HL is spoken (G. Jia, 2008); (3) the percentage of time that the HL is used in leisure activities (G. Jia, 2008; Kondo-Brown, 2005), such as reading books and magazines, or watching TV and movies; and (4) the frequency with which children attend activities conducted in the HL (G. Jia, 2008; Kondo-Brown, 2005), such as swimming class, piano class or weekend HL school.

2.4   Referring expressions for first mentions in narratives in Mandarin

In narrative production, when the event involves more than one entity or participant, a speaker has to use appropriate referring expressions to introduce the entities or participants so that the listener can understand them in the absence of shared physical context. First mentions comprise the referring expressions the speaker uses to refer to animate referents, objects, places or concepts when they occur for the first time in a story. In English, adequate first mentions often consist of indefinite NPs, names, or NP-modifying relative clauses (Schneider, Hayward & Dubé, 2006). For example, when telling a story about *Alice in Wonderland* in English, when the animate referent *Alice* is first mentioned, the appropriate expression would be *a girl* not *the girl*. The indefinite article *a* signifies that the referent has not been referred to in prior discourse, whereas expressions like *the girl*, or a pronoun, *she*, are only appropriate in subsequent mentions of *Alice*. Moreover, a proper name such as *Alice*, or a relative clause like *a girl who is playing with a rabbit*, are also appropriate to introduce the animate referent *Alice* for the first time because these forms provide adequate information for the listener to identify the target referent in the absence of shared knowledge.

Crosslinguistic research examining how monolingual children introduce referents in story telling has suggested that there are some universals in the use of referring expressions in first mentions (Spanish: Álvarez, 2003; Kail & Sanchez-Lopez, 1997; Mandarin: Hickmann & Liang, 1990; German, French, English, and Mandarin: Hickmann, Hendriks, Roland & Liang, 1996; French: Kail & Hickmann, 1992; Cantonese: To, 2006; Italian: Serratrice, 2006). For example, indefinite forms are typically used to introduce the referent for the first time, whereas personal pronouns are used in subsequent, not first, mentions (Hickmann *et al.*, 1996; To, 2006). However, given crosslinguistic differences in morphosyntactic structure, some linguistic devices for

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encoding first mentions are language-specific. For the remainder of this section, the linguistic

devices used in Mandarin first mentions are described.

In Mandarin, similar to English, names, possessive NPs and relative clauses can help the

listener to identify the target referent for the first time, as in examples (1), (2) and (3):

(1)   **xiang4   ma1ma1**   lai2   le
        elephant   mama   come   particle
        "Mama-Elephant comes."

(2)   **xiang4   ma1ma1   de   peng2you3**   lai2   le
        elephant   mama   POSS[2]   **friend**   come   particle
        "Mama-Elephant's friend comes."

(3)   [mai4 qi4qiu2   de]   **lao3   ye2ye2**   lai2   le
        sale balloon   particle   old   grandfather   come   particle
        "An old man who sells balloons comes."

In example (1), *xiang4ma1ma1* is a proper name and thus it encodes adequate information for a

first mention. In example (2), the possessive NP *xiang4 ma1ma1 de peng2you3* "mama-

elephant's friend" is used to define the relationship between the target referent and

xiang4ma1ma1. In example (3), note that the relative clause precedes the noun *lao3 ye2ye2* "old

man", thus the basic word order is *modifying clause + particle de + noun.*

In addition to names, possessive NPs and relative clauses, indefinite NPs, which consists

of the numerical determiner, *yi1* "one", classifiers, and nouns can also mark a new referent, as in

the indefinite construction: *yi1 + classifier + N.* Classifiers in Mandarin are usually categorized

into two types: (1) 75 sortal classifiers that are associated with particular entities (Erbaugh, 2006),

e.g., *zhi1* is used with some animate entities, and *zuo4* is used to describe buildings or houses; (2)

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[2] POSS = possessive marker

the general classifier *ge4* that can be combined with any type of entity[3]. When we introduce the

main character *rabbit* in *Alice in Wonderland* for the first time, we could use the NP *yi1 + zhi1 +*

tu4zi1 "a rabbit", as in example (4a):

(4a)   **yi1**   **zhi1**   **tu4zi1**   zou3   guo4   lai2
       one   **SCL[4]**   **rabbit**   walk   across   come
       "A rabbit comes over."

Here the noun *tu4zi1* "rabbit" is marked by the numerical determiner *yi1* "one" and the specific

classifier *zhi1* to indicate an indefinite meaning. If we use the general classifier *ge4* instead of the

specific classifier *zhi1* with the noun *tu4zi1* "rabbit" (see example (4b)), it is a less adequate first

mention in comparison to the example (4a), i.e., the specific classifier is more appropriate in this

context:

(4b)   **yi1**   **ge4**   **tu4zi** zou3 guo4 lai2
       one   **GCL**   **rabbit** walk across come
       "A rabbit comes over."

If the noun *tu4zi1* "rabbit" is only marked by the classifier or by the numerical determiner *yi1*

"one" in the clause-initial position, they are ungrammatical expressions in Mandarin, as in (4c)

and (4d):

 (4c)   ***zhi1**   **tu4zi**   zou3   guo4   lai2.
        SCL   **rabbit**   walk   across   come
        "A rabbit comes over."

(4d)   ***yi1**   **tu4zi**   zou3   guo4   lai2.
       one   **rabbit**   walk   across come
       "A rabbit comes over."

       Not only are Mandarin first mentions marked by NP-internal morphology, but syntactic

placement of the NP is also a device for conveying new information (Hickmann & Liang, 1990).

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[3] Although most nouns in Mandarin take a specific classifier, 40% of nouns can only take the general classifier *ge4* (Erbaugh, 2006). For example, *nü3hai2* "girl" is typically marked by the general classifier *ge4*.
[4] SCL = specific classifier

For example, an NP consisting of CL + N, *zhi1* + *tu4zi1* "rabbit", is not acceptable in the pre-

verbal position (see (4c)), but if we place this NP in the post-verbal position, it is an acceptable

referring expression for a first mention, as in example (4e):

(4e) **lai2**   le   **zhi1**   **tu4zi**
     come   particle   **SCL**   **rabbit**
     "Here comes a rabbit."

It should be noted that the NP *yi1* + N is still unacceptable even we place it in the post-verbal

position, as in (4f):

(4f) ***lai2** le   **yi1**   **tu4zi**
     come particle   **one**   **rabbit**
     "Here comes a rabbit."

Hickmann and Liang (1990) identify three types of post-verbal clauses that were frequently used

by Mandarin native speakers for first mentions in narratives: (1) a post-verbal NP in an

existential construction with the verb *you3* "have" (there is…); (2) a post-verbal NP in motion

verb construction with *lai2* "come", and (3) a post-verbal object in a transitive, SVO, clause. The

NP construction CL + N is only acceptable if it occurs in these post-verbal clauses, as in (4e), (4g)

and (4h).

(4g) **you**3 **zhi1**   **tu4zi**   lai2   le
     have **SCL**   **rabbit**   come   particle
     "There is a rabbit coming."

(4h) ta1   kan4jian4   **zhi1** **tu4zi**
     he   see   **SCL**   **rabbit**
     "He sees a rabbit."

The indefinite NP (i.e., *yi1* + CL + N) is also acceptable in post-verbal position to mark new

referents, as in (5a)–(5c):

(5a)   **lai2** le   **yi1   zhi1   tu4zi**
        come particle   **one   SCL   rabbit**
        "Here comes a rabbit."

(5b)   **you3   yi1   zhi1   tu4zi**   lai2   le
        have   one   SCL   rabbit come   particle
        "Here comes a rabbit."

(5c)   ta1 **kan4jian4**   **yi1   zhi1   tu4zi**
        he   **see**   **one   SCL   rabbit**
        "He sees a rabbit."

However, names and possessive NPs cannot occur in the *lai2* and *you3* post-verbal clauses (see

(6a) and (6b)). They can only occur as the object in an SVO clause, as in (6c).

(6a)   ***lai2** le   **xiang4ma1ma1/xiang4ma1ma1 de peng2you3**
         come particle   **mama-elephant/mama-elephant's friend.**
          "Here comes mama-elephant/mama-elephant's friend."

(6b)   ***you3 xiang4ma1ma1/xiang4ma1ma1 de peng2you3**   lai2   le
        have mama-elephant/mama-elephant's friend   come particle
        "There is mama-elephant/mama-elephant's friend playing."

(6c)   ta1   **kan4jian4   xiang4ma1ma1/xiang4ma1ma1 de peng2you3**
        he   **see   mama-elephant/mama-elephant's friend**
        "He sees mama-elephant/mama-elephant's friend."

Another specific feature of Mandarin first mentions is the use of a bare noun. Some

researchers have argued that a bare noun (with no numerical determiner *yi1* and classifiers) could

be employed to encode new or old information in Mandarin (Li & Thompson, 1981), as in (7):

(7)   wo3   xiang3   chi1   **ping2guo3**
       I   want   eat   **apple**
       "I want to eat an apple/the apple."

In (7), if the referent *ping2guo3* is not mutually known by the speaker and the listener, it conveys

new information. If the referent *ping2guo3* is mutually known by the speaker and the listener

based on the prior discourse context, the referent *ping2guo3* encodes old information. Therefore,

in this study, if the prior discourse contextual information is clear and sufficient to identify the referent for the first time, a bare noun can be interpreted as having an indefinite meaning, and thus, constitute an adequate first mention. For example, if the speaker mentioned the "swimming pool" or the "diving board" previously in the narrative, and then the speaker used the bare noun form *jiu4sheng1yuan2* "lifeguard" without using *yi1* or classifiers or any type of post-verbal placement, it is still considered as an adequate first mention because the previously mentioned contextual information "swimming pool" was clear and sufficient to help the listener to identify the referent *jiu4sheng1yuan2* "lifeguard" for the first time. By contrast, if there is no clear contextual information provided previously, it is inappropriate to use the bare noun to introduce a new referent.

Finally, regarding subsequent mentions in Mandarin, an NP marked by the demonstrative pronoun *na4* "that", can only convey old information, regardless of syntactic position, as in (8a) and (8b):

(8a) **na4   zhi1   tu4zi**   lai2   le
      That   SCL   rabbit   come   particle
      "That rabbit comes."

(8b) lai2   le   **na4 zhi1   tu4zi**
      come   particle **that SCL   rabbit**
      "That rabbit comes."

Similar to English, personal pronouns, such as *ta1* "he/she/it" can only be used in subsequent mentions, shown in (9)

(9)   **ta1**   lai2   le
      he   come   particle
      "He comes."

2.5   First mention abilities in Mandarin monolingual children

Studies on first mentions in Mandarin-speaking children's narratives have demonstrated how children of varying ages use the relevant linguistic forms in their story telling. Hickmann and Liang's (1990) study examined the first and subsequent mention abilities of Mandarin adults (N = 9) and Mandarin children (N = 49) aged 4–10 years old. The results revealed a developmental progression in children's uses of the numerical determiner, classifiers, and NP position when they introduced referents for the first time. With respect to the numerical determiner *yi1* "one" at the NP level, only 7- and 10-year-old children made systematic use of this determiner; the 4–6 year-old children did not use the determiner *yi1* "one" frequently. With respect to classifiers, children started to increase the use of specific classifiers at age 6, whereas 4- and 5-year-old children either did not use classifiers or used the general classifier, *ge4*. With respect to the NP position in the sentence, children only started to use post-verbal position to mark first mentions frequently at age 7. In contrast, Mandarin adults tended to introduce new referents with the numerical determiner and the specific classifiers at the NP level, as well as post-verbal NPs. The study concluded that appropriate Mandarin first mention abilities developed gradually and tended to be acquired by age 10. In general, the 10-year-old Mandarin-speaking children were close to the adult standard in terms of using the numerical determiner *yi1* "one" and the specific classifiers at the NP level, as well as placing new referents in post-verbal position. Another longitudinal study with Mandarin-speaking preschool children (N = 5) found that, before the age of 3½ years, children did not use the numerical determiner *yi1* "one" and post-verbal placement of the NP productively to signal new referents in conversational and story-telling activities (Min, 1994).

Hickmann and Liang (1990) and Min (1994) both reveal that the developmental trajectory of using linguistic devices to mark first mentions in narratives extends fairly late (i.e., 10-year-

olds) in Mandarin monolinguals. Based on these observations, it could be expected that the school-aged Mandarin HL children's first mention abilities would be affected by their limited exposure to and contexts of use for Mandarin in an English majority country. In addition, limited or no literacy/schooling experience in Mandarin could have an impact because narrative skills constitute a bridge between oral and written language genres (Schneider, Hayward & Dubé, 2006). In sum, the use of referring expressions in first mentions is likely vulnerable to incomplete acquisition in Mandarin HL children. In particular, it would be expected that Mandarin HL children may not be able to use the numerical determiner *yi1* "one" consistently, or they may predominately use the general classifier *ge4* and pre-verbal NP placement, because these are features of earlier developmental stages in monolinguals.

2.6   Research questions

The purpose of this study was to investigate how Mandarin HL children use referring expressions in first mentions in narratives in order to examine their linguistic abilities across the domains of the lexicon, morphology and syntax. The following three research questions were addressed in this study:

(1) Do Mandarin HL and Mandarin monolingual children differ in their overall abilities to use adequate referring expressions in first mentions in narratives?

(2) What are the specific referring expressions used by Mandarin HL and Mandarin monolingual children in their first mentions? Do they use different linguistic devices in their first mentions?

(3) Do factors like AOA, SES background and language environment predict individual differences in Mandarin HL children's abilities with first mentions in narratives? Do children with educational experience in Mandarin have stronger first mention abilities

than children with English-only educational experience?

2.7   Method

2.7.1   Participants

Thirty-eight Mandarin HL children (M_{age} = 8;7, SD = 1;2, range = 6;9–10;10) participated in this study. Nineteen children were born in Canada and nineteen children were born in China but immigrated to Canada with their parents at an early age (N = 38, AOA: M = 2;0, SD = 1;2, range = 0;0–7;5). All children were exposed to Mandarin from birth and their parents were all Mandarin native speakers. Twenty-one children were recruited from a Mandarin–English bilingual public school (HL_BIL) and seventeen children were recruited from English-only public schools (HL_ENG), all in Edmonton, Canada. The AOA of HL children who attended two types of schools were significantly different, with a slightly older mean AOA for the English-only schooling group (M_{HL_ENG} = 2;3, range $_{HL\_ENG}$ = 0;0–5;7; M_{HL_BIL} = 1;10, range $_{HL\_BIL}$ = 0;0–7;5; p = .02); however, for both groups, the mean AOA was in the toddler years, and there is considerable overlap in the ranges.

This study also included 15 Mandarin monolingual children (M_{age} = 7;1, SD = 0.2, range = 6;8–7;4) as a comparison group. They were all first grade students and were tested in an elementary school in Lanzhou, Mainland China. While the two groups of children overlap in age, the Mandarin HL children were older as a group ($M_{Heritage}$ = 8;7, $M_{monolingual}$ = 7;1, p < .001). The age difference between the two groups of children was unavoidable because we first collected the monolinguals' data in China and then recruited the HL children in Canada. We found the HL children were older than monolinguals but we could not go back to China at that time to recruit and test new age-matched monolingual participants. The age difference was controlled in the statistical analyses. Note that the age range of both groups is within the developmental period in

Hickmann and Liang's (1990) study where monolinguals could use the full range of referring expressions in first mentions, just not in every appropriate context.

2.7.2   Procedures

Edmonton Narrative Norming Instrument

Stimuli for the present study were the two story picture sets of the ENNI (Edmonton Narratives Norms Instrument) developed by Schneider, Dubé and Hayward (2005) (http://www.rehabresearch.ualberta.ca/enni/home). The stories were created according to story grammar principles and depict information that is considered to be essential to good stories. Each story set contains three stories in wordless pictures, with two main animal characters of different species, a young male and a young female, introduced in the first story in the set (5 pages long, single basic episode). The second story (8 pages, 2 episodes) introduces a third character that is an adult animal (the same type of animal as one of the main characters) and the third story (13 pages, 3 episodes) introduces a fourth character in addition to the previous three (another adult of the same type of animal as the third character, opposite gender).

The children completed this storytelling task individually in their homes with a native Mandarin-speaking researcher. Before the test stories, the children and the researcher went through a training story to ensure the child understood the task. Following the guidelines in the ENNI instruction manual, when telling the story, the children were seated opposite the researcher so that the researcher could not see the pictures. This was done to discourage children from assuming shared knowledge of the story by joint viewing of the pictures. The researcher then asked each child to go over the picture book page-by-page to familiarize him/herself with the story, and then when the child was ready, the child told the story from beginning to end.

Following the ENNI instruction manual, the researcher did not provide explicit assistance

during the task. The only feedback provided to children included general encouragement, repetition of the child's previous utterance, or if the child did not say anything, a request to tell what was happening in the story. The child was reminded before each story that the researcher would not be able to see the pictures. The children's narrative productions were video recorded for later transcription and analysis.

Alberta Language Environment Questionnaire (ALEQ: Paradis, 2011; http://www.linguistics.ualberta.ca/CHESL_Centre/Questionnaires.aspx) Language background information for each Mandarin HL child was collected through the ALEQ, a parental questionnaire which includes such topics as age of arrival in Canada, child's age at testing, months of exposure to English (MOE), mother's level of education (MOTED), language use among family members in the home, and the child's experiences with media, organized activities and playmates in both English and Mandarin. For language use in the home, parents were asked a series of questions with scaled responses about the use of languages from each household member to the child (FAMLANG), and the use of language from the child to each household member (CHILDLANG): for example, 0 = only speak Mandarin at home; 1 = Mandarin usually, English seldom; 2 = English 50%, Mandarin 50%; 3 = English usually, Mandarin seldom; 4 = only speak English at home. The proportion of language use at home was derived from these responses by totaling the responses and then dividing by the highest total possible number. Effectively, the proportion of language use indicates the proportion of English in the home, since Mandarin was set at 0. Parents were also asked about the language and frequency of children's experiences with media (e.g., computer games, television and books), organized activities and friends within an average week. Points were assigned according to how often the child engaged in each media type, activity or playing with friends within an average week, and what language each took place in. Again, points were totaled and divided by the highest possible score for each

language. Thus, an English richness (ENGRICH) and a Mandarin richness score (MANRICH) were derived. Higher scores indicate a richer environment in that language. Because they are proportions, the richness score range is from 0 to 1.0. However, a child's two language richness scores are not inverses of each other, i.e., a MANRICH score of 0.3 does not necessarily entail an ENGRICH score of 0.7. The information collected from this questionnaire is summarized Table 2. 1, and was included as predictors in the statistical analyses.

Table 2. 1 Mandarin HL children's characteristics

Factors	All HL children (N = 38)			HL_BIL (N = 21)			HL_ENG (17)		
	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Age of arrival	24	14	0–89	22	30	0–89	27	28	0–67
Age at testing	103	14	81–130	105	16	81–130	100	11	85–116
MOE	52	18	12–99	50	22	12–96	55	14	36–99
MOTED	16	2	12–22	16	2	12–18	16	2	14–22
FAMLANG	0.2	0.2	0–0.8	0.2	0.2	0–0.5	0.2	0.2	0–0.8
CHILANG	0.3	0.2	0–1	0.3	0.2	0–0.6	0.4	0.3	0–1
ENGRICH	0.6	0.1	0.3–0.8	0.6	0.1	0.1–0.8	0.7	0.1	0.5–0.8
MANRICH	0.3	0.2	0–0.8	0.5	0.2	0.2–0.8	0.1	0.1	0–0.4

Note. HL_BIL = the HL children who attended Mandarin–English bilingual schools; HL_ENG = the HL children who attended English-only schools; Age of arrival and Age at testing were calculated in months; MOE = months of exposure to English; MOTED = mother's level of education in years; FAMLANG = proportion of English spoken among adults at home; CHILANG = proportion of English spoken by child at home; ENGRICH = richness of the English environment outside school; MANRICH = richness of the Mandarin environment outside school

2.7.3 Transcription

Children's narratives were video recorded and then transcribed in full using the CHAT/CLAN system from the Child Language Date Exchange System (CHILDES) database (MacWhinney, 2000, http://childes.psy.cmu.edu/). The transcriber was an experienced CHAT/CLAN user and a Mandarin native-speaker[5].

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[5] Secondary transcribers to determine reliability were not deemed necessary, as the children were old enough to be completely intelligible and comprehensible.

2.7.4   Coding referential NPs in first mentions

The ENNI includes a coding and scoring system for referring expressions used in first mentions in English. This system was adapted for Mandarin by the author together with a second Mandarin-speaking research assistant. In the ENNI Manual for English, first mentions scoring targets 8 animate and 6 object referents from the stories, 14 in total, and this was followed in the Mandarin adaptation. These referents were selected on the basis of the likelihood that a speaker would mention them, i.e., a study with 377 English monolingual children showed these 14 referents were commonly mentioned by children when telling ENNI stories (Schneider & Hayward, 2010).

The NPs used in first mentions by the children for these referents were first coded into six different NP types, based on Hickmann and Liang (1990) and To (2006): indefinite NPs, CL + N, bare Ns, proper names, possessive NPs, demonstratives + N, personal pronouns, and non-specific lexical items (i.e., *dong1xi1* "something"). Details of coding and examples are illustrated in supplementary materials online (Appendix A). In addition to the coding of different types of NPs, we also coded the indefinite NPs, CL + N, proper names, and possessive NPs in terms of their clause positions (cf. 1.3). Furthermore, classifiers in the construction CL + N and NUM + CL + N were coded as "SCL" or "GCL". The specific classifiers that should be used with each reference in ENNI story-telling are listed in Table 2. 2.

Table 2. 2 Appropriate specific classifiers with each reference assessed in first mentions

Specific classifier	Referent	English equivalent
zhi1/tou2	*da4xiang4*	*big elephant*
zhi1	*chang2jing3lu4*	*giraffe*
wei4	*jiu4sheng1yuan2*	*lifeguard*
wei4	*nü3jiu4sheng1yuan2*	*women lifeguard*
zhi1/tiao2	*gou3*	*dog*
zhi1	*tu4zi1*	*rabbit*
wei4	*yi1sheng1*	*doctor*
wei4	*mai4qi4qiu2de1ye2ye2*	*balloon seller*
jia4	*fei1ji1*	*airplane*
zhang1	*wang3*	*net*
zuo4	*sha1cheng2bao3*	*sandcastle*

2.7.5   First mentions scoring criteria

Subsequent to the coding, the Mandarin first mentions scoring criteria was developed based on the guidelines provided for English First Mentions in the ENNI manual. As noted in 2.4, there are 14 referents across all the stories selected for scoring. Only the first mentions of these target referents were scored. Like the English system, first mention scoring was scaled. A score of 3 indicated a fully adequate expression for its context. A score of 2 indicated a less than adequate expression for a referent that was still partially informative, and a score of 1 indicated an inadequate expression. If the referent was omitted entirely, the score was 0. If the referent was introduced with the numerical determiner *yi1* "one" and a specific classifier, in either pre- or post-verbal position, this constituted a fully adequate referring expression for a first mention and was given a score of 3[6]. By contrast, the use of the general classifier *ge4* preceding the noun or the demonstrative pronoun (*na4* "that") preceding a noun constituted a less adequate but still informative expression, and was given a score of 2. Second, proper names such as *xiang4*

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[6] The Mandarin HL children sometimes used English nouns in their Mandarin sentences. If they did so, but used the numerical determiner and an appropriate classifier, the presence of an English noun did not affect the score. This was because the English noun had been incorporated into Mandarin morphosyntax. However, if the English noun was not properly incorporated into the morphosyntactic structure of Mandarin, it received a score of 1.

ma1ma1 "Mama-Elephant"*,* possessor NPs, such as *da4 xian4g de peng2you3* "elephant's friend",

and referents modified by relative clauses were also given a score of 3. Third, a CL + N

expression was considered as a fully adequate first mention if it appeared in the post-verbal

position. If a CL + NP expression occurred in the pre-verbal position, it was given a score of 2.

Fourth, with respect to bare Ns, these were given a score of 3 when there was clear close

contextual information to help the listener identify a referent for the first time. For example, if the

child mentioned "the swimming pool" or "the diving board" in an utterance immediately before

or two utterances distant from the referent, then it was adequate to use the bare noun form

jiu4sheng1yuan2 for the first time, in pre- or post-verbal position*.* Fifth*,* non-specific expressions

such as *yi1 ge4 ren2* "someone" or *yi1 ge4 dong1xi1* "a thing", no matter if it occurred in the pre-

or post-verbal position, were less adequate but still informative in first mentions and received a

score of 2. A personal pronoun such as *ta1* "he/she/it" was not appropriate to first introduce the

target referent and was given a score of 1. If the child did not mention the target referent in the

story telling process, a score of 0 was given for that referent.

The coding and scoring system was adapted and implemented jointly by two Mandarin

speakers, the author and a research assistant, in a subset of the transcripts. All disagreements

were resolved through consensus, and a final coding/scoring system was arrived at. After this

process, the remainder of the transcripts were coded and scored by the author.

2.8   Results

2.8.1   Overall first mention scores of monolingual and HL children

Table 2. 3 presents the descriptive statistics for the overall first mention scores of the Mandarin

monolingual and HL children. Note that the maximum first mention score is 42 (3 x 14 referents).

The Mandarin HL children were divided into two groups based on whether they attended

Mandarin-bilingual or English-only schools. Two observations can be made about these raw scores: the monolingual scores are slightly higher than those of the HL groups, who have similar individual scores (35 vs. 32 and 31), and the lowest scores come from children in the HL groups (30 vs. 23 and 24).

Table 2. 3 HL and monolingual children's first mentions scores

	Mean	*SD*	Range
Monolingual (N = 15)	35	3	30–38
HL (all) (N = 38)	31	3	23–38
HL_BIL (N = 21)	32	3	23–38
HL_ENG (N = 17)	31	2	24–36

Note. HL = Heritage language children; HL_BIL = the Heritage language children who attended Mandarin–English bilingual schools; HL_ENG = the Heritage language children who attended English-only schools.

Mixed-effects modeling in R (Baayen, 2008) was used to investigate whether the monolingual and HL children were significantly different in overall first mentions performance. The reason for using mixed-effects modeling instead of a two-sample t-test was that the age of the two groups of children was significantly different ($M_{Heritage}$ = 8;7, M_{MON} = 7;1, *p* < .001). Thus, in order to filter out the impact of the age difference between the two groups, children's age at testing was modeled as a random-effect factor with a mean of zero and unknown variance. The fourteen referents (e.g., *giraffe, elephant,* or *lifeguard*) were coded as Referent, and children were coded as Subject, both modeled as random-effect factors. The dependent variable is Referent Score, which consisted of the individual score for the 14 target referents. The fixed-effect factor in the model was Language Group (three levels: Monolingual, HL_BIL, and HL_ENG). The

model was based on 742 observations (i.e., 38 HL children + 15 monolinguals x 14 individual

referent score = 742 observations). The model (Table 2. 4) explains 25% of the variance (R^2 =

0.254). The model took the monolingual group as the reference level, and so the -0.16 (p = .01)

coefficient estimate for the HL_BIL children and the -0.17 (p = .01) coefficient estimate for the

HL_ENG children indicate that both HL groups had lower overall scores than the monolinguals.

Table 2. 4 Model results for first mention scores of monolingual and HL children

Fixed effects	Estimate	SE	t	p
(Intercept)	2.49	0.08	30.91***	< .001
HL_BIL	-0.16	0.07	-2.33*	0.01
HL_ENG	-0.17	0.07	-2.25*	0.01

Note. SE = standard error; HL_BIL = the Heritage language children who attended Mandarin-English bilingual schools; HL_ENG = the Heritage language children who attended English-only schools. *p < .05. *** p < .001.

2.8.2   The specific linguistic devices used in first mentions by monolingual and HL children[7]

Recall that referring expressions in first mentions require a convergence of lexical, morphological

and syntactic abilities. Following the results in 2.8.1, this analysis was aimed at determining

where HL children show relative strengths and weaknesses in the different linguistic subdomains

of referring expressions.

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[7] The HL children did not use any ungrammatical referring expressions (cf. 2.4)

Table 2. 5 Types of noun phrases used in monolingual and HL children

	NUM + CL + N	CL+ N	Bare N	Name	POSS N	Dem N	Non-specific N	code-switch (English N)
MON	74/207 (35.7%)	1/207 (0.5%)	86/207 (41.5%)	28/207 (13.5%)	16/207 (7.8%)	2/207 (1%)	0/207 (0%)	-
HL_BIL	136/279 (48.7%)	10/279 (3.6%)	94/279 (33.7%)	6/279 (2.2%)	20/279 (7.1%)	7/279 (2.5%)	6/279 (2.2%)	7
HL_ENG	132/231 (57.1%)	14/231 (6.1%)	33/231 (14.3%)	2/231 (0.9%)	12/231 (5.2%)	28/231 (12.1%)	10/231 (4.3%)	40

Note. For this analysis, we excluded cases when the monolingual and HL children used relative clauses to introduce the target referent.

Table 2. 5 presents the occurrence of different NPs used by the monolingual and HL children. One difference is that the HL children used more NUM + CL + N and CL + N constructions than monolinguals. While the HL children and monolinguals used the numerical determiner *yi1* equally correctly, the HL children used the general classifier *ge4* as opposed to specific classifiers more in these constructions than the monolinguals, which lowered their scores – since, if a specific classifier were required, use of a general classifier earned a score of 2 instead of 3. Table 2. 6 displays the distribution of specific and general classifiers used by the children in NUM + CL + N and CL + N constructions, which a Chi-Square test revealed as being significantly different among the three groups of children X^2 (2, N = 53) = 41.95, *p* < .001. The monolingual children were able to use the classifier *jia4* with *fei1ji1* "airplane"*, zhang1* with

wang3 "net", *zhi1* with animals, *wei4* with *jiu4sheng1yuan2* "lifeguard", and *zuo4* with

cheng2bao3 "castle"*,* whereas the HL children only used *zhi1* with *chang2jing3lu4* "giraffe" and

pi1 with *ma3* "horse". Note that the HL_BIL group produced more specific classifiers than the

HL_ENG group.

Table 2. 6 The general and specific classifiers used by monolingual and HL children

	MON	HL_BIL	HL_ENG
General CL	58	137	150
Specific CL	19	9	1

Note. CL = classifier; MON = monolingual children; HL_BIL = the Heritage language children who attended Mandarin-English bilingual schools; HL_ENG = the Heritage language children who attended English-only schools.

Table 2. 5 also shows that the HL_BIL children were close to monolinguals in terms of

using bare nouns in first mentions (33.7% vs. 41.5%), but the HL_ENG group used bare nouns

infrequently (14.3%). Next, the monolingual children used proper names (score of 3) more often

than the HL children (13.5% vs. 2.2% and 0.9%). Similar use of possessive NPs was found for all

groups (7.8% vs. 7.1% and 5.2%). Furthermore, Table 2. 5 shows that, for the Dem + N

construction and non-specific lexical items, the HL children used them more often than the

monolinguals (2.5% and 12.1% vs. 1%; 2.2% and 4.3% vs. 0%). The HL-ENG group in

particular used more Dem + N constructions and non-specific lexical items; both of which were

assigned a score of 2. By contrast, only one monolingual child used a Dem + N construction

(twice), and all monolingual children were able to use specific lexical terms to introduce the

target referent. Finally, the final column of Table 2. **5** reveals that the HL_ENG children used a

code-switched English noun more often than the HL_BIL group (40 vs. 7).

Table 2. 7 The occurrences of post-verbal, pre-verbal, and relative clauses used by Mandarin monolinguals and HL children (percentage in parenthesis)

	MON	HL_BIL	HL_ENG
lai2 'come' + NP	4/126 (3%)	2/176 (1%)	4/148 (3%)
you3 'have' + NP	5/126 (4%)	34/176 (19%)	20/148 (14%)
NP_2 in $NP_1 + V + NP_2$	24/126 (19%)	44/176 (25%)	43/148 (29%)
Preverbal clause	86/126 (68%)	86/176 (49%)	79/148 (53%)
Relative clause	7/126 (6%)	10/176 (6%)	2/148 (1%)

Note. MON = monolingual children; HL_BIL = the Heritage language children who attended Mandarin-English bilingual schools; HL_ENG = the Heritage language children who attended English-only schools. Only animate referents were included in the analysis. This is because inanimate referents are likely appearing in the object position of the subject-verb-object clause. It will create a bias in calculating the occurrence of NP_2 in $NP_1 + V + NP_2$ clause.

At the clause level, Table 2. 7 shows that the HL children used each of these different syntactic structures, like their monolingual counterparts. Mandarin monolinguals used more preverbal clauses (68%) than the HL children (49% and 53%). This is likely because monolinguals used more proper names and possessive NPs to introduce referents. These expressions are appropriate in the pre-verbal position only (cf. 2.4). With respect to the post-verbal clauses, Table 2.7 shows that, like the monolinguals, the HL children were able to use three types in first mentions. As shown in examples (10a) and (10b), the indefinite NPs (NUM + CL + N) were placed correctly after the verb *you*3 "have". Examples in (11a) and (11b) illustrate correct placement of CL + N after the motion verb *lai2* "come". With respect to the *NP₂ in the NP₁ + V + NP₂* clause, the monolinguals and the HL children preferred to use the full indefinite

NPs (NUM + CL + NP) after the verb, as in examples (12a) and (12b). Correctly constructed

prenominal relative clause first mentions are shown in (13a) and (13b).

you3 "have" + NP postverbal clause

(10a)	you3	**yi1**	**ge4**	**xiao3gou3**	zai4	wan2		sha1zi1.
	have	**one**	**GCL**	**little dog**	aspect	play		sand
	"A little dog is playing with sands."						(HL child)	

(10b)	you3	**yi1**	**zhi1**	**xiao3**	**tu4**	zai4		dui1	cheng2bao3.
	have	**one**	**SCL**	**little**	**rabbit**	aspect		build	castle
	"A little rabbit is building the castle."						(monolingual child)		

lai2 "come" + NP postverbal clause

(11a)	you4	lai2	le		**ge4**	**nü3**	**de**		**lifeguard**
	again	come	particle		**GCL**	**female**	**particle**		**lifeguard**
	"Then comes a female lifeguard."						(HL child)		

(11b)	you4	lai2	le		**wei4**	**hen3**	**qiang2zhuang4**	
	again	come	particle	**SCL**	**very**	**strong**		

	de		**a"yi2.**
	particle		**aunt**
	"Then comes a very strong women."		(monolingual child)

NP₂ in NP₁ + V + NP₂

(12a)	xiao3gou3	kan4jian4	**yi1**	**ge4**	**doctor**.
	little dog	see	**one**	**GCL**	**doctor**
	"A little dog sees a doctor."				(HL child)

(12b)	tu4zi1	ge1ge1	tu1ran2	fa1xian4	le	**yi1**	**ge4**	**ye2ye2**.
	rabbit	brother	suddenly	find	particle	**one**	**GCL**	**grandfather**
	"suddenly the rabbit finds an old man."					(monolingual child)		

Relative clause + *de* + NP

(13a) yi1   ge4   [mai4 qi4qiu2   de]   **lao3**   **tu4zi1 ye2ye2**
       one   CL   [sell   balloon   de]   **old**   **rabbit grandfather**
       "An old rabbit who sells balloons."   (HL child)

(13b) ta1tmen1   kan4jian4   yi1   ge4   [mai4 qi4qiu2   de]   they
       see   one GCL [sell   balloon   de]

       shu1shu1
       uncle
       "They see a man who sells balloons."   (monolingual child)

In sum, although Mandarin monolinguals outperformed Mandarin HL children in terms of using specific classifiers and specific lexical items, the HL children were comparable to their monolingual peers in terms of using the possessive construction, the numerical determiner *yi1* in indefinite NP constructions, and in the use of different post-verbal and relative clauses.

2.8.3   Sources of individual differences in the HL children

Mixed-effects regression modeling in R (Baayen, 2008) was used to determine the factors predicting individual differences among the HL children. The random-effect variables included in the model were Child (coded as Subject) and the 14 target referents (coded as Referent). The fixed variables included were age of arrival (AOA), the length of exposure to the English (MOE), mother's level of education (MOTED), the language spoken among family members at home (FAMLANG), the language spoken by the child at home (CHILANG), and the richness of the English (ENGRICH) and Mandarin (MANRICH) environments. Before modeling, correlations among the fixed variables were calculated to probe for potential collinearity effects. If significant correlations were found, factors were decorrelated, and a residual factor for one of them was created, which was then entered into the model. Residual factors were correlated with the original factors. Details of the residual factors are given in supplementary materials online (Appendix C).

The first analysis was based on all 38 HL children. The analysis started with a full model that overfitted the data, and then the non-significant predictors were removed in a step-wise fashion. Nested models that differed in complexity (number of predictors) were compared by using the maximum likelihood ratio test, and if the reduced model accounted for the same amount of variance as the full model, the reduced model was chosen. The final, best-fitting model (based on 532 observations, 38 children) is summarized in Table 2. 8. The model explained 27% of the variance (R^2 = 0.268). The positive coefficient estimate of 0.002 of AOA indicates that HL children who arrived in Canada at a later age performed better with Mandarin first mentions. The positive coefficient estimate of 0.039 for MOTED shows that children whose mothers had higher educational levels performed better with Mandarin first mentions.

Table 2. 8 Model results of individual differences of all HL children (N=38)

	Estimate	SE	t	p
(Intercept)	1.628	0.287	5.666***	< .001
AOA	0.002	0.001	2.076*	0.02
MOTED	0.039	0.017	2.302*	0.01

Note. SE = standard error; AOA= age of arrival; MOTED = mother's level of education.
*p < .05. *** p < .001.

Given that the HL group included children who attended Mandarin-bilingual (HL_BIL, N = 21) and English-only (HL_ENG, N = 17) schools, we conducted two sub-group analyses to see whether their first mention abilities were predicted by different factors. The random factors were still Subject and Referent. The fixed factors were still AOA, MOE, FAMLANG, CHILANG,

ENGRICH, MANRICH and MOTED[8]. The model selection process was parallel to that described above for the HL group as a whole.

The final, best fitting model for the HL_BIL group (N = 21, 294 observations) is summarized in Table 2. 9. The model explained 32% of the variance (R^2 = 0.323). The positive coefficient estimate of 0.062 for MOTED shows that, for HL_BIL children, those whose mothers had higher educational levels performed better on Mandarin first mentions.

Table 2. 9 Model results of individual differences of the HL children attending bilingual schools (N=21)

	Estimate	SE	t	p
(Intercept)	1.327	0.459	2.89*	0.002
MOTED	0.062	0.029	2.19*	0.014

Note. SE = standard error; MOTED = mother's level of education
*p < .05.

For the model of the HL_ENG children, the final, best fitting model (N = 17, 238 observations is summarized in Table 2. 10. The model explained 28% of the variance (R2 = 0.275). Three factors emerged as significant in this model: MANRICH, AOAResid and MOTEDResid, indicating that children with richer Mandarin environments at home, who arrived later to Canada and who had mothers with higher levels of education had superior abilities with first mentions in narratives.

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[8] The sub-analyses were based on relatively small numbers of HL children. In order to avoid overspecifying the variation, a full model analysis limits the fixed-effects to three factors. Different combinations of three were entered until the best-fitting model was arrived at.

Table 2. 10 Model results of individual differences of HL children attending English-only schools

	Estimate	SE	t	*p*
(Intercept)	2.223	0.095	23.409***	< .001
MTRICH	0.69	0.34	2.032*	0.02
AOAResid	0.003	0.001	2.137*	0.02
MOTEDResid	0.038	0.02	1.897*	0.03

Note. SE = standard error; MTRICH = richness score of Mandarin; AOAResid = residual factor of age of arrival; MOTEDResid = residual factor of mother's level of education.
p < .05. *** *p* < .001.

2.9   Discussion

The first objective of this study was to determine if Mandarin HL children's use of referring expressions in first mentions in narratives was similar or dissimilar to that of their monolingual Mandarin peers. The second objective was to determine the predictive factors accounting for the individual differences exhibited by Mandarin HL children. In a nutshell, the Mandarin HL children scored lower than the monolinguals overall for first mentions on the Mandarin-adapted ENNI, and this was largely because they used the general classifier *ge4*, the demonstrative pronoun *na4* "that", and non-specific lexical items more often than the monolinguals. However, Mandarin HL children did not show weaknesses in all linguistic domains. They were able to use the numerical determiner *yi1* "one" in the indefinite NP structure (as shown in example (4a)), possessive NPs (example (2)), post-verbal NPs (example (4e)) and relative clauses (example (3)) appropriately in first mentions and akin to their monolingual peers. With respect to the predictive factors accounting for individual variation in first mention scores, the results showed HL children's AOA and mother's education level to be significant. When divided into groups based on school experience, for the HL group who attended English-only schools, richness of the Mandarin environment was also a significant predictor.

2.9.1   The first mention abilities of Mandarin HL children

Adequate first mentions in Mandarin require the convergence of lexical, morphological, and syntactic knowledge. In the current study, Mandarin HL children displayed weaknesses in their knowledge of classifier morphemes and vocabulary, but otherwise exhibited comparable morphsyntactic skills to their monolingual peers.

Regarding classifiers, in comparison to the Mandarin monolinguals, Mandarin HL children overused the general classifier *ge4* in contexts where a specific classifier was required. According to Hickmann and Liang's (1990) study on the development of first mentions in Mandarin monolingual children, only children aged 4–5 years overused the general classifier *ge4* in indefinite NPs*;* monolingual 6-year-olds had already begun to increase their use of specific classifiers. Given that the HL children in this study were older than 6;0, overuse of the general classifier is not an expected developmental error at this age. Since the repertoire of classifiers in Mandarin is large and noun-classifier correspondences must be learned mainly one-by-one, this might explain why HL children showed limited diversity in classifiers used but, at the same time, consistently showed grammatical NP-internal morphological structure. Furthermore, the sub-group analysis revealed that the HL children who attended Mandarin-bilingual schools produced more specific classifiers than the HL children who attended English-only schools, thus suggesting that formal schooling bolsters knowledge of morphological systems. Our findings with classifiers are in accordance with previous studies on morphological acquisition in HL speakers, where it has been argued that the morphological domain often exhibits incomplete acquisition because of insufficient L1 exposure and use in a host country (Anderson, 2004; Li & Lee, 2001; Montrul, 2008; Polinsky, 2006). While incomplete acquisition is the most likely explanation for the use of classifiers exhibited by HL children in this study because the mean AOA was 2;0, it is entirely possible that for some of the older AOA children, attrition could have

taken place. Future longitudinal studies would enable us to differentiate between incomplete acquisition and attrition.

Our results also showed that Mandarin HL children were not comparable to their monolingual peers with respect to lexical knowledge. For example, they used more non-specific lexical items, such as *yi1 ge4 ren2* "someone" or *yi2 ge4 dong1xi1* "a thing" in their first mentions. Moreover, they code-switched to English words sometimes. These results are consistent with Kaufman (2005) who found that when mentioning specific animate referents, Hebrew HL children were not able to produce the specific animal names in Hebrew because of insufficient lexical knowledge. It should be also noted that, in the HL group in this study, the HL children who attended English-only schools used non-specific lexical items and code-switched more often than the HL children who attended Mandarin-bilingual schools. This difference within the HL group highlights the potential importance of formal schooling and literacy on lexical knowledge in a HL.

The analysis of the specific linguistic devices used by Mandarin HL children showed that they did not have weaknesses in all linguistic domains. For example, we found that when using indefinite NPs, Mandarin HL children were able to place the numerical determiner *yi1* "one" with classifiers appropriately. At the syntactic level, similar to Mandarin monolinguals, Mandarin HL children were able to use different types of post-verbal clauses and relative clauses appropriately in first mentions. For example, they could correctly place the construction CL + N after the verb *you3* "have" and the motion verb *lai2* "come". They could place the modifying clause before the head noun to form a correct relative clause. Note that the use of the numerical determiner *yi1* "one" in the full indefinite NP and the use of post-verbal NPs in *you3* "have" and *lai2* "come" clauses are language-specific ways of introducing the referents, and, thus, cannot be transferred from the children's knowledge of English.

In sum, this study found that children's weaknesses in their HL were uneven. For linguistic domains requiring a great deal of input and experience to acquire, such as specific classifier morphemes and lexical terms, HL children performed worse than their monolingual peers. By contrast, their more limited exposure to Mandarin did not seem to hinder them from acquiring language-specific morphosyntactic structures such as the indefinite determiner construction and post-verbal NP placement to signal new information. Therefore, it can be argued that some linguistic domains are more vulnerable in the HL acquisition context than others.

2.9.2   Individual differences

When considering all HL children as a group, we found two significant predictors: AOA in Canada and mother's level of education (MOTED). Regarding the former, the HL children who immigrated with their parents to Canada at a later age tended to outperform the children who had an earlier arrival age or were born here. Thus, early arrival in the host country is associated with diminished development and maintenance of the HL, even for children. This finding is consistent with research on adult HL speakers (G. Jia, 2008; Montrul, 2008) showing that those who arrived in a host country at a younger age maintained a lower level of L1 competence in adulthood and tended to shift to the societal language as their dominant or preferred language when they were very young. With respect to the sub-group analysis on the HL children who were recruited from different schools, AOA was only a significant predictive factor for the HL children who attended English-only schools. Perhaps after years of English-only immersion at schools, those HL children were likely to have switched their dominant language from Mandarin to English early on. As a result, they tended to have lower proficiency in Mandarin, as evidenced in their first mention skills. For the HL children who attended Mandarin-bilingual schools, although some immigrated to Canada at a young age or were born here, they all had consistent exposure to

Mandarin at school every day. The difference between these two groups in terms of the impact of AOA points to how schooling in the HL could help counteract the negative effects of early L2 exposure on L1 maintenance. This interpretation is reinforced by the fact that, among this sample of children, the HL children in the bilingual schools had a slightly earlier AOA than the HL children in English-only schools.

The second significant predictor in the whole group analysis was mother's level of education, and it was also a significant predictor in each sub-analysis. The results revealed that the children whose mother had more years of education performed better with first mentions. This finding is consistent with the studies by Amastae (1982) and Hammer *et al.* (2012) on Spanish HL speakers. It is possible that the mothers who had a higher education level in this study tended to value the heritage culture and language, and transmitted these values to their children. It is also possible that mothers with higher education tended to use more talk overall and more complex Mandarin vocabulary and morphosyntax when speaking with children, as has been found in studies of maternal education and language use with monolingual, English-speaking children (Hoff, 2006). A fruitful domain for future research would be to examine HL input in immigrant families as a function of maternal education levels directly, for example, recording mother-child interactions in the home and analyzing them for differences based on mother's level of education.

Still on the topic of input factors, one interesting finding of this study was that, for all HL children as a group, the richness of the Mandarin environment (MANRICH) was not a significant predictor of first mention scores, but for the sub-analysis of HL children in English-only schools it was significant. In this study, the richness of the language environment was determined by the density of engagement in HL media, activities and friends in an average week. Kondo-Brown (2005) and G. Jia (2008) found HL maintenance in adult speakers was likely facilitated by

continued exposure to a rich HL environment through media (i.e., radios, TV programs, movies), books, and interactions with peers. Like the HL adults included in Kondo-Brown's and G. Jia's studies, the HL children recruited from English-only schools in this study did not have formal schooling in the HL. By contrast, the non-significant effect of richness of the Mandarin environment found in the first mentions of the HL children who attended Mandarin-bilingual schools was probably due to the fact that they already had consistent and rich Mandarin exposure at school every day. Thus, for the HL children who lacked formal HL schooling, diverse and rich HL exposure at home becomes extremely important for them to develop and maintain their HLs. Furthermore, we found that the mean score of the MANRICH variable for the HL children who attended English-only schools was 0.1 (range = 0–.4), whereas the mean score of MANRICH for the HL children who attended Mandarin-bilingual schools was 0.5 (.2–.8). Thus, while the latter had a richer Mandarin environment, the richness of the environment impacted the first mention abilities of the former. Perhaps a richness level of 0.5 is a kind of critical threshold, where anything above this level does not exert a strong effect on HL development and maintenance, while variation within the 0–.5 range does have an effect. Future research is needed to verify this hypothesis.

In contrast to AOA, maternal education and richness of the HL environment, other variables did not emerge as significant in any analyses, and this is inconsistent with prior research. First, home language use varied among the children and their families in this study, but this did not significantly predict the first mention abilities of the Mandarin HL children. This variable measured how much English vs. Mandarin was used by family members. Kondo-Brown (2005) and G. Jia (2008) both found evidence for the use of the HL at home predicting stronger HL abilities in the speakers. Namely, the more the HL was used by the parents and the child at home, the better the HL was maintained long-term. One explanation for this discrepancy between our

study and these others could be the distinction between the genre of language used in daily interactions, and the genre of language used in story-telling. For example, in a home context, the parents and the child's daily conversations might not involve various specific classifiers and the lexical items used in the contexts represented in the ENNI stories (i.e., animal names or professional names). Because reading/being read to were activities included in our MANRICH variable, this might explain why a simple quantitative measure of HL use did not emerge as a significant predictor of narrative performance. Another reason for this discrepancy might have to do with having child vs. adult participants in the study. Perhaps home language use has a significant long-term impact on HL maintenance because it establishes language use patterns among family members that could stretch from childhood to adulthood.

Another inconsistency between our findings and previous research is the role of exposure to English on HL development and maintenance. Children's length of English exposure (MOE) and the richness of their English environment (ENGRICH) did not significantly predict individual differences in Mandarin first mention scores. In contrast, some studies on adult HL speakers (G. Jia, 2008; Montrul, 2008; Polinsky, 2008) found that longer L2 exposure time significantly predicted lower levels of L1 ability. This relationship exists presumably because intensive contact with the L2 would restrict the speaker's L1 input and output. However, since exposure time to English and AOA are related conceptually, the significance of AOA in our study means that some part of the relationship between L2 onset and L1 maintenance found in other studies is also present in ours. In addition, as with the absence of an effect of home language, perhaps length of exposure to English would have a greater impact in adult HL speakers. Certainly, in a study with adult HL speakers, length of exposure to English would likely vary more as well. Finally, our ENGRICH and MANRICH variables were not inverses of each other, so children could have a rich English and a rich Mandarin environment at home. This

could be a reason why no "trade-off" between English and Mandarin emerged in this study. On

the contrary, our findings suggest that immigrant families might not have to sacrifice the HL for

acquiring the societal language, because exposure to English did not have a significant negative

impact on first mention abilities in the HL.

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CHAPTER 3. The acquisition of relative clauses by Mandarin heritage language children

3.1 Introduction

Heritage language (HL) speakers are defined as those who are exposed to their first language (L1) from birth and raised in the L1 environment exclusively in the first years of their life. Later on, as they start (pre)school and socialization outside the home environment, they gradually shift towards the societal language (L2) that becomes their dominant language. In general, HL speakers would achieve native-like or near native-like L2 ability, depending on their age of arrival in the host country. By contrast, their L1 proficiency varies a great deal among individuals. Thus far, the majority of studies on the acquisition of the L1 have been focused on adult rather than child HL speakers (Au, Knighly, Jun & Oh, 2002; Cuza, 2012; Montrul, 2002, 2005, 2009; Montrul & Ionin, 2012; Polinsky, 2006, 2008b, 2011; Pires & Rothman, 2009; Rothman, 2007). These studies found that, in comparison to monolingual speakers, adult HL speakers exhibit inferior comprehension and production abilities in the domains of phonology, the lexicon, morphology, and syntax, which could be the consequences of incomplete acquisition and L1 attrition in childhood (Anderson, 1999, 2001; Cuza, Pérez-Tattam, Barajas, Miller & Sadowski, 2013; Kaufman, 2005; Montrul, 2008).

However, recently, studies on the acquisition of the L1 in HL children have shown that HL (bilingual) children tended to display protracted acquisition of the L1 as compared to monolinguals (Flores & Barbosa, 2014). Unlike incomplete acquisition and L1 attrition, protracted acquisition of the L1 suggests that HL children could develop native-like L1 ability eventually, but that the whole acquisition process requires a longer timeframe. The evidence of protracted acquisition of the L1 in HL children has shown that the process of HL acquisition during the early developmental stages cannot be simply predicted by studies only focused on adult HL speakers. In order to better understand how and why adult HL speakers are similar or different from monolingual speakers, direct studies with HL children are needed.

In addition to the phenomenon of incomplete acquisition, attrition and protracted acquisition of the L1, crosslinguistic influence from the dominant societal L2 could also affect the acquisition of the minority L1 in HL children. A large body of research on early bilingualism has already shown that if bilingual children's two languages display uneven levels of proficiency, the dominant language tends to influence the acquisition of the weaker language (Döpke, 1998; Foroodi-Nejad & Paradis, 2009; Gathercole, 2007; Nicoladis, 2002; Paradis, 2010; Serratrice, Sorace, Filiaci & Baldo, 2009; Yip & Matthews, 2007). However, due to insufficient direct research on HL children, whether the societal L2 influence would lead to deficient acquisition or protracted acquisition of the L1 in HL children is less well understood.

The present study is focused on the acquisition of relative clauses (RCs) in Mandarin HL children aged from 6;0 to 9;8 years old living in Canada. The goals are to understand 1) whether Mandarin HL children's comprehension and production of RCs is similar or dissimilar to that of their monolingual peers, 2) how Mandarin HL children's comprehension and production of RCs develop over time, and 3) whether crosslinguistic influence from the dominant L2 leads to incomplete acquisition, attrition or protracted acquisition of their RCs.

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3.2   Incomplete acquisition, attrition and protracted acquisition of the HL in children

Studies on the acquisition of the L1 in HL children have shown conflicting findings. Some studies have found that the grammatical knowledge of HL children's L1 was not comparable to monolinguals, which was due to limited L1 exposure and extensive contacts with L2 in the host country. As a result, HL children tended to display incomplete acquisition or attrition in their L1 (Anderson, 1999, 2001; Li & Lee, 2001; Silva-Corvalán, 1994, 2014). For example, Li and Lee (2001) found Cantonese HL children were not comparable to monolinguals in terms of using diverse classifiers and the quantifier *dou1* in required contexts in narratives. Anderson's longitudinal studies (1999, 2001) on two Spanish-English speaking siblings (aged from 4;7 to 6;7 years) showed that their gender agreement in Spanish underwent attrition as there were more errors after they had two years of schooling in English.

In contrast, the studies conducted by Polinsky (2008b) and O'Grady, Kwak, O. Lee and M. Lee (2011) did not find evidence of incomplete acquisition or attrition in HL children. Polinsky (2008b) found HL children performed on a par with monolingual children in terms of comprehending subject-type and object-type RCs in Russian. O'Grady and his colleagues (2011) found Korean HL children had the same preference as Korean monolingual children and adult native speakers in terms of interpreting the disjunction in negated clauses. It should be noted that Polinsky and O'Grady *et al.* only examined HL children's comprehension, while Silva-Corvalán, Li and Lee and Anderson's studies were only focused on the production abilities of HL children. It remains unclear whether HL children would display non-target-like performance in both comprehension and production of their L1.

Recently, research on HL children showed that protracted acquisition could be another outcome (Flores & Barbosa, 2014; Rinke & Flores, 2014). In a study on the acquisition of clitic placement by twelve Portuguese HL children aged between seven and fifteen years old living in Germany (Flores & Barbosa, 2014), the results showed that the errors made by the younger HL children can also be found in the early developmental stages of monolingual children. Moreover, although the HL children aged seven years old did not have comparable performance to seven-year-old monolinguals, the older HL children's L1 was convergent with the target grammar. Flores and Barbosa argued that given that these Portuguese HL children were exposed to the reduced L1 input in Germany, they required a longer time to have a critical mass of input to enable them acquire complex properties of the L1.

Flores and Barbosa's proposal is in line with other studies on simultaneous and sequential bilingual children (Gathercole & Hoff, 2007; Hoff, 2006; Hoff, Core, Place, Rumiche, Señor & Parra, 2012; Paradis, 2010; Paradis, Tremblay & Crago, 2014). These studies have shown that bilingual children lag behind monolingual age peers in acquiring some morphosyntactic structures in the non-dominant language. Given that HL children's L1 is a weaker language, they may lag behind their age-matched monolingual peers for acquiring certain properties of the L1; however, as long as their L1 exposure is maintained, they should have sufficient L1 exposure to acquire those properties in a target-like way eventually, according to Flores and Barbosa's proposal.

The studies reviewed so far indicate that whether HL children show deficient or protracted acquisition of the L1 depends on the amount of L1 exposure they have in the host country. Several studies on HL acquisition have shown that some age-related and input factors could contribute to the development and maintenance of the L1 in HL speakers (Anderson, 1999, 2001; G. Jia, 2008; G. Jia & Aaronson, 2003; G. Jia, Aaronson, Young, Chen & Wagner, 2005;

Kondo-Brown, 2005; R. Jia & Paradis, 2013). For instance, Anderson (1999, 2001) found that younger age of onset of English exposure and longer exposure to the dominant societal language, English, were associated with lower levels of HL proficiency in lexical and morphosyntactic abilities of Spanish HL children. R. Jia and Paradis (2013) found that the Mandarin HL children who had older ages of arrival and rich and diverse Mandarin environments tended to have stronger narrative abilities in Mandarin. Moreover, G. Jia (2008) found that Mandarin HL children who heard and spoke more Mandarin at home had higher levels of HL proficiency in the domains of the lexicon and morphology. Furthermore, it is worth pointing out that the HL children's age could also be considered as an input factor, as older Mandarin HL children may have a larger cumulative amount of L1 input than younger Mandarin HL children (Flores & Barbosa, 2014).

In sum, the phenomena of incomplete acquisition, attrition, and protracted acquisition are all possible outcomes of HL acquisition in children. However, it is still difficult to differentiate the phenomena of incomplete acquisition and protracted acquisition of the L1. For example, if we observe some non-target-like structures used by HL children at some point, it is possible that they will still maintain that deviant knowledge over time. Alternatively, they may acquire these structures at a later developmental stage. Therefore, both cross-sectional and longitudinal investigations are needed to help us determine whether HL children's L1 is convergent with or divergent from the target grammar.

3.3   Crosslinguistic influence in HL acquisition

Another effect that should be taken into account in the study of L1 acquisition in HL children is crosslinguistic influence. As HL children's L1 is, by definition, a minority language, and is usually their non-dominant language (Anderson, 1999, 2001; Fillmore, 1991; Kaufman &

Aronoff, 1991; Montrul, 2008; O'Grady, Kwak, O. Lee & M. Lee, 2011; Polinsky, 2006; Pires & Rothman, 2009; Silva-Corvalán, 1994), it is possible that their later learned L2 would interfere with the L1 grammar to some extent. Studies on early bilingualism have shown that bilingual children who have unbalanced language proficiency between their two languages tend to exhibit non-target like performance with respect to some linguistic structures in the non-dominant language, and it could be attributed to influence from the dominant language (Döpke 1998; Foroodi-Nejad & Paradis, 2009; Gathercole, 2007; Nicoladis, 2002; Serratrice, Sorace, Filiaci & Baldo, 2009; Yip & Matthews, 2007). For instance, Yip and Matthews's study (2007) was focused on the acquisition of RCs in three simultaneous Cantonese-English bilingual children who were aged between two to three years old. The analysis of children's spontaneous speech revealed that the three bilingual children used the Cantonese head-final RC structure in their English RCs, but they did not employ English head-initial structure to form Cantonese RCs. Given that all three bilingual children were living in Hong Kong, and their Cantonese was relatively stronger at the time of testing, crosslinguistic influence was expected from children's Cantonese to English. Kidd, Chan and Chiu (2015) also investigated the comprehension of Cantonese RCs in twenty simultaneous Cantonese-English bilingual children (Mage = 8;11) living in Australia. The results showed that bilinguals performed better on comprehending subject-type Cantonese RCs. When comprehending object-type Cantonese RCs, bilinguals wrongly assumed the RC subject was the head referent. The head referent in English RCs appears in clause-initial position, whereas the head referent in Cantonese RCs appears in clause-final position. Thus, the errors made by bilinguals in comprehending object-type Cantonese RCs were attributed to influence from their English. The authors argued that, given that all children were living in Australia where the predominant societal language is English, the greater exposure to English social contexts might have had an impact on these children's Cantonese.

Although crosslinguistic influence could affect the acquisition of the weaker/minority language in bilingual children, some studies found that its effects are not pervasive. For instance, Serratrice and her colleagues (2009) found that due to crosslinguistic influence from English to Italian, English-Italian bilingual children tended to accept ungrammatical bare NPs used in a generic context in Italian. However, they did not reject the grammatical use of plural NPs with a definite article in Italian. Moreover, Flores and Barbosa's (2014) study revealed that crosslinguistic influence was one of the factors causing differences between Portuguese HL bilingual children and their monolingual peers with respect to clitic placement, but it was not a decisive factor because Portuguese HL children did not apply the German placement rule in every context. The present study aims to investigate whether crosslinguistic influence from the dominant societal L2 would affect both comprehension and production of RCs in Mandarin HL children.

3.4   Relative clauses in Mandarin

A RC is a subordinate clause that modifies a noun or noun phrase. In Mandarin, RCs are prenominal, which means the modifying clause precedes the head noun. Moreover, a RC marker *de* is placed between the RC and the head noun. The typical structure of a Mandarin RCs is: *modifying clause + de + head noun*, as the following example shows:

Object-type RC

(1)   [lao3   ye2ye2 mo1_] de   na4   zhi1   **gou3**
       [old-man touch_]   RCM (Relative clause marker)   that   classifier   **dog**
       "**The dog** that an old man touches."

In example (1), the RC *lao3ye2ye2 mo1* 'old man touches' is indicated in the square brackets, and it precedes the head noun *gou3* 'dog'. The RC marker *de* marks the boundary between the head noun/noun phrase and the RC.

Like many SVO languages, Mandarin allows relativization of a head noun whose grammatical role in the RC can be Subject or Object. For example, the head noun *gou3* 'dog' in example (1) is the object of the verb *mo1* 'touch'. Example (2) is a subject-type Mandarin RC. The underscore gap indicates a subject position that is filled by the head noun *nan2hai2* 'boy'.

Subject-type RC

(2)   [_qin1   xiao3   nü3hai2]   de   na4   ge4   **nan2hai2**
        [_ kiss   little   girl]   RCM   that   classifier   **boy**
        "**The boy** who kisses a little girl".

As we can see in example (1) and example (2), the head nouns gou3 'dog' and nan2hai2 'boy' both appear in the clause-final position. By contrast, the equivalent English RCs in example (1) and (2) have the head nouns *dog* and *boy* at the clause-initial position.

Mandarin RCs can also be considered as a subset of the noun modifying construction in Mandarin, given that all noun-modifying constructions in Mandarin employ a head-final structure. Consider examples (3) and (4).

(3)   cong1ming   de   **xue2sheng1**
        smart   modifier   student
        'Smart student'

(4)   shang4   wu3dao3   ke4   chuan4   de   **qun2zi**
        have   dance   class   wear   modifier   skirt
        'The skirt for the dance class '

In example (3), the adjective *cong1ming1* 'smart' modifies the noun *xue2sheng1* 'student', and the particle *de* marks the boundary between them. In example (4), the elements preceding the particle *de* are used to modify the noun *qun2zi* 'skirt'. There has been some research suggesting that the early-acquired noun modification construction facilitates the acquisition of RCs in Cantonese (Chan, Matthews & Yip, 2011; Kidd, Chan & Chiu, 2015). As

Cantonese and Mandarin have similar head-final noun modification constructions, it could be expected that the acquisition of RCs in Mandarin children might also be eased by the acquisition of other noun modification constructions. This factor will be considered in the current study.

With respect to the acquisition of Mandarin RCs in monolingual children, both Chen and Shirai (2015) and Hsu (2014) conducted corpus analysis and showed that Mandarin monolingual children tended to produce the first RC around the age of two, and RC knowledge tended to be stable after the age of five. In the study of the spontaneous speech of four Mandarin monolingual children aged from 0;11 to 3;5 as well as the speech of their caregivers, Chen and Shirai found that the first RC was produced by children aged 1;6, and the distributional pattern of different relative types found in these four children was reflected by the distributional pattern found in Mandarin-speaking adults' speech samples. Both Mandarin-speaking adults and children used object-type RCs more frequently than other types. This finding suggested an important role for input in the acquisition of RCs in Mandarin-speaking children and likely children learning other languages as well. Another study conducted by Hsu (2014) showed a clear developmental process in RC acquisition. It was found that 3-year-old and 4-year-old Mandarin monolingual children often made errors when they produced RCs in a sentence imitation task. By contrast, 5-year-old children were able to produce target RC structure in most of their responses. The finding suggested that RC knowledge tends to be stable in 5-year old Mandarin monolingual children.

The present study was only focused on the acquisition of Mandarin subject-type and object-type RCs, because they are the most common RC types in Mandarin.

3.5   Study 1

3.5.1 Research questions

Study 1 aimed to determine whether HL children were similar or dissimilar to their monolingual peers regarding their comprehension and production of Mandarin RCs, and what age and input factors account for HL children's performance. The specific research questions we asked are as follows:

(1). Do Mandarin HL children perform on a par with Mandarin monolingual children in comprehension?

Previous studies on the comprehension ability of Russian and Korean HL children have showed that they were comparable to their monolingual peers (Polinsky, 2008b; O'Grady *et al.*, 2011). Thus, it is expected that Mandarin HL children and the monolingual children in this study may show similar performance in comprehending grammatical subject-type and object-type RCs.

(2). Do Mandarin HL children perform on a par with Mandarin monolingual children in production?

Previous studies on child HL speakers have shown that HL speakers tend to have inferior production abilities as compared to monolinguals (Anderson, 1999, 2001; Li & Lee, 2001). Thus, it is expected that Mandarin HL children would produce some non-target-like RCs.

(3). Does the dominant English L2 play a role in the acquisition of RCs in HL children?

Because there is a typological difference between Mandarin and English, and both Yip and Matthews (2007) and Kidd, Chan, and Chiu's (2015) studies observed crosslinguistic influence in the acquisition of Cantonese RC in Cantonese-English bilingual children, we can investigate potential crosslinguistic influence from the dominant English to Mandarin. In comprehension, we formed Mandarin RCs with the English head-initial structure in the comprehension task. The

assumption is that if there were crosslinguistic influence from children's English to Mandarin, we would expect that Mandarin HL children would require less processing time and have a higher level of accuracy than their monolingual peers when comprehending head-initial Mandarin RCs. By contrast, monolinguals would need longer processing time and make more errors when comprehending these head-initial Mandarin RCs. In production, if there were influence from English, Mandarin HL children might employ the English head-initial structure in their Mandarin RCs.

(4). What age and input factors account for the comprehension and production RCs in Mandarin HL children?

According to the previous studies on individual differences in HL acquisition (G. Jia, 2008; Kondo-Brown, 2005; R. Jia & Paradis, 2013), it is expected that differences in HL children's age of arrival in the host country, the length of exposure to English and the amount of HL exposure at home would be associated with differences in performance on the tasks.

3.5.2 Method

Participants Twenty-nine Mandarin HL children (Mage = 8;00, SD = 0;11, range = 6;0-9;8) participated in this study. Six children were born in Canada and twenty-three children were born in China but immigrated to Canada with their parents at an early age (N = 29, AOA: M = 3;0, SD = 2;1, range = 0;0-6;3). All children were exposed to Mandarin from birth and their parents were all Mandarin native speakers.

This study also included fifteen Mandarin monolingual children (Mage = 7;1, SD = 0;2, range = 6;8-7;4) as a comparison group. They were all first grade students and were tested in an elementary school in Lanzhou, Mainland China. The age difference between the HL group and the monolingual group was controlled for in the statistical analyses.

Procedures The comprehension experiment was designed using DMDX (I. Forster & C. Forster, 2003) software. DMDX is widely used in psychological laboratories to measure the accuracy of response as well as reaction times to visual and auditory stimuli. The experiment consisted of thirty-five test items: ten grammatical head-final Mandarin RCs (five subject-types and five object-types), ten ungrammatical head-initial Mandarin RCs (five subject-types and five object-types) and fifteen Mandarin declarative sentences. Each test item was presented with one auditory stimulus and one visual stimulus. The auditory stimuli were recorded by the author. For the visual stimuli, all pictures were taken by a digital camera and edited by the Photoshop software. A total of thirty-five test stimuli were randomized each time to avoid the ordering effect in the comprehension experiment.

Grammatical testing stimuli were RCs with the head-final syntactic structure and an obligatory RC marker *de*, as the following examples show:

Grammatical subject-type RC
(3)   [qin1   nü3hai2   de]   nan2hai2
        [kiss   girl   RM]   boy
        'The boy [who kisses the girl].'

Grammatical object-type RC
(4)   [nan2hai2   qin1   de]   nü3hai2
        [boy   kiss   RM]   girl
        'The girl who the boy kisses.'

Ungrammatical testing stimuli were RCs with the English head-initial syntactic structure, as the following examples show:

Ungrammatical subject-type RC
(5)   *nan2hai2   [qin1   nü3hai2   de]
         boy   [kiss   girl   RM]
         'The boy [who kisses the girl].'

Ungrammatical object-type RC
(6)   *nan2hai2   [nü3hai2   qin1   de]
         boy   [girl   kiss   RM]
             'The boy [who the girl kisses]'

In addition to twenty Mandarin RCs, fifteen Mandarin declarative sentences were included as filler stimuli in the comprehension experiment. These declarative sentences had the same numbers of morphemes as the target RCs, as the following example show:

Grammatical declarative sentence
(7)   nan2hai2   zai4   qi2   che1
         boy   is   ride   bike
             'The boy is riding a bike.'

For each test item, the child first heard a sentence. Then two pictures were displayed on a computer screen at the same time and they depicted reversible actions (e.g. a boy kisses a girl, a girl kisses a boy). The child was encouraged to choose the picture that contains the character modified by the RC. The right SHIFT key corresponds to the right-side picture and the left SHIFT key corresponds to the left-side picture. The child was encouraged to press the right/left SHIFT key as soon as possible, because the experiment also recorded reaction times for each stimulus. All picture stimuli were constructed with animate characters. Before the testing stimuli began, two practice stimuli were conducted to ensure the child understood the instruction.

The production experiment consisted of two practice scenarios and four test scenarios. In each scenario, participants were encouraged to provide one subject-type and one object-type Mandarin RC. A total of four scenarios were randomized in each time to avoid the ordering effect in the production experiment. At the beginning of the experiment, the child was told that he/she was going to play a game with *Winnie the Pooh*. The child would see each puppet show that was played by two identical animate characters and other supporting characters. When the child watched the show, *Winnie the Pooh* was blindfolded so he could only hear what the puppet was talking about, but he could not see what the puppet was doing. When the show ended,

Winnie the Pooh turned around and took off the blindfold, and he asked the child to say 'who did

what to whom in that puppet show?'. For example, one puppet show presented two identical

dogs, one boy and one girl. The child was encouraged to use target RCs to disambiguate between

two identical dogs, as the following examples show:

Subject-type RC
(8)   [mo1   nü3hai2   de]   gou3
         [touch girl   RM]   dog
         'The dog that touches/the girl.'

Object-type RC
(9)   [xiao3 nan2hai2   mo1   de]   gou3
         [little   boy   touch RM]   dog
         'The dog that the little boy touches.'

To ensure that the child knew how to complete the experiment, two practice scenarios began

first. In these two practice scenarios, if the child used other sentences instead of RCs to

distinguish between two identical characters, the experimenter would provide the target RCs and

ask the child to pay attention to the form of RCs. During the experiment, if the child did not use

RCs to disambiguate between two identical characters, the experimenter then played the practice

scenarios one more time and then encouraged the child to use RCs. If the child were still unable

to use RCs, the experimenter just completed the experiment without providing any help.

In addition to a comprehension and a production experiment, a parental questionnaire

was also administered to collect children's language background information (ALEQ: Paradis,

2011;   http://www.linguistics.ualberta.ca/CHESL_Centre/Questionnaires.aspx).   The

questionnaire includes such topics as age of arrival in Canada, child's age at testing, months of

exposure to English (MOE), and language use among family members in the home. For language

use in the home, parents were asked a series of questions with scaled responses about the use of

languages from each household member to the child (FAMLANG), and the use of language from

the child to each household member (CHILDLANG), for example 0 = only speak Mandarin at home; 1= English seldom, Mandarin usually; 2 = English 50%, Mandarin 50%; 3 = English usually, Mandarin seldom; 4 = only speak English at home. The proportion of language use at home was derived from these responses by totaling the responses and then dividing by the highest total possible number. Effectively, the proportion of language use indicates the proportion of English in the home, since Mandarin was set at 0. The information collected from this questionnaire is summarized in Table 3. 1, and was included as predictors in the statistical analyses.

Table 3. 1 Mandarin HL children's characteristics

	AOA	AGE	AOE	MOE	HOMELANG	FAMLANG	CHILANG
Mean	36	96	49	49	0.3	0.2	0.4
SD	26	11	20	16	0.2	0.2	0.3

Note. AOA = Age of arrival. AOA and AGE at testing were calculated in months; MOE = months of exposure to English; FAMLANG = proportion of English spoken among adults at home; CHILANG = proportion of English spoken by child at home; HOMELANG = average score of FAMLANG and CHILANG

Moreover, given that the older Mandarin HL children may have a larger cumulative amount of L1 input than the younger Mandarin HL children, HL children's age was also considered as an input factor into the analysis.

Coding Comprehension performance was measured based on reaction times (in milliseconds) and the accuracy of response to each item, which were automatically recorded by the DMDX software (DMDX codes 0 for the correct response and 1 for the incorrect response). If a child did not respond to the test item, DMDX coded it as an incorrect response. For the convenience of logistic regression analysis, the correct response was recoded as TRUE and the incorrect response was recoded as FALSE. The evaluation of production performance was based on whether the child could produce the target head-final Mandarin RCs. The coding system was the same as in comprehension: TRUE was for the correct response, and FALSE was for the

incorrect response. The FALSE responses include head-initial RC responses and non-RC responses.

3.5.3   Results

HL children and monolingual children's RC comprehension

Table 3. 2 presents the mean correct performance of the two groups of children in four conditions:

Table 3. 2 Mean correct performance of two groups of children in four conditions

	SG	OG	SU	OU
HL group	77%	89%	90%	65%
MON group	87%	87%	89%	56%

Note. HL = Heritage language; MON = monolingual; SG = grammatical head-final subject-type RCs; OG = grammatical head-final object-type RCs; SU = ungrammatical head-initial subject-type RCs; OU = ungrammatical head-initial object-type RCs.

As we can see in Table 3. 2, both HL children and monolingual children had higher levels of accuracy in comprehension for head-final Mandarin RCs (SG and OG) and head-initial subject-type RCs (SU). Regarding head-initial object-type RCs (OU), both groups of children had lower levels of accuracy than in the other conditions, and the HL group actually showed a slight advantage (65% vs. 56%).

To investigate whether the monolingual and HL children were significantly different in terms of processing grammatical head-final and ungrammatical head-initial Mandarin RCs, we used mixed-effects modeling in R (Baayen, 2008). The reason for using mixed-effects modeling instead of a two-sample t-test was that the age of the two groups of children was significantly different ($M_{Heritage}$ = 8;00, M_{MON} = 7;1, $p < .001$). In order to filter out the impact of the age difference between the two groups, children's age at testing was modeled as a random-effect factor with a mean of zero and unknown variance. Moreover, the thirty-five stimuli were coded

as Items, and children were coded as Subjects, both modeled as random-effects to control for by-participant and by-item variation. The dependent variable of the first analysis in comprehension was Reaction Time (RT). Children who processed sentences very fast (RT < 1800ms) and children who processed sentences very slowly (RT > 9700 ms) were considered outliers, and their responses were removed from the analysis [1]. The second modeling analysis in comprehension had the Response, which was coded as TRUE or FALSE, as a dependent variable. For these two modeling analyses, the fixed effects were: Language Group (two levels: Monolingual and HL), Conditions (four levels: grammatical subject-type RC, grammatical object-type RC, ungrammatical subject-type RC, and ungrammatical object-type RC).

The results only showed a significant group difference regarding RTs in performance in the ungrammatical object-type RC condition *(β = 408.6, t = 1.9, p = .04)*. The positive coefficient estimate of 408.6 indicates that, in comparison to Mandarin HL children, monolingual children required a longer time to process head-initial object-type RCs[2]. No significant difference was found for accuracy between the two groups of children in any of the four conditions.

To find out the factors predicting individual differences in the HL group's accuracy performance, an additional regression analysis was conducted. The dependent variable was children's Response (two levels: TRUE and FALSE). The random-effects were Subject and Item. The fixed effects included were children's AGE, AOA (two levels: foreign born and non foreign born), the length of exposure to English (MOE), the language spoken among family members at home (FAMLANG), the language spoken by the child at home (CHILANG), and the HOMELANG (average score of FAMLANG and CHILANG). The correlation between the factor AGE and MOE were not significant, but CHILANG and HOMELANG were significantly

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[1] RTs < 3SDs from mean and RTs > 3SDs from mean were removed from the study (Mean$_{RT}$ = 5771 ms, SD$_{RT}$ = 1300 ms)

[2] For the analysis of group differences, the reference level was always the HL group.

correlated (r (29) = .86, p < .001), and FAMLNG and HOMELANG were significantly

correlated (r (29) = .92, p < .001). Therefore, CHILANG and FAMLANG were decorrelated

from HOMELANG. Only CHILANG and FAMLANG residuals were entered into the model.

The analysis started with a full model that overfitted the data, and then the non-significant

predictors were removed in a step-wise fashion. Nested models that differed in complexity

(number of predictors) were compared by using the maximum likelihood ratio test, and if the

reduced model accounted for the same amount of variance as the full model, the reduced model

was chosen. The optimal model arrived at through this process only included a significant effect

for AGE (β = 0.02, z = 2.1, p = .03). The positive coefficient estimate of 0.02 indicates that

children's accuracy was higher if they were older.

HL children and monolingual children's RC production

Table 3. 3 presents the percentage of correct RCs, head-initial RCs and non-RC responses

for both HL and monolingual groups in production. A Chi-Square test revealed that the two

groups of children were significantly different with respect to different types of responses

presented in Table 3. 3 (X^2 (2, N=44) = 413.77, p < .001).

Table 3. 3 Responses of HL and monolingual group in production (percentage in parentheses)

	Correct	Head-initial RCs	Non-RC responses
HL group	134/224 (60%)	19/224 (8%)	71/224 (32%)
MON group	112/120 (93%)	0/120 (0%)	8/120 (7%)

Note: HL = heritage language children; MON = monolingual children

As we can see in Table 3. 3, Mandarin monolingual children performed at ceiling (93%) and

Mandarin HL children had a lower level of accuracy (60%). With respect to error types, 8% HL

children's responses were head-initial RCs (see example (8) and (9)). There were ten Mandarin

HL children who used head-initial RCs in production. In contrast, none of the Mandarin

monolingual children produced head-initial Mandarin RCs. Moreover, the majority of incorrect

responses found in the HL group were non-RC responses.

Head-initial subject-type RC

(8)   *zhe4 ge4   **gou3** [zhui1 ma3   de]
         this   CL   **dog**   [chase horse de]
         'This is the dog that chases the horse'.

Head-initial object-type RC

(9)   *zhe4 ge4   **xiao3 nü3nai2**   [sheng4dan4 lao3   ye2ye2   qin1   de]
         this   CL   **small girl**   [Christmas   old   grandfather   kiss   de]
         'This is the girl that the Santa Claus kisses'.

In example (8) and (9), HL children placed the head noun *gou3* 'dog' and the head noun *xiao3*

nü3nai2 'little girl' at the clause-initial position. In both cases, the modifying clause was placed

after the head noun, which is identical to the word order in English, but it violates the syntactic

word order used in Mandarin RCs.

Two regression analyses were conducted to investigate whether the HL group and the

monolingual group were different or similar in terms of producing subject-type and object-type

RCs. The dependent variable was children's Response, which was coded as TRUE or FALSE.

The incorrect responses included both head-initial RC responses and non-RC responses. The

fixed effects were Language Group (two levels: MON and HL). The random effects were still

Items, Subject, and AGE. The analysis revealed that monolingual children outperformed HL

children for both subject-type RCs ($\beta = 3.8$, $z = 2.6$, $p < .01$) and object-type RCs ($\beta = 3.8$, $z =$

2.6, $p < .01$).

An additional regression analysis was conducted to investigate predictive factors

accounting for individual differences in RC production. The dependent variable was still

children's Response (two levels: TRUE vs. FALSE). The random effects were still Subject and

Item. The fixed effects were AOA, MOE, FAMLANG, CHILANG, and HOMELANG. CHILANG and FAMLANG residuals were entered into the model, because CHILANG and FAMLANG were significantly correlated with HOMELANG. The final optimal model is presented in Table 3. 4.

Table 3. 4 Significant effects in final model for HL children's production

Fixed effects	Estimate	*SE*	*z*	*p*
(Intercept)	-13.1	5.1	-2.6	< .001***
AGE	0.1	0.05	0.7	< . 001***
CHIResid	-11.7	5.4	-2.1	.02*

*$p < .05$. ***$p < .001$
Note. CHIResid = Residual factor of CHILANG

The positive coefficient estimate of 0.1 for the variable AGE suggests that the older Mandarin HL children outperformed the younger Mandarin HL children in production. The negative coefficient estimate of -11.7 of the variable CHIResid suggests that the Mandarin HL children who spoke more Mandarin at home performed better in production (recall that the proportion of language use at home set Mandarin at 0).

3.5.4   Interim discussion

In comprehension, Mandarin HL children and Mandarin monolingual children had similar performance in terms of processing speed (RTs) and accuracy in the grammatical subject-type and object-type RC conditions. This finding is consistent with our expectations. Regarding ungrammatical head-initial RCs, recall that they were constructed to investigate potential crosslinguistic influence. The results showed that the two groups of children were comparable in terms of accuracy with ungrammatical RCs, but the Mandarin monolingual children had slower RTs than the Mandarin HL children when processing head-initial object-type RCs. Perhaps Mandarin HL children used an English RC parsing strategy to process the head-initial object-

type RCs, which resulted in them having shorter RTs as compared to monolinguals. The reason no group difference was found in processing head-initial subject RCs could be because the syntactic word order of the head-initial subject-type RC overlaps with the simple SVO transitive sentence in Mandarin. Therefore, this word order, while ungrammatical, could nevertheless help both groups of children to figure out 'who did what to whom'.

In production, our results showed that Mandarin monolingual children outperformed Mandarin HL children for both subject-type and object-type RCs. The error analysis revealed that some Mandarin HL children employed English head-initial syntactic structures in their Mandarin RCs. This finding suggested that crosslinguistic influence from the dominant language, English, might have played a role in the production of Mandarin RCs. Moreover, we found that the majority of incorrect responses were non-RC responses. This finding indicates that, although Mandarin HL children's comprehension of RCs was intact, they were unable to use RCs productively at the time of testing as compared to their monolingual peers.

The analyses of input factors revealed significant effects of the variable AGE in comprehension, and AGE and CHILANG in production. We will interpret these effects further in the general discussion section.

3.6   Study 2

In study 1, we found Mandarin HL children were different from their monolingual peers in the production of Mandarin RCs. However, it is unclear whether HL children would maintain their inferior production ability over time, or whether they would display protracted acquisition and be able to produce RCs later on in development. Moreover, although in study 1 Mandarin HL children were comparable to monolinguals in comprehension, we do not know whether that native-like comprehension ability would be maintained or attrited over time. The research

question we asked in study 2 was: *what is the developmental trajectory of HL children's comprehension and production abilities over time?* According to the longitudinal studies conducted by Anderson (1999, 2001) on Spanish HL children, it could be predicted that the Mandarin HL children's accuracy in comprehension and production would decrease over time. In contrast, according to Flores and Barbosa's (2014) findings, Mandarin HL children's production performance could be predicted to improve over time.

3.6.1   Method

Participants Nine out of twenty-nine HL children in the cross-sectional study were tested twice, with an interval of one year. Among these nine children, two children were born in Canada and seven children were born in China (N = 9, AOA: M = 3;6, SD = 2;2, range = 0;0-5;4). The same comprehension and production experiments were used in the first and second rounds. The mean and SD of these children's ages in the two rounds are presented in Table 3. 5.

Table 3. 5 Mean and SD of HL children's age across two rounds

	AGE_RD1	AGE_RD2
Mean	8;10	9;10
SD	0;11	0;11

Note. RD1 = round 1; RD2 = round 2

3.6.2   Results

Table 3. 6 presents the percentage of correct responses in four conditions across two rounds.

Table 3. 6 Accuracy in four conditions of the comprehension across two rounds

	SG	OG	SU	OU
RD1	84%	91%	89%	73%
RD2	91%	89%	93%	89%

Note. RD = round. SG = grammatical subject-type RC condition. OG = grammatical object-type RC condition. SU = ungrammatical subject-type RC condition. OU = ungrammatical object-type RC condition

As we can see from Table 3. **6**, the Mandarin HL children performed at ceiling (e.g., 90%) for both grammatical subject-type and object-type RCs in both Round 1 and Round 2. There appears to be no sign of L1 attrition, and they were superior at processing the OU targets at round 2 (72% vs. 89%).

The modeling analysis aimed to find out whether HL children's comprehension performance attrited or improved over time. Given the analysis was based on nine HL children, in order to avoid overspecifying the variation, only one fixed factor, 'Round', was entered into the model. The random effects were still Subject and Item. The dependent variables for the comprehension analysis were RTs and Response (two levels: TRUE vs. FALSE). The analyses revealed a significant effect for RT performance in the head-initial object-type RC condition (RT: β = -346.5, t = -2.14, p = .02) and a trend toward significance for accuracy in the head-initial object-type RC condition (β = 1.07, z = 1.84, p =. 06). The negative coefficient estimate of -346.5 indicates that Mandarin HL children had a short processing time in round 2. The positive coefficient for accuracy indicated that there was a trend toward increased accuracy.

The HL children's comprehension performance at Round 2 was also compared with the fifteen monolingual children from study 1. The fixed factor was Group (two levels: HL vs. monolingual). The random effects were still Subjects, Items and AGE. The dependent variables were the RTs and the Response (two levels: TRUE vs. FALSE). The analyses revealed that at Round 2, the only group difference found was in the accuracy performance for the ungrammatical head-initial object-type RC condition (β = -1.57, z = -2.16, p = .03). The RT performance in the head-initial object-type RC condition only showed a trend (β = 959.9, t = 1.52, p = .06). The negative coefficient estimate of -1.57 suggests that, in comparison to Mandarin HL children, Mandarin monolingual children had a lower level of accuracy when

processing head-initial object-type RCs. The positive coefficient for RT performance indicated that there was a trend toward increased processing time for the Mandarin monolingual group.

In the modeling analysis of Mandarin HL children's production across two rounds, the fixed and random factors were the same as the modeling analysis in comprehension. The dependent variable for the production analysis was the Response (two levels: TRUE vs. FALSE). The analysis revealed that Mandarin HL children's production improved significantly in Round 2 ($\beta = 1.6$, $z = 2.1$, $p = .03$). The mean correct performance in Round 2 was higher than in Round 1 (96% vs. 86%). A follow-up error analysis revealed that all nine Mandarin HL children were able to produce RCs at the first time of testing, but six Mandarin HL children produced head-initial Mandarin RCs. At the second time of testing, only one child was still using the English head-initial structure. The other eight Mandarin HL children were all able to produce target head-final RCs in the given scenarios.

3.6.3   Interim discussion

In study 2, HL children's comprehension and production were examined over time. In comprehension, the HL children had consistent comprehension performance in both Round 1 and Round 2, and they all performed at ceiling. In production, the HL children's performance improved significantly in Round 2. Both comprehension and production results suggest that Mandarin HL children were not losing their RC knowledge over the time period of this study. Instead, their L1 appeared to converge on the target grammar by Round 2.

3.7   General discussion

The objective of this paper was to investigate the acquisition of RCs by Mandarin HL children. Study 1 was designed to find out the following: (1) whether Mandarin HL children would be similar to or different from their monolingual peers in comprehending and producing Mandarin

subject-type and object-type RCs; (2) whether crosslinguistic influence was apparent in comprehension, production or both, and (3) what input factors contribute to the comprehension and production of RCs performance. Study 2 was designed to track the developmental trajectory of Mandarin HL children's comprehension and production abilities over time in order to disentangle the phenomena of incomplete acquisition, attrition and protracted acquisition of the HL.

Combining the findings of study 1 and study 2, we conclude that Mandarin HL children did not display incomplete knowledge of Mandarin RCs. For comprehension of Mandarin RCs, the HL children were comparable to their monolingual peers in processing Mandarin subject-type and object-type RCs, and they all performed at ceiling in both study 1 and study 2. This finding is consistent with the studies on Russian and Korean HL children (O'Grady *et al.*, 2011; Polinsky, 2008b), which reported that HL children did not have inferior comprehension ability in the domain of morphosyntax. Although in study 1 we did find that the majority of Mandarin HL children were unable to use the target RCs in production, the protracted developmental pattern revealed in study 2 suggests that all of the HL children in study 1 might have been able to produce RCs at a later age. Moreover, the analysis of individual differences in study 1 showed that the older HL children outperformed the younger HL children in the production of Mandarin RCs. This also supports the conclusion made in study 2 that Mandarin HL children seem to show protracted development of RCs in production. This finding regarding age is similar to the results of Flores and Barbosa (2014), who found that older Portuguese HL children showed higher levels of accuracy than younger Portuguese HL children for clitic placement. In sum, our study indicates that the reduction of HL exposure in the host country does not necessarily result in incomplete acquisition for RCs. It is possible that if HL children exhibit inferior abilities in both comprehension and production of morphosyntax, incomplete acquisition is likely to happen. By

contrast, if HL children show native-like comprehension ability but inferior production ability at some point, protracted development tends to be found in production. Future research is needed to know if this conjecture is borne out.

Regarding the phenomenon of L1 attrition, the longitudinal data in study 2 showed that the HL children did not lose their Mandarin RC knowledge over time. First, HL children's comprehension performance was comparable to their monolingual peers over a two-year period. Second, for those Mandarin HL children who produced RCs at the first time of testing, they still were able to produce RCs at the second time of testing. Our findings are inconsistent with the results reported in Anderson's (1999, 2001) longitudinal study, which found that the two Spanish HL children lost their morphological knowledge (i.e. gender agreement) as English exposure increased over time. The difference between our study and Anderson's could be rooted in the different linguistic subdomains. Perhaps gender morphology, which is tied to lexical knowledge, is more sensitive to reduced L1 input than the morphosyntax underlying RCs. Alternatively, perhaps Anderson found evidence of L1 attrition because she examined the speech from two siblings. The older sibling who started English schooling early might prefer to use English to interact with the younger sibling. As a consequence, both siblings' L1 underwent attrition because the amount of exposure to Spanish at home decreased over time. In our study 2, only 2/9 of the Mandarin HL children had younger siblings. The other seven Mandarin HL children had no siblings. An interesting direction for future research would be to investigate the acquisition of RCs in HL children with and without siblings, to determine if family composition has an effect on L1 attrition.

HL children are bilinguals who usually have higher levels of proficiency in the L2; therefore, crosslinguistic influence from their stronger L2 to the weaker L1 might be unavoidable. In both study 1 and study 2, we found that children's L2, English, affected their L1

at the level of language processing and production. Our results are consistent with prior research on the acquisition of Cantonese RCs in Cantonese-English bilingual children (Kidd, Chen & Chiu, 2015; Yip & Matthews, 2007), which also found that language dominance plays an important role in crosslinguistic influence. However, it should be pointed out that the effect of crosslinguistic influence was not pervasive in this study. When comprehending head-final Mandarin RCs, Mandarin HL children did not make more errors or showed slower RTs as compared to monolinguals. Thus, their knowledge of English was not interfering with their comprehension abilities of grammatical Mandarin RCs. Instead, it appeared that knowledge of English strengthened their processing of the ungrammatical Mandarin RCs formed with English word order. These findings are very similar to what was observed by Serratrice, Sorace, Filiaci, and Baldo (2009). They found that, due to crosslinguistic influence from English to Italian, English-Italian bilingual children tended to accept ungrammatical bare NPs used in a generic context in Italian. However, they also knew the grammatical use of plural generic NPs with a definite article in Italian. With respect to production, although some Mandarin HL children produced head-initial Mandarin RCs in both study 1 and study 2, they did not employ the head-initial syntactic structure in all Mandarin RCs. In addition, Mandarin HL children did not produce more head-initial than head-final Mandarin RCs or lose their Mandarin RC knowledge as their English exposure increased in round 2. These findings point to the conclusion that crosslinguistic influence does not result in incomplete acquisition and L1 attrition in HL children.

The current study also found that the HL children's age and the amount of L1 spoken at home were two factors influencing children's HL performance. Specifically, older children had better comprehension and production skills, and children who spoke more of the HL at home were better able to produce RCs. As the variable age is associated with the amount of L1

experience, it is expected that the older HL children, who had more L1 experience, would perform better in both comprehension and production of RCs. With respect to the use of Mandarin at home, the finding is consistent with what is reported by G. Jia (2008), who found that more HL use with family members predicted better spoken-proficiency in Mandarin HL children. Taken together, these findings point to how HL exposure is important for developing and maintaining L1 in HL speakers.

In addition to continuous L1 exposure, an alternative explanation for acquiring RCs successfully over time could be that there is the structural overlap between Mandarin RCs and other types of modifying constructions in Mandarin. Perhaps the frequency of exposure to other simple modifying structures increases over time, which in turn helps Mandarin HL children to acquire the complex RC structure. This *construction conspiracy* account has been already discussed with respect to acquiring complex grammatical constructions in English-speaking children (Croft, 2001; Goldberg, 1995; Langacker, 2000). It has been argued that the acquisition of the target complex construction could be facilitated by the prior knowledge of simple constructions. In Mandarin, the modifying elements always precede the modified noun/noun phrase, and the morpheme *de* always marks the boundary between them. For example, if a noun *xue2sheng1* 'student' is modified by an adjective *cong1ming2* 'smart', the morpheme *de* is usually employed and the adjective is placed before the modified noun, as in the noun phrase *cong1ming2 de xue2sheng1* 'smart student'. Similarly, in Mandarin RCs, the clause before the head noun can be considered as a modifying element, and it is followed by the particle *de*. Thus, Mandarin HL children's knowledge of the position of modifying elements and the grammatical function of morpheme *de* might facilitate the acquisition of the more complex RC structure. Future research could explore the frequency of different modifying structures used by Mandarin HL children over time, and to find out whether there are significant correlations between them.

In conclusion, the present study shows that the reduced L1 input HL children receive in the host country does not necessarily lead to incomplete acquisition or L1 attrition. Moreover, the L2 influence does not result in deficient acquisition of the L1 in HL children. Our results suggest that, perhaps for some complex structures, HL children may show protracted L1 development when compared to monolinguals, but nevertheless, can fully acquire certain constructions.

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CHAPTER 4. The Acquisition of aspect in Mandarin heritage children

4.1   Introduction

Heritage language (HL) speakers are those who are exposed to their mother tongue (L1) from birth and are L1 dominant during the first years. Later on, as they start daycare or schooling in the predominant societal language (L2), they gradually become L2 dominant. Studies on Spanish, Russian and Mandarin HL speakers have shown that aspect morphology is prone to incomplete acquisition, L1 attrition or crosslinguistic influence from the L2 in both adult and child HL speakers (Cuza, Pérez-Tattam, Barajas, Miller & Sadowski, 2013; Montrul, 2002, 2008, 2009; Polinsky, 2011; Shi, 2011). According to Montrul (2008), incomplete acquisition of the L1 means that HL speakers were unable to fully acquire the L1 grammar given that they were exposed to reduced L1 input in the host country. L1 attrition means that the grammatical system of the HL speakers' L1 had a chance to develop fully but later on, some grammatical knowledge began to deteriorate as a result of an increase use of L2 over time. Crosslinguistic influence in HL speakers usually means the L2 affects the acquisition of the L1 grammar, as their L1 is a weaker language.

In studies of Spanish adult and child HL speakers' aspect morphology, Cuza *et al.* (2013) and Montrul (2008) have argued that incomplete acquisition or L1 attrition could be consequences of both crosslinguistic influence from HL speakers' L2 and reduction in the L1

input. In contrast, Shi's (2011) and Silva-Corvalán's (1994) study demonstrated that the incomplete acquisition of aspect morphology in Spanish and Chinese adult HL speakers' was not due to crosslinguistic influence from their L2 but rather was a result of reduced input and use of the L1 in the host country. These findings raise questions about whether the non-target-like use of L1 aspect morphology is stemming from L2 influence per se, or is attributable to reduced L1 exposure only, or is because of both sources. The current study aims to contribute to our understanding of the effect of crosslinguistic influence and reduced L1 exposure on the acquisition of aspect morphology in HL children. Specifically, the study is focused on the development of aspect morphology in Mandarin HL children living in western Canada where English is the predominant societal language.

Mandarin employs four unbounded grammatical morphemes to mark the perfective-imperfective distinction: the perfective aspect maker *le* and *guo,* and the imperfective aspect marker *zai* and *zhe.* According to studies on the acquisition of aspect grammar in Mandarin monolingual children, the developmental trajectory of these four aspect markers is strongly influenced by input frequency (Chen & Shirai, 2010; Li & Bowerman, 1998). Thus, we could investigate whether Mandarin HL children would acquire these aspect markers given that they are exposed to reduced L1 input. Moreover, in comparison to the verb type used in the English construction, BE auxiliary + Verb-*ing,* Mandarin has greater restrictions on the verb type paired with the imperfective aspect marker *zai* to indicate an ongoing action (Chen & Shirai, 2010; Li & Bowerman, 1998). Therefore, we could find out whether there is English interference in the use of the imperfective aspect marker *zai* by Mandarin HL children. To date, only two studies have been focused on the acquisition of aspect grammar in Mandarin HL speakers (L. Jia & Bayley, 2008; Shi, 2011). L. Jia & Bayley's (2008) study only investigated the use of the perfective aspect marker *le* by Mandarin HL children. Shi's study was focused on the acquisition of *le, zai*

and *zhe* but in Mandarin adult HL speakers. Neither study investigated the effect of L2 influence

on L1. Therefore, further studies are needed on development of aspect markers in Mandarin HL

children.

This study is focused on the perfective aspect marker *le* and imperfective aspect marker

zai and *zhe.* The study includes a production and a grammaticality judgment task and aims to

show whether Mandarin HL children exhibit non-target-like use of these aspect markers, whether

their L2 English affects the use of the imperfective aspect marker *zai,* and what input-related

factors account for individual differences in Mandarin HL children. The study will contribute to

our understanding of the development of both perfective and imperfective aspect markers in HL

children as well as sources of non-target-like aspect morphology used by HL speakers.

4.2   Aspect in Mandarin

Aspect can be encoded through lexical classes of verbs or through grammatical morphemes

marked on verbs. Regarding lexical aspect (also called *Aktionsart,* Smith, 1997), Vendler (1967)

and Smith (1997) classified four broad aktionsart types, which are accomplishments,

achievements, activities, and statives. Three temporal features are used to identify similarities or

differences among these verb classes: telicity (whether the verb encodes potential endpoints),

durativity (whether the verb indicates the duration of the event), and dynamicity (whether the

verb is dynamic or non-dynamic). For accomplishments and achievements, they are telic and

dynamic verbs because they both encode an event that is dynamic and has a potential endpoint.

The only difference between them is that accomplishments are durative as they describe a process

leading to a result, whereas achievements indicate that the process leads up to a terminal point

that is instantaneous. In English, for example, the verb *arrive* is an achievement verb (e.g. *John*

arrives home on time), and the verb *build* is an accomplishment verb (e.g. *Alex builds a house)[1]*.

For activities and statives, they are both atelic and durative verbs because they refer to situations that do not have an explicit endpoint and always endure a length of time. Activities encode dynamic situations that require effort either from inside or outside to continue, while statives encode non-dynamic continuous situations that do not need extra input of energy. In English, for example, the verb *know* is a stative verb (e.g. *John knows that news)*, and the verb *swim* is an activity verb (e.g. *he swims*).

Studies on Mandarin aspect have shown that Mandarin verbs can also be classified into four broad aktionsart types (Li, 1990; Li & Bowerman, 1998). For example, the verb *pao3* 'run' and *you2yong3* 'swim' are activities, the verb *luo4* 'drop' and *si3* 'die' are achievements, the verb *gai4* 'build' and *gua4* 'hang' are accomplishments, and the verb *zhi1dao4* 'know' and *zuo4* 'sit' are stative verbs. In addition to these four broad verb aktionsart types, Li and Bowerman (1998) also identified a special type: resultative verb compounds (RVCs) which takes a Verb + Verb or Verb +Adjective structure in Mandarin, such as the verb *xue2dong3* 'know-understand' and the verb *xi4 gan1jin4* 'wash-clean'. Because RVCs emphasize an instantaneous result rather than a durative situation, they are classified as a subcategory of the achievement verb class (Li, 1990; Li & Bowerman, 1998).

In addition to lexical aspect, languages also employ grammatical aspect (i.e. viewpoint aspect) through grammatical markings (i.e. perfective or imperfective markings) on verbs to indicate whether the situation has temporal limits. In English, for example, the progressive viewpoint is expressed through the construction: BE auxiliary + Verb-*ing,* as in the sentence with the present tense *he is watching TV*. The perfect viewpoint is expressed through the construction:

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[1] The English and Mandarin examples cited in this section are extracted from Li and Bowerman's (1998) study.

HAVE + Verb–*ed* or Verb–*en*, as in the sentence with the present tense *he has arrived here/ he*

has eaten an apple (Li & Bowerman, 1998). In Mandarin, the grammatical aspect is expressed

through four markers: *zai, zhe, le,* and *guo. Zai* and *zhe* are two imperfective aspect markers. *Zai*

is also called the progressive aspect marker as it typically encodes an action that is ongoing. *Zhe*

is also called durative aspect marker as it encodes an action that is enduring or continuing (Li,

1990; Li & Bowerman, 1998; Li & Thompson, 1981). *Zai* precedes the verb whereas *zhe* appears

after the verb (see example (1) - (4)).

(1)   ta1   **zai**   wan2   you2xi4
        he   **progressive marker** play   game
        'He is playing a game'

(2)   *ta1   wan2   **zai**   you2xi4
        he   play   **progressive marker** game
        'He is playing a game'

(3)   ta1   zhan4   **zhe**   kan4   shu1
        he   stand   **durative marker**   read   book
        'He is standing while reading a book'

(4)   *ta1   **zhe**   zhan4   kan4   shu1
        he   **durative marker**   stand   read   book
        'He is standing while reading a book'

Le and *guo* both encode the perfective viewpoint. *Le* is usually called perfective aspect marker

and *guo* is usually called experiential aspect marker (Li, 1990; Li & Bowerman, 1998; Li &

Thompson, 1981). *Le* encodes a complete action, but the completion of such action has no

relationship to the time of speaking, whereas *guo* only suggests a complete action in the past. In

general, the use of *guo* indicates that the subject has experience of doing something at least once

in the past. *Le* can occur either immediately after the verb or at the sentence final position (see

example (5) and (6)), while *guo* only immediately follows the verb (see example (7) and (8)),

(5)   wo3   chi4-wan2   **le**   fan4
        I   eat-finish   **perfective marker**   dinner
        'I have eaten a dinner'[2]

(6)   wo3   chi4-wan2   fan4   **le**
        I   eat-finish   dinner   **perfective marker**
        'I have eaten a dinner'

(7)   ta1   kan4   **guo**   na4   bu4   dian4ying4
        he   see   **experiential marker**   that   classifier   movie
        'He has watched that movie (at least once in the past)'

(8)   *ta1   **guo**   kan4   na4   bu4   dian4ying4
         he   **experiential marker**   see   that   classifier   movie
        'He has watched that movie'

It should be noted that, in Mandarin, the sentence final *le* sometimes can be used to indicate an

inchoative meaning, which denotes the beginning of an new action (Li, 1990; Li & Thompson,

1981), as example (9) shows:

        (9)   wo3   chi1   fan4   **le**
                I   eat   dinner **inchoative marker**
                'I am going to eat the dinner'

In example (5) and (6), the verb *chi1wan2* 'eat-finish' is a RVC verb which indicates a resultative

situation. Thus, the use of *le* suggests the completion of the action regardless of its position in the

sentence. In comparison to example (5) and (6), the verb *chi1* 'eat' in example (9) is an activity

verb and encodes a dynamic action, so that the use of *le* at the sentence final position denotes the

beginning of an action 'eat'. According to previous studies on Chinese aspect (Li, 1990; Li &

Thompson, 1981), the verb final *le* has been unanimously recognized as a perfective aspect

marker suggesting the completion or termination of a situation, regardless the verb type it

combines with. For the sentence final *le,* it indicates perfective meaning only when the predicate

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[2] Even though the construction Have + V-en indicates the perfect viewpoint, and not exactly the perfective viewpoint, I used the perfect construction here because it is the best translation for these Mandarin sentences.

is an accomplishment or an achievement verb (see example (6)). If the predicate is an activity or

a stative verb, the sentence final *le* suggests an inchoative reading (see example (9)).

In general, the Mandarin perfective aspect marker *le* can be used with different aktionsart

types, whereas the imperfective aspect marker *zai* is incompatible with postural statives and

achievements (see example (10) and (11)):

(10) *ta1   **zai**   **zhan4**   (postural stative)
        he   progressive marker   stand
        'he is standing'

(11) *ta1   **zai**   **shuai1po4** yi1   ge4   bei1zi (RVC achievement)
        he progressive marker break   one   classifier bottle
        'He is breaking a bottle'

In Mandarin, the imperfective viewpoint with postural statives is usually expressed through the

durative aspect marker *zhe.* Therefore, it is grammatical to say *zhan4 zhe* 'is standing'. For the

example (11), it is ungrammatical to pair the imperfective aspect markers *zai* with Mandarin

achievements. This is different from English, as English allows *–ing* paired with achievements,

such as 'he is dying' or 'he is breaking a bottle'. In short, the imperfective aspect marker *zai* can

only be paired with activities and accomplishments in Mandarin (see example (12) and (13).

(12) ta   **zai**   **pao3**   (activity)
        he   progressive marker   run
        'he is running (dynamic action)'

(13) ta   **zai**   **hua4** hua4   (accomplishment)
        he   progressive marker   draw   picture
        'he is drawing a picture '

Regarding the imperfective aspect marker *zhe*, like *zai,* it cannot be combined with

achievements, as example (14) illustrates:

(14)   *ta1   **shuai1po4 zhe**   yi1   ge4   bei1zi   (RVC achievement)

        he   break   durative marker   one   classifier bottle

        'He is breaking a bottle'

Zhe can only be used with activities, statives and accomplishments in Mandarin (see example

(15)-(17))

(15)   ta   **pao3**   **zhe**   (activity)
        he   run   durative marker
        'he is running (enduring action)'

(16)   ta   **zuo4 zhe**   kan4   shu1   (postural stative)
        he   sit   durative marker   read   book
        'he is sitting (there) and reading a book'

(17)   ta   **hua4**   **zhe**   hua4   (accomplishment)
        he   draw   durative marker picture
        'he is drawing a picture (enduring action)'

        It should also be pointed out that the use of aspect markers in Mandarin is not obligatory.

Sometimes, aspect can be encoded through aspectual adverbials. For example, the aspectual

adverb *yi1zhi2* 'all the time non-stopping' can be used to encode an event that is enduring or

continuous, as example (18) shows:

(18)   ta1   **yi1zhi2**   pao3.
        he   **all the time non-stopping**   run
        'He is running (enduring action).'

Here the predicate *pao3* 'run' is not marked with the durative marker *zhe,* but the aspectual

adverbial *yi1zhi2* indicates that the action is continuing for a long time. Thus, the example (15)

and the example (18) have the same meaning. The aspectual adverb *yi3jing1* 'already' is usually

used to encode a perfective viewpoint, as example (19) shows:

(19)   ta1   **yi3jing1**   gan4wan2   gong1zuo4.
        he   **already**   do-finish   work
        'He has already done his work.'

Here the predicate *gan4wan2* is not marked with the perfective aspect marker *le*, but the aspectual adverbial *yi3jing1* indicates that the action was already completed.

Instead of using the durative aspect marker *zhe* or the aspectual adverbial *yi1zhi2* 'all the time non-stopping', the enduring or continuing action can also be encoded by using static prepositional phrases with postural statives, as example (20) illustrates:

(20)   ta1   zuo4   **zai4**   **yi3zi   shang4**
       he   sit   **locative marker**   chair   above
       'He is sitting on a chair for a long time'

In example (20), the predicate *zuo4* 'sit' is a postural stative verb, so that the use of the static prepositional phrase *zai4 yi3zi shang4* indicates that there is no change of state of 'sitting'.

In sum, the progressive aspect marker *zai* and the durative aspect marker *zhe* can be paired with certain verb types. This is different from English, as English allows the progressive marker *–ing* paired with different aktionsart types in the progressive construction BE auxiliary + V-*ing*. Table 4. 1 summarizes the four Mandarin aspect markers and their uses. The present study is only focused on the aspect markers *le, zai* and *zhe*.

Table 4. 1 Four Mandarin aspect markers and their uses

Imperfective aspect	*zai*	progressive marker	used with accomplishments and activities
	zhe	durative marker	used with accomplishments, activities and statives
Perfective aspect	*le*	perfective marker	used with different aktionsart types
	guo	experiential marker	used with different aktionsart types

4.3 Acquisition of aspect by Mandarin L1 and L2 speakers

The acquisition of aspect morphology in monolingual children has been investigated in many languages, such as Chinese, English, French, Japanese, and Spanish (Brown, 1973; Li, 1990; Li

& Bowerman, 1998; Li & Shirai, 2000). It has been found that children acquire aspect morphemes in a given language systematically as proposed by the Aspect Hypothesis (Anderson & Shirai, 1994; Li & Shirai, 2000; Shirai, Slobin & Weist, 1998). According to the Aspect Hypothesis, if the language encodes the perfective and imperfective distinction, the perfective aspect form is typically developed earlier than the imperfective aspect form. Moreover, the Aspect hypothesis predicts that children would first acquire the pairing of the perfective aspect form with telic verbs (i.e. achievements and accomplishments), and the pairing of the imperfective aspect form with atelic verbs (i.e. activities or statives). As language input increases over time, children then acquire non-natural grammatical and lexical aspect pairings.

Studies on the acquisition of Mandarin aspect grammar are in general consistent with what the Aspect Hypothesis predicts. For example, Li and Bowerman (1998) examined the acquisition of three grammatical aspect markers *le, zai,* and *zhe* in 135 Mandarin monolingual children aged from 3 to 6 years old. The results demonstrated a strong interactional effect between grammatical aspects and lexical aspects in both comprehension and production. For example, it was found that children of all ages tended to use the progressive aspect marker *zai* with atelic verbs (i.e. activities and statives), and the perfective aspect *le* predominantly with telic verbs (accomplishments and achievements). Moreover, the study reported a developmental trajectory of *le, zai* and *zhe.* It was found that 3-year-old children were able to use *le* with different aktionsart types, but 3-year-old children used *zai* exclusively with activities. It was not until 5 years of age that children began to use *zai* with accomplishments, but they still produced a low proportion of *zai* with accomplishments (5%).

Instead of using experimental techniques, Chen and Shirai (2010) examined the early emergence and development of the aspect marker *le, zai* and *zhe* in four Mandarin monolingual children's longitudinal corpora at the age of 1, 2 and 3 years old. The results showed that of all

the predicates marked with *le, zai* and *zhe, le* was used predominantly by these four children across all three stages (over 80% of usage), whereas *zai* and *zhe* were used much less frequently (below 10% of usage). Consistent with Li and Bowerman's study, Chen and Shirai also found a strong interactional effect between lexical aspects and grammatical aspects in production. It was found that children used the perfective aspect marker *le* predominantly with achievements across all three stages, whereas, the imperfective aspect markers *zai* and *zhe* were used largely with activities and statives, respectively, by these four children across all three stages. The study also revealed the developmental trajectory of *le, zai* and *zhe*. Before the age of 3, children were able to use the perfective aspect marker *le* with its non-natural aktionsart types productively, whereas, it was until the age of 3 that they began to produce the imperfective aspect markers *zai* and *zhe* with non-natural aktionsart types. Another significant contribution of Chen & Shirai's study was that they found the distribution patterns of *le, zai, and zhe* in adult speech were mirrored in the children's speech, suggesting an important role of input frequency in the acquisition of aspect markers in Mandarin monolingual children.

In addition to studies on the early acquisition of aspect in young Mandarin monolingual children, Jin and Hendriks (2005) used picture-sequenced stories to elicit aspect uses in Mandarin monolingual children aged from 5 to 10 years old (i.e. L1 group). The study also included thirty English speakers, who were learning Mandarin as an L2. Ten adult native speakers of Mandarin served as the control group. Jin and Hendriks found that more than 60% of the predicates were not marked with aspect markers in the L1, L2 learner group and the control group. The L1 and L2 learner group produced unmarked predicates with an average 80% compared to slightly over 60% for the control group. The study also revealed a strong interactional effect between lexical and grammatical aspect. It was found that the L1 and L2 group used *le* exclusively with achievements, and *zai* and *zhe* exclusively with activities and states respectively. The results also

showed a developmental pattern for *le* in Mandarin monolingual children, which was consistent with the findings reported in Li and Bowerman's study (1998). For the L2 learners, it was found that the use of *le*, *zai* and *zhe* depended on the level of Mandarin proficiency. In spite of the fact that all L2 groups used *le* with achievements predominantly, the L2 learners who had a higher level of Mandarin proficiency tended to use *le* with its non-natural aktionsart types while the learners who had a lower level of Mandarin proficiency could not use *le* with its non-natural aktionsart types. For the imperfective aspect markers *zai* and *zhe,* the study revealed that although all L1 and L2 learner groups were able to apply them to activities and statives, they occurred sparsely in learners' story telling. Jin and Hendriks also found that the L2 learners wrongly used the progressive aspect marker *zai* with RVCs, suggesting that there might be crosslinguistic transfer from their English. They argued that perhaps the L2 learners wrongly assumed that the English progressive marker *–ing* has the same grammatical function as the progressive aspect marker *zai* in Mandarin.

In sum, prior research on the acquisition of aspect grammar in Mandarin monolingual children has shown that the perfective aspect marker *le* is usually acquired at an early age (i.e. around age of 3), and it is first used with its natural aktionsart classes (i.e. achievement and accomplishment verbs) and then with its non-natural aktionsart classes (i.e. activities and states verbs). The imperfective aspect marker *zai* and *zhe* appear less frequently than *le* during the early developmental stages, and they tend to be acquired at a later age (i.e. after the age of 5). Moreover, Jin and Hendrik's study revealed that the use of aspect markers depends on the speakers' Mandarin proficiency. The speakers who have a low level of Mandarin proficiency are less likely to use aspect markers. Furthermore, Jin and Hendriks's study found crosslinguistic influence from L2 learners' English to Mandarin in the acquisition of the imperfective aspect marker *zai.*

4.4   Acquisition of aspect in HL speakers

Studies on Spanish, Russian and Mandarin HL child and adult speakers have indicated that aspect morphology is a vulnerable area for incomplete acquisition, L1 attrition and crosslinguistic influence (Cuza *et al.,* 2013; Montrul, 2002; Polinsky, 2006; Shi, 2011). For instance, Montrul (2002) found that adult HL speakers who started English exposure between 0 and 7 were significantly different from the monolingual control group regarding using statives in the Preterite and interpreting achievements used in the Imperfect. Polinsky (2006) found Russian HL speakers tended to retain achievement and accomplishment verbs in the perfective form but not in the imperfective form[3], and process and stative verbs in the imperfective form but not in the perfective form. Both studies suggested that there might be incomplete development or attrition for the non-natural pairings of lexical and grammatical aspects as a result of reduced input and use of the HL.

To distinguish the effects of incomplete acquisition and attrition, Cuza *et al.* (2013) conducted a cross-sectional study on both Spanish child and adult HL speakers regarding their production of tense-aspect morphology in Spanish. It was found that the Imperfect tense markings remain underdeveloped across all child and adult HL groups, suggesting incomplete acquisition of aspect grammar in Spanish HL speakers. Moreover, the results showed that, in comparison to the young HL children, the older HL children overproduced the Preterite as opposed to the Imperfect in some contexts where the use of the Imperfect was appropriate in Spanish. This finding indicated the attrition of Imperfective aspect during early childhood.

In addition to the effects of incomplete acquisition and L1 attrition found in Spanish and Russian HL speakers, Cuza *et al.* (2013) and Montrul (2002) also found that L2 transfer plays a

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[3] In Russian, the aspects are lexicalized: the verbs can have perfective or imperfective verb form.

role in the acquisition of aspect grammar in Spanish HL speakers. Montrul (2002) found that HL speakers and L2 Spanish adult learners were similar in terms of using and interpreting non-natural lexical and grammatical aspect pairings in Spanish (i.e. stative verbs in the Preterite and achievement verbs in the Imperfect). Cuza *et al.* (2013) found that the older HL children overproduced the Preterite tense forms as opposed to the Imperfect tense form in some contexts, which was due to semantic transfer from English as the simple past tense in English can indicate both perfect and imperfective eventualities. Both Montrul (2002) and Cuza *et al.* (2013) argued that crosslinguistic influence from the English leads to incomplete or attrited Spanish aspect grammar.

The crosslinguistic influence found in adult HL speakers is relevant to the study of HL acquisition in children. Studies on early bilingualism have already indicated that bilingual children who have unbalanced language proficiency between their two languages tend to exhibit non-target-like performance with respect to some linguistic structures in the non-dominant language, and it could be attributed to the influence from the dominant language (Döpke 1998; Foroodi-Nejad & Paradis, 2009; Gathercole, 2007; Nicoladis, 2002; Serratrice, Sorace, Filiaci & Baldo, 2009; Yip & Matthews, 2007). Some bilingual children in these studies can be categorized as HL children (Döpke 1998; Foroodi-Nejad & Paradis, 2009; Serratrice, Sorace, Filiaci & Baldo, 2009). For example, in the study of the acquisition of articles in English-Italian bilingual children, Serratrice and her colleagues (2009) found that due to the influence from English to Italian, English-Italian bilingual children tended to accept ungrammatical bare NPs used in a generic context in Italian. It was argued that due to crosslinguistic influence, sometimes bilinguals would allow structures in comprehension or production that monolinguals either reject or use rarely. The study also revealed that these bilingual children did not reject the grammatical use of plural NPs with a definite article in Italian, suggesting that the effect of crosslinguistic

influence was not pervasive. Following these observations, the present study aims to find out whether Mandarin HL children's L2 English affects the acquisition of the imperfective aspect marker *zai* paired with certain aktionsart types.

In contrast with studies that showed crosslinguistic influence accounting for incomplete development or attrition of aspect grammar in the HL, some studies argued that the non-target-like use of aspect morphology by HL speakers was only due to reduced exposure and use of the HL in the host country. For example, in the study of the speech production of adult Spanish HL speakers, Silva-Corvalán (1994) found adult HL speakers tended to neutralize the morphological perfective-imperfective distinction in Spanish, that is, they used stative verbs with the Imperfect form in both perfective and imperfective contexts. It was explained that this simplification of tense-aspect morphology was attributed to reduced input and use of Spanish. In the study of Mandarin aspect markers *le, zai,* and *zhe* used by six Mandarin adult HL speakers living in Nijmegen, Netherlands. Shi (2011) found that the Mandarin HL adult speakers who had early L2 exposure (i.e. before 4 years old) used imperfective aspect markers rarely in production. She also found these early bilingual HL speakers wrongly used the progressive aspect marker *zai* with achievement RVCs. It was argued that given that the imperfective aspect markers (i.e. *zai* and *zhe*) tend to be acquired at a later age in Mandarin monolingual children (i.e. after the age of 5), early bilingual HL speakers, who started L2 learning early on and had reduced L1 input, might not fully acquire imperfective aspect markers during the early childhood. However, the study did not directly look at the development of imperfective aspect markers in Mandarin HL children. The conclusion would be more persuasive if there is evidence of incomplete acquisition found in Mandarin HL children.

Thus far, only L. Jia and Bayley's (2008) study has examined the acquisition of aspect grammar in Mandarin HL children, but this study only examined the use of the perfective aspect

marker *le.* The results demonstrated that lexical aspects (i.e. aktionsart types) did not significantly affect the use of *le* by Mandarin HL children, but age of arrival and amount of Mandarin exposure at home significantly accounted for the use of *le* by Mandarin HL children in narratives. It was found that, in comparison to the children who were born in the U.S. and the children who arrived in the U.S. before the age of six, the children who arrived in the U.S. after the age of six used *le* more appropriately in obligatory contexts. Moreover, the children who reported using Mandarin primarily at home were more likely to use *le* in both obligatory and optional contexts than children who reported using a combination of English and Mandarin or English predominantly. These findings were consistent with prior studies on the effects of age of arrival and L1 exposure in HL speakers (G. Jia, 2008; Kondo-Brown, 2005), which reported that the early age of arrival and less L1 exposure at home tend to be associated with a low level of HL proficiency. Both age of arrival and the exposure to Mandarin at home were examined in the present study.

To summarize, research on Spanish, Russian and Chinese adult HL speakers has found some gaps in the area of aspect morphology, which could be attributed to L2 influence and restricted input and use of the L1. Moreover, it was found that two input-related factors, age of arrival and L1 exposure at home, accounted for individual differences in HL speakers.

4.5 Research questions

The present study aimed to find out whether Mandarin HL children were able to produce *le, zai* and *zhe* paired with different aktionsart types, whether their L2 English affected the acquisition of the imperfective aspect marker *zai,* and what input-related factors accounted for individual differences. The specific research questions were as follows:

(1) Are Mandarin HL children able to use le, zai, and zhe in both natural and non-natural

pairings*?*

Prior studies on the production of aspect markers in Mandarin monolingual children (Chen & Shirai, 2010; Li & Bowerman, 1998; Jin & Hendriks, 2005) have shown that the perfective aspect marker *le* was acquired and became stable before the age of 5, whereas the imperfective aspect marker *zai* and *zhe* tend to be acquired and became stable after the age of 5. Given that the Mandarin HL children in this study started (pre)school in the L2 at an early age, resulting in reduced L1 input at an early age, they probably rarely use the imperfective aspect marker *zai* and *zhe* in production, or they probably only use *le, zai* and *zhe* with their natural aktionsart types. Moreover, given that Jin and Hendriks (2005) found crosslinguistic influence from learners' L1 English to their L2 Mandarin in the production of the imperfective aspect marker *zai*, it is expected that Mandarin HL children's L2 English would interfere with the production of *zai.*

 (2) Are Mandarin HL children able to detect the ungrammatical pairing of zai with achievements and statives?

As illustrated in section 4.2, there are situations where Mandarin does not allow the imperfective aspect marker *zai* paired with achievements and postural statives, whereas English allows achievements and postural statives to be used in the progressive construction: BE auxiliary + V-*ing*. According to Serratrice *et al.*'s (2009) findings on the effect of crosslinguistic influence in the interpretation of bare NPs by English-Italian bilingual children, it is expected that Mandarin HL children would accept the ungrammatical pairing of the imperfective aspect marker *zai* with achievements and postural statives.

(3) *Do the factors age of arrival and home language exposure predict individual differences?*

Previous studies on the acquisition of the L1 in HL speakers have shown that the HL speakers who arrived in the host country at an early age and who were exposed to less L1 at home tended to be divergent from native speakers (G. Jia, 2008; Kondo-Brown, 2005; L. Jia & Bayley, 2008;

Shi, 2011). Thus, it is expected that age of arrival and the home language exposure would account for individual differences in the production and grammaticality judgment task. Perhaps Mandarin HL children who arrived in Canada at a later age and who were exposed to more Mandarin would use more aspect markers production and make fewer errors in the grammaticality judgment task.

4.6   Method

Participants. Thirty-two Mandarin HL children participated in this study (age: Mean = 8;9, SD = 1;2, Range = 6;9 – 10;10). Twenty-six Mandarin HL children were recruited from Mandarin-English bilingual schools (age of arrival: Mean =1;7, SD=2;5, Range = 0-7;5), and six Mandarin HL children were recruited from English-only schools (age of arrival: Mean = 3;3, SD = 2;3, Range =0-5;4). Fourteen children were born in Canada and eighteen children were born in China. These children were exposed to Mandarin from birth and their parents were all Mandarin native speakers. The study also includes ten adult Mandarin native speakers as a monolingual baseline.

Materials. For the production task, children were asked to describe twelve situations enacted with toys. The overall design of this task had three situations for each verb class (i.e. activities, stative, accomplishments, achievements). For each enactment, children were asked to look carefully at the situations in which the toy would make some action movements. For example, an activity action was about a boy 'running', a postural stative action was about a monkey 'standing' all the time, an accomplishment action was about a doll 'climbing' to the top of some stairs, and an achievement action was about a horse 'knocking down' a boy. Children then were asked to describe what they saw in that situation. The experimenter gave an introduction to the child after each action movement by saying *ni neng2 gao4su wo3 hou2zi*

zen2me la? 'Can you tell me how is the monkey?' The instruction sentence contains no aspect marker, so that it would not influence children's responses. Before the testing session, children were given three training trials to make sure they understand the procedure. The testing session was videotaped for later transcription and analysis.

(2) The grammaticality judgment task aimed to investigate potential crosslinguistic influence from the L2 English in the acquisition of the imperfective aspect marker *zai* (i.e. the progressive aspect marker). Participants were asked to determine whether a given sentence was correct or incorrect. There were sixteen sentences: eight grammatical sentences and eight ungrammatical sentences. The grammatical sentences included four predicates that have RVCs marked with the perfective aspect marker *le* and four predicates that have stative verbs marked with the durative aspect marker *zhe.* The ungrammatical sentences included four RVCs and four stative verbs marked with *zai.* The order of the testing stimuli was varied randomly among participants. Before the testing session, children were given four training trials (i.e. two grammatical sentences and two ungrammatical sentences) to make sure they understood the procedure. The testing session was videotaped for later transcription and analysis.

(3) A short parental questionnaire was attached to the consent form to collect children's language background information. The questionnaire included topics such as, age of arrival in Canada, child's age at testing, and language use among family members in the home. For language use in the home, parents were asked a series of questions with scaled responses about the use of languages from each household member to the child (FAMLANG), and the use of language from the child to each household member (CHILDLANG), for example 0 = only speak Mandarin at home; 1= English seldom, Mandarin usually; 2 = English 50%, Mandarin 50%; 3 = English usually, Mandarin seldom; 4 = only speak English at home. Effectively, the proportion of language use indicates the proportion of English in the home, since Mandarin was set at 0. The

information collected from this questionnaire is summarized in Table 4. 2, and was included as

predictors in the statistical analyses.

Table 4. 2 Mandarin HL children's characteristics

	AOA	AGE	FAM_LANG	CHI_LANG
Mean	22.9	105.5	0.2	0.3
SD	29.6	14.2	0.2	0.2

Note. AOA = Age of arrival. AOA and AGE at testing were calculated in months; FAMLANG = proportion of English spoken among adults at home; CHILANG = proportion of English spoken by child at home

Coding and Analysis. For the production task, all children's responses were transcribed,

and then verbs were classified into different aktionsart types. Although the production task was

designed to elicit verbs belonging to a particular aktionsart type, it was impossible to ensure that

the children would use the target verbs, because they were free to focus on any part of the

situation. Thus, only the verbs marked by the aspect markers *le, zai* or *zhe* were coded, and then

these verbs were classified into activities, accomplishments, achievements, and statives. For the

grammaticality judgment task, participants' responses were allocated to one of four categories:

(1) *Hit:* correct acceptance of a grammatical sentence; (2) *Miss:* incorrect rejection of a

grammatical sentence; (3) *False Alarm:* incorrect acceptance of an ungrammatical sentence; (4)

Correct Rejection: correct rejection of an ungrammatical sentence.

Regarding the grammaticality judgment performance, the percentage accuracy for each

participant was first calculated, and then the mean percentage accuracy was calculated for the

monolingual and the HL group respectively. For the production performance, the frequency

distribution of each aspect marker paired with activities, statives, accomplishments and

achievements for each participant was first calculated, and then the mean frequency distribution

across all Mandarin HL children was calculated. In order to examine whether the aktionsart type, age of arrival and home language exposure account for Mandarin HL children's performance, mixed-effects regression modeling was used (Baayen, 2008). The test items, the verbs used in the task, and participants were all considered as random variables in the modeling analysis, as they all have unknown variance. For the production analysis, if children used aspect markers with a given verb, then their responses were coded as TRUE. If children did not use aspect markers when they should have used aspect markers, then their responses were coded as FALSE. The fixed variables were the aktionsart type (four levels: activities, accomplishments, achievements, and statives), the grammatical aspect (three levels: perfective *le,* progressive *zai,* and stative *zhe*)*,* age of arrival (AOA), and exposure and use Mandarin at home (FAM_LANG and CHI_LANG). With respect to grammaticality judgment analysis, the dependent variable was participants' responses, which were coded as TRUE or FALSE. The fixed variables were the aktionsart type (i.e. achievements or statives), the sentence type (i.e. grammatical or ungrammatical), age of arrival (AOA), and exposure and use of Mandarin at home (FAM_LANG and CHI_LANG).

4.7   Results

4.7.1 Production

The aim of the production task was to examine how Mandarin HL children use aspect markers in natural and non-natural pairings. The results showed that of all 603 sentences produced by thirty-two Mandarin HL children, only 38% of predicates were marked by aspect markers (i.e. 229/603*100=38%). Of all predicates that were marked by aspect markers, 28% of the predicates were classified as activities (65/229*100=28%), 7% of the predicates were classified as statives (16/229*100=7%), 23% of predicates were classified as accomplishments (51/229*100=23%), and 42% of predicates were classified as achievements (97/229*100=42%).

Of all predicates that were marked with aspect markers, 59% were marked with the perfective

aspect marker *le* (137/229*100=59%)*,* 37% were marked with the imperfective aspect marker *zai*

(85/229*100=37%), and 4% were marked with the imperfective aspect marker *zhe*

(7/229*100=4%). Table 4. 3 presents frequency distributions of *le, zai,* and *zhe* paired with

activities, accomplishments, achievements, and statives across all Mandarin HL children.

Table 4. 3 Frequency distributions of aspect markers with four aktionsart types across Mandarin
HL children (SD in brackets)

	% le	*% zai*	*% zhe*
Activity	29 (38)	63 (41)	7 (21)
Accomplishment	69 (43)	31 (43)	0
Achievement	92 (17)	8 (16)	0
Stative	0	56 (34)	44 (32)

As we can see in Table 4. 3, Mandarin HL children were able to use the perfective aspect

marker *le* with activities, accomplishments, and achievements, but they used *le* predominantly

with its natural aktionsart types: accomplishments (69%) and achievements (92%). More

variations were found in *le* paired with accomplishments than *le* paired with achievements. With

respect to the imperfective aspect marker *zai*, Mandarin HL children were able to use it correctly

with activities and accomplishments, but they tended to pair *zai* with activities (63%) rather than

with accomplishments (31%). The analysis also found that Mandarin HL children used *zai* with

achievements and statives in some sentences. Recall that they are ungrammatical pairings in

Mandarin (see section 4.2). A closer look at these errors revealed that Mandarin HL children used

zai exclusively with RVCs and postural statives, as example (21)-(24) shows:

(21)   *na4   ge4   ren2   **zai**   **qi2shang4**   ma3
           that   classifier   person   progressive marker   climb-above   horse
           'that person is climbing on a horse'

(22)   *ta   **zai**   **diao4dao4**   shui3   li3
        he   progressive marker   fall under   pool   inside
        'he is falling into the pool'

(23)   *ta1   **zai**   **zuo4**   zai4   qi3zi   shang4
        he   progressive marker   sit   on   chair   above
        'he is sitting on the chair.'

(24)   *ta   **zai**   **zhan4** na4li
        he   progressive   stand   there
             'he is standing there.'

In example (21) and (22), the verb compounds *qi2 shang4* 'climb-above' and *diao4 dao4* 'fall-under' were RVC verbs, they both emphasize the result from a process. Therefore, they cannot be used with the aspect marker *zai* that usually indicates the action is ongoing. In example (23) and (24), the verb *zuo4* 'sit' and *zhan* 'stand' were postural stative verbs, they cannot be combined with the progressive aspect marker *zai* to indicate an enduring or continuing action. In Mandarin, another imperfective aspect marker (i.e. the durative aspect marker) *zhe* or the static prepositional phrases should be used to encode an enduring or continuing action.

Regarding another imperfective aspect marker *zhe,* Table 4. 3 shows that Mandarin HL children were able to use it with activities and statives, but they preferred to use it with statives (44%) rather than activities (7%). Recall that *zhe* with statives is a natural pairing. Unlike the errors were found for the use of *zai,* no errors were found for the use of *zhe* by Mandarin HL children.

In short, the frequency distributions of aspect markers used in production demonstrated that Mandarin HL children were able to use *le, zai* and *zhe* in both natural and non-natural pairings, but they tended to use *le, zai* and *zhe* with their natural aktionsart types. Moreover, the results showed that Mandarin HL children wrongly used *zai* with RVC achievements and postural statives in production. To further investigate whether the verb asktionsart type

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significantly accounts for the use of aspect markers in production, three mixed-modeling analyses

was conducted for *le, zai* and *zhe* respectively. The results revealed that the verb aktionsart type

did significantly predict the use of *le, zai,* and *zhe* in production. Table 4. 4 presents three final

modeling results.

Table 4. 4 Modeling results of Mandarin HL children's production

Modeling results of the verb aktionsart type on the use of the aspect marker *le*

Fixed effects	Estimate	*t*	*p*
(Intercept)	0.11	4.1	< .01**
accomplishments	0.42	7.3	< . 01**
achievements	0.58	10.2	< . 01**

Modeling results of the verb aktionsart type on the use of the aspect marker *zai*

Fixed effects	Estimate	*t*	*p*
(Intercept)	0.12	3.8	< .01**
activities	0.42	2.89	< . 01**

Modeling results of the verb aktionsart type on the use of the aspect marker *zhe*

Fixed effects	Estimate	*t*	*p*
(Intercept)	0.01	2.1	< .01**
statives	0.05	2.4	< . 01**

**$p < .01$

The positive coefficients of accomplishments and achievements in the modeling analysis

of *le* suggests that Mandarin HL children were more likely to use *le* with accomplishments and

achievements rather than activities in production. The positive coefficient of activities in the

modeling analysis of *zai* suggests that Mandarin HL children preferred to use *zai* with activities

rather than accomplishments. In the modeling analysis of *zhe,* the positive coefficient of statives

suggests that Mandarin HL children were more likely to use *zhe* with statives rather than

activities. These findings together confirm the results presented in Table 4. 3, which showed that

the combination of aspect markers with their natural aktionsart types is the preferred pattern

among Mandarin HL children.

Additional mixed modeling analysis was conducted to investigate whether the factor such as age of arrival in Canada and the amount of Mandarin exposure at home account for the use of *le, zai* and *zhe.* The analysis revealed that children's age of arrival significantly accounts for the occurrence of *le* in production ($\beta = 0.14$, $t = 2.5$, $p < .01$). The positive coefficient 0.14 suggests that the children who were born in China and arrived in Canada at a later age were more likely to use *le* in production.

4.7.2   Grammaticality Judgment

The grammaticality judgment task was designed to investigate potential English influence on the acquisition of the imperfective aspect marker *zai.* The analysis of adult native speakers' data revealed that they accepted all grammatical sentences that have RVCs and statives paired with the perfective aspect marker *le* and *zhe*, and rejected all ungrammatical sentences that have RVCs and statives paired with the imperfective aspect marker *zai.* Table 4. 5 presents the accuracy of the HL group in the grammaticality judgment task.

Table 4. 5 Accuracy of Mandarin HL children in the grammaticality judegment task (percentage accuracy is in brackets)

	Hit	*Miss*	*False Alarm*	*Correct Rejection*
Grammatical: RVC + *le*	121(94.5%)	7 (5.5%)	-	-
Ungrammatical: *zai* +RVC	-	-	67(52.3%)	61(47.7%)
Grammatical: stative + *zhe*	107(83.6%)	21(16.4%)	-	-
Ungrammatical: *zai*+ stative	-	-	48(37.5%)	80(62.5%)

Table 4. 5 shows that Mandarin HL children had a higher level of accuracy when they were asked to determine grammatical pairings of the perfective aspect marker *le* and *zhe* with RVCs and statives (i.e. 94.5% and 83.6%). With respect to ungrammatical pairings, the analysis revealed that Mandarin HL children were different from adult monolinguals, as they only rejected

47.7 % and 62.5 % of sentences that have the imperfective aspect marker *zai* paired with RVCs

and statives. A closer look at the ungrammatical sentences rejected by Mandarin HL children

showed that 95% of children were able to provide grammatical counterparts by either deleting the

imperfective aspect marker *zai* from the sentence or replacing *zai* with *le* in the sentence, as

example (25) and (26) showing:

The ungrammatical sentence:
(25a) *ma1ma1　　**zai**　　**zuo4hao3**　　yi1 guo1　　mi3fan4　　(zai+RVC)
　　　mother progressive marker do-ready　one classifier　　rice
　　　'Mother has cooked rice'

The grammatical sentence provided by a Mandarin HL child:
(25b) ma1ma1 **zuo4hao3**　**le**　　　　yi1　　guo1　　mi3fan4　　(RVC+le)
　　　mother do-ready　perfective marker one　classifier　　rice
　　　'Mother has cooked rice'

The ungrammatical sentence:
(26a) *xiao3peng2you3　　**zai**　　　**zhan4**　　yi1hui3er　　(zai+stative)
　　　child　　　　progressive marker　stand　　a while
　　　'A child is standing (there) for a while'

The grammatical sentence provided by a Mandarin HL child:　　　　　(stative + le)
(26b) xiao3peng2you3　　**zhan4**　　**le**　　　　yi1hui3er
　　　child　　　　　stand　　perfective marker　a while
　　　'A child stood (there) for a while'

Additional mixed-effects modeling analyses revealed that Mandarin HL children

performed better in the grammatical condition than in the ungrammatical condition ($\beta = 6.11$, $z =$

5.21, $p < .001$), and the verb aktionsart type displays a trend toward significance in the

ungrammatical condition ($\beta = .98$, $z = 1.7$, $p = .08$). The positive coefficient .98 indicates that for

the ungrammatical pairings of RVCs and statives with *zai,* Mandarin HL children were more

likely to accept the sentence that has RVCs paired with *zai.* Regarding individual differences, the

mixed-modeling analysis revealed that children's age of arrival in Canada was significant ($\beta =$

.025, $z = 2.16$, $p = .03$). The positive coefficient .025 indicates that the Mandarin HL children

who were born in China and arrived in Canada at a later age performed better regarding accepting

grammatical pairings of RVCs and statives with *le* and *zhe* as well as rejecting the ungrammatical pairings of RVCs and statives with *zai*.

4.8   Discussion

The objective of this study was to find out how Mandarin HL children use the aspect marker *le, zai* and *zhe* with different aktionsart types, whether their L2 English interferes with the acquisition of the imperfective aspect morpheme *zai,* and what input-related factors account for individual differences.

The results demonstrated that most of the predicates produced by Mandarin HL children were not marked by *le, zai* and *zhe*. This finding is very similar to what Jin and Hendriks (2005) have reported on the production of *le, zai,* and *zhe* by Mandarin monolingual children and the L2 Mandarin learners who had a lower level of proficiency in Mandarin. This finding indicates that Mandarin HL children were conservative in using these markers to express aspect. Nevertheless, the pattern of using aspect markers by Mandarin HL children confirms previous research on young Mandarin monolingual children (Chen & Shirai, 2010) and adult HL speakers (Shi, 2011), which showed that the perfective aspect marker *le* was more preferred than the imperfective aspect marker *zai* and *zhe* in production.

The production data also suggests that Mandarin HL children did not have divergent aspect grammar from monolingual speakers. It was found that they were able to use *le, zai* and *zhe* with both their natural and non-natural aktionsart types, even though they preferred to pair aspect markers with their natural asktionsart types. This pattern of aspect use corroborates Li and Bowerman's (1998) and Chen and Shirai's (2010) study on the acquisition of aspect grammar by young Mandarin monolingual children, which showed a strong interactional effect between lexical aspects and grammatical aspects. However, the finding contrasts with what L. Jia and

Bayley (2008) have reported on the use of *le* in Mandarin HL children, because they found that the use of *le* was not significantly affected by the verb aktionsart type. The difference between the current study and L.Jia and Bayley's study is probably because L.Jia and Bayley used the *frog story* to collect the data, which might limit the number of instances of using *le* with a great variety of verb aktionsart types.

An interesting finding emerged in production was that, although Mandarin HL children were able to use the imperfective aspect marker *zai* correctly with its natural and non-natural aktionsart type, they wrongly paired *zai* with achievements and postural statives. In English, achievements and postural statives can be marked by the progressive *–ing* and used in the construction BE auxiliary + V-*ing,* whereas, in Mandarin, achievements and postural statives cannot be paired with the imperfective aspect marker *zai* to indicate an ongoing or enduring action. The finding was very similar to what Jin and Hendriks (2005) have reported on the use of *zai* with RVCs by L2 Mandarin learners who spoke English as the L1. Perhaps the Mandarin HL children, like those L2 Mandarin learners, wrongly assumed *zai* has the same grammatical function as English progressive marker *–ing.* Given that English has less restriction on the verb aktionsart type used in BE auxiliary + V-*ing* construction, the use of *zai* with achievements and postural statives was probably because Mandarin HL children transferred the less complex aspect knowledge from English. This finding is comparable to the research conducted by Montrul (2002) and Cuza *et al.* (2013), which also found the effect of crosslinguistic influence on the acquisition of aspect grammar in Spanish HL speakers.

The results from the grammaticality judgment task further confirm the evidence of L2 influence. It was found that, in contrast with the adult monolinguals' performance, Mandarin HL children tended to accept the sentence that has *zai* paired with RVCs and postural statives. However, it should be noted that the effect of L2 English influence was not pervasive, as

Mandarin HL children were still able to determine the grammatical pairings of *le* with achievements and *zhe* with statives. These findings are consistent with Serratrice and her colleagues' study (2002) on the acquisition of articles in English-Italian bilingual children, which indicated that bilingual children tended to accept the structures that monolinguals either rejected or never used as a result of crosslinguistic influence, but it does not have an 'across-the-board' effect.

Regarding the input-related factors accounting for individual variation, the study revealed that Mandarin HL children's age of arrival in Canada significantly predicted their performance in the production and grammaticality judgment task. It was found that the Mandarin HL children who were born in China and arrived in Canada at a later age tended to use aspect markers more in production, reject ungrammatical pairings of *zai* with RVCs and postural statives, and accept grammatical pairings of *le* with RVCs and statives. This finding is consistent with what L. Jia and Bayley (2008) found in their study, which showed that the Mandarin HL children who arrived in the U.S. after the age of six used the aspect marker more appropriately in the obligatory contexts. As a later age of arrival implies more experience with L1 and late L2 onset, perhaps this is the reason why these children had better performance than those who were born in the host country and started L2 exposure early on. The significant effect of age of arrival found in the present study is also consistent with previous studies on HL speakers, which found that the later age of arrival usually predicts a higher level of the HL ability (G. Jia, 2008; Kondo-Brown, 2005).

Taken the findings together, we can see that Mandarin HL children exhibit both strengths and weaknesses in the acquisition of aspect grammar in Mandarin, which indicates that reduced L1 exposure does not necessarily result in deficient acquisition of all three aspect markers in Mandarin HL children. The results have shown that the difficulties Mandarin HL children had

were all related to the acquisition of the imperfective aspect marker *zai,* which has specific restrictions on the verb aktionsart type it can pair with. It was found that the errors the Mandarin HL children made were primarily due to L2 influence, which causes them to rely more on English aspect knowledge to pair *zai* with achievements and postural statives. Thus, we can conclude that crosslinguistic influence from the L2 is the main source accounting for incomplete development of aspect grammar in Mandarin HL children. However, it is worth pointing out that whether the effect of crosslinguistic influence would result in an incomplete acquisition of aspect grammar over a longer term is still unknown. According to the present study, the Mandarin HL children who had more L1 experience tended to reject ungrammatical pairings of *zai* with achievements and statives. Thus, one could speculate that perhaps the effect of L2 influence would be weakened as HL children's L1 exposure accumulates over time. Further longitudinal study on the acquisition of aspect grammar in Mandarin HL children is necessary to confirm this proposal.

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CHAPTER 5. General conclusion

Throughout this dissertation, I have explored the effects of incomplete acquisition, attrition, protracted acquisition, and cross-linguistic influence in the acquisition of first mentions, RCs and aspect grammar in Mandarin HL children. Incomplete acquisition of the L1 means that HL speakers fail to reach age-appropriate levels of proficiency for certain grammatical structures as a result of reduced L1 exposure during early childhood. L1 attrition means that the grammatical system of the speakers' L1 had a chance to develop initially, but later some grammatical aspects began to deteriorate due to increasing exposure to the dominant L2 and reduced use of the L1. Protracted acquisition of the L1 suggests that HL children could develop native-like L1 abilities eventually, but that the whole acquisition process requires a longer timeframe. The results have been discussed in detail in three separate journal-style papers. In this chapter, I discuss themes that emerged from these three studies for our understanding of HL acquisition in children. Following the discussion in Section 5.1, 5.2, 5.3 and 5.4, I present the implications for HL development and maintenance in children in Section 5.5.

5.1 Incomplete acquisition, protracted acquisition, and L1 attrition

The three studies contained within this dissertation used both cross-sectional and longitudinal designs. The children's data were collected via various tasks, including comprehension, production, grammaticality judgment, psycholinguistic experiments, and

narratives. Taken together, the results provide evidence of incomplete and protracted development of the L1 in Mandarin HL children, but not of L1 attrition.

Regarding the phenomenon of incomplete acquisition, the results of these three studies demonstrate that it does not have 'across-the-board' effects. On one hand, it was shown that, in comparison to monolingual peers, Mandarin HL children displayed inferior abilities in terms of using specific vocabulary items and classifiers in first mentions. Moreover, they made errors in using the imperfective aspect marker *zai* with achievement and stative verbs in production as well as accepting *zai* paired with achievement and stative verbs in a grammaticality judgment task. These findings are similar to previous studies on Chinese and Spanish HL speakers, which reported incomplete development of lexical and morphological knowledge in adult and child HL speakers (Anderson, 1999; Li & Lee, 2001; Montrul, 2002, 2005, 2007; Silva-Corvalán, 1994). It may be that, lexical breadth, the large repertoire of specific classifiers, and the restricted co-occurrence of *zai* with certain verbs, are language specific information and would require a great deal of input to acquire. Given that Mandarin HL children were exposed to reduced L1 input during early childhood, these specific areas of knowledge were more vulnerable to incomplete acquisition. On the other hand, Mandarin HL children did not exhibit incomplete acquisition regarding using a general classifier *ge* in noun phrases since this area of knowledge does not need to be learned on a case-by-case basis.

It should be noted that, although reduced L1 exposure tends to affect the domain of morphology, it does not necessarily result in incomplete acquisition of all morphological forms (e.g. perfective and imperfective aspect markers) of the same grammatical category (e.g. aspect). The results of Chapter 4 showed that Mandarin HL children did not exhibit incomplete development of the perfective aspect marker *le.* According to the studies on Mandarin monolingual children, the perfective aspect marker *le* occurs frequently in the input and is

acquired by monolinguals before the age of 4 (Chen & Shirai, 2010; Li & Bowerman, 1998). Perhaps the exposure to the majority language context is not a barrier preventing Mandarin HL children from acquiring the perfective aspect marker *le* which emerges early in the monolingual setting, given that HL children usually receive L1 input exclusively during the first few years before they begin schooling in the L2. It appears that a form that occurs more frequently in the language input and is acquired at the early stage of L1 acquisition tends to develop towards an adult-like state in HL children.

In contrast with the phenomenon of incomplete acquisition found in the domain of the lexicon and morphology, the results of Chapter 2 and Chapter 3 showed that the syntax-pragmatics interface and the domain of syntax seemed resilient to reduced L1 input in Mandarin HL children. In Chapter 2, it was found that, like monolinguals, Mandarin HL children were able to use post-verbal clauses appropriately in first mentions. This finding is different from studies focused on the interface areas in adult heritage speakers' grammar (e.g. syntax-semantics interface, Cuza & Frank, 2011; syntax and discourse interface, Sorace, 2004), which reported that the interface areas tended to be affected by incomplete acquisition/L1 attrition due to reduced exposure and use of the L1 in HL acquisition settings. One explanation for this discrepancy could be attributed to the quality and quantity of the L1 input received by the Mandarin HL children. In Chapter 2, it was found that exposure to diverse Mandarin contexts significantly accounted for the variation among individuals. Perhaps external factors, such as reading HL books, Mandarin schooling, and using Mandarin in different contexts helped the Mandarin HL children in this study to develop post-verbal clauses used in first mentions.

With respect to the RC study presented in Chapter 3, it was found that Mandarin HL children were comparable to monolinguals in terms of comprehending both subject-type and object-type RCs. Moreover, their production of RCs was convergent with the monolingual

native-speaker grammar at the second of year of testing. Perhaps the Mandarin HL children included in this study received sustained and consistent L1 input during the two-year study period, which, in turn, helped them to accumulate the critical mass of input needed to acquire RC structure. Another explanation could be that the exposure and use of other Mandarin modifying constructions over time might have facilitated the acquisition of the complex RC structure to some extent since the Mandarin RC is a sub-type of the modifying construction (Chan, Matthews & Yip, 2011).

A unique contribution of this dissertation is that the longitudinal data presented in Chapter 3 differentiated the phenomenon of incomplete acquisition from protracted acquisition of the L1 during the early stages of L1 acquisition in HL children. It was found that although Mandarin HL children exhibited inferior abilities in using RCs at the first year of testing, their production of RCs was convergent with monolingual norms at the second year of testing. The results suggest that if we observe HL children using some non-target-like structures or forms at some point, it is possible that they would acquire them at a later developmental stage, as compared to monolingual peers. This finding supports Flores and Barbosa's (2014) proposal on protracted development of the L1 in HL children, pointing to the importance of accumulated L1 experience in the acquisition of the HL. It appears that the reduced input in HL acquisition settings would slow down the development of the HL rather than result in deficient acquisition of the HL. This observation is also in line with previous studies on language development in bilingual children (Gathercole & Thomas, 2009; Paradis, Tremblay & Crago, 2014). Following on this observation, it would be interesting to examine the development of the lexicon, specific classifiers and the imperfective aspect marker *zai* at a later developmental stage to see if Mandarin HL children would show protracted development of these areas of knowledge as their L1 exposure accumulates over time.

The work presented in this dissertation did not find evidence of L1 attrition because the longitudinal data presented in Chapter 3 demonstrated that Mandarin HL children's comprehension and production of RCs did not undergo attrition over time. This finding is inconsistent with Anderson's longitudinal studies (Anderson, 1999, 2001), which reported L1 attrition in the area of gender morphology in two young Spanish HL children. An explanation for this discrepancy could be that the two young Spanish HL children's L1 exposure decreased over time in the home setting, whereas the Mandarin HL children in these studies received sustained and consistent L1 exposure (see the detailed discussion in Chapter 4). Another explanation could be that Anderson's studies and the RC study contained within the Chapter 3 were focused on different linguistic subdomains. In Spanish, gender morphology is closely tied to lexical knowledge. Thus, this area of knowledge is expected to more sensitive to reduced L1 input than the morphosyntactic knowledge underlying Mandarin RCs.

In sum, the findings of three studies show the following key points: (1) HL acquisition outcomes could be varied according to different linguistic subdomains. It appears that the linguistic subdomains that depend on a large amount of L1 input (e.g. lexicon, morphology) are likely to be affected by incomplete acquisition; (2) Reduced L1 exposure does not necessarily lead to incomplete acquisition or attrition of the L1. It seems that as long as HL children receive sustained and consistent L1 exposure over time, they might show protracted development of some specific or complex properties in their L1. Future research would benefit from longitudinal analyses to see at what age we consider protracted acquisition to be over and accept that incomplete acquisition has to take place.

5.2   Crosslinguistic influence

The studies presented in Chapters 3 and 4 examined the role of crosslinguistic influence in HL acquisition. The results demonstrated that crosslinguistic influence from HL children's L2 could affect the domain of morphology and morphosyntax at the level of both comprehension and production. It was shown that Mandarin HL children processed and produced Mandarin RCs formed with English word order, and they produced and accepted ungrammatical pairings of *zai* with achievements and postural statives, which is likely due to the influence from their dominant language, English. These findings are in line with prior research on the acquisition of the weaker language in bilingual children (Döpke, 1998; Foroodi-Nejad & Paradis, 2009; Paradis, 2010; Yip & Matthews, 2007), which reported that speakers' dominant language could affect the acquisition of the weaker language to some extent. For HL children, they usually receive more L2 input and use the L2 more frequently. When there is structural overlap between their two languages, it is expected that the dominant societal L2 would compete with their L1. Consequently, in some cases, the L1 structure or form might be replaced by the L2 structure or form.

What is the relationship between crosslinguistic influence and incomplete acquisition/attrition or protracted acquisition of the L1? According to the longitudinal data presented in Chapter 3, it appears that the influence from the dominant societal L2 does not result in incomplete acquisition or L1 attrition in HL children. Instead, the transfer from the societal L2 leads to protracted acquisition of the L1 in HL children. It was shown that Mandarin HL children's societal language, English, did not cause any difficulties in comprehension of subject-type and object-type RCs in both the first and second year of testing. Moreover, although some Mandarin HL children produced some RCs formed in English word order at the first year

of testing, their production of RCs were convergent with the native norms at the second year of testing. These findings indicate that HL children are likely to show protracted development of some structures or forms which have competing structures or forms in their L2. According to this account, when considering the effect of English on the acquisition of the imperfective aspect marker *zai* in Mandarin HL children, one could speculate that perhaps Mandarin HL children would acquire the specific use of *zai* at a later developmental stage, as long as their L1 exposure is sustained and consistent over time. Further longitudinal investigation is necessary to find out if this speculation is true.

In sum, the data presented in this dissertation demonstrated that some non-target-like performance found in HL children at some point could be the result of the influence from their L2, but this transfer effect could be weakened as children's L1 exposure accumulates over time. Future research would benefit from more longitudinal analyses to ascertain the relationship between L2 influence and protracted acquisition or incomplete acquisition across different linguistic domains.

5.3   Theoretical accounts of the HL acquisition

The studies presented in this dissertation did not adopt a particular theoretical framework *a priori*. Overall, it appears that both the generative approach and the usage-based approach could explain why Mandarin HL children exhibited strengths in some areas but showed weaknesses in other areas. In this section, I will first discuss the implications of my findings for the generative and the usage-based theoretical frameworks respectively. Then I will argue that the usage-based approach is better at explaining the findings in Chapter 2 and Chapter 3.

The generative approach assumes that children are born with innate abstract knowledge, which is guided by the principles and constraints of Universal Grammar (Chomsky, 1986;

Pinker, 1984). Language acquisition is the process of mapping the input language to certain pre-given abstract categories (Chomsky, 1986; Crain & Thornton, 1998; Guasti, 2002). The generative approach predicts that HL children are not different from monolingual children in terms of acquiring some basic grammatical knowledge that tends to emerge very early in childhood (Montrul, 2010; Montrul, 2015), because like monolinguals, they are exposed to the L1 from birth and receive L1 input exclusively during the first few years. This account could explain why the Mandarin HL children were able to use a general classifier *ge* at the noun phrase level in first mentions and the perfective aspect marker *le* appropriately in production. Specifically, the HL children appeared to have fully acquired these structures because these areas of knowledge are acquired at an early developmental stage (i.e. before the age of 4) in a primarily monolingual setting. The generative approach also predicts that HL speakers should demonstrate knowledge of some structures or forms that are not frequent in the L1 input given that language input is downplayed within the generative framework (Larsson & Johannessen, 2014; Montrul, 2010; Montrul, Foote & Perpiñán, 2008). This account offers an explanation for the native-like comprehension ability in the acquisition of RCs by Mandarin HL children. Although Mandarin HL children were exposed to reduced L1 input as compared to monolinguals, the L1 input might still be able to trigger the syntactic operation of head-final RCs. Thus, Mandarin HL children were comparable to monolingual peers in terms of comprehending both subject-type and object-type Mandarin RCs because the RC knowledge represented in their minds does not fundamentally differ from monolinguals' representation.

The generative approach also assumes that the interface areas, such as those between verb morphology and semantics, and between syntax and semantics/discourse, are prone to incomplete acquisition and attrition because these areas require speakers' different levels of linguistic knowledge to interact with each other (Cuza & Frank, 2011; Montrul, 2006b, 2015;

Sorace, 2004), which might cause some difficulties for HL speakers given that they are exposed to reduced L1 input and use the L1 in limited contexts. For the acquisition of aspect grammar, the results showed that Mandarin HL children made some errors regarding using the imperfective aspect marker *zai* with achievements and statives. It may be that the interaction between the semantic knowledge at the level the lexicon (i.e. verb semantics) and the morphological knowledge (i.e. *zai*) presented a challenge to Mandarin HL children, so that they were not able to fully acquire this aspect marker as a result of reduced L1 input. However, it should be pointed out that the generative framework could not explain well why Mandarin HL children were comparable to Mandarin monolingual children in terms of using post-verbal clauses in first mentions, which requires coordination between speakers' syntactic and pragmatic knowledge, and is thus an interface area. I will revisit this issue when discussing the usage-based approach.

Regarding the knowledge of words and the specific classifiers used by Mandarin HL children in first mentions, this is highly language-specific information and not constrained by Universal Grammar. Usually, the acquisition of these areas of knowledge depends, to a large extent, on the amount of L1 input. Therefore, HL children would be expected to show inferior abilities as a function of reduced L1 exposure and use in a generative approach.

In contrast with the generative approach, the usage-based approach claims that there is no pre-given abstract knowledge, and there is no discrete cutoff point between the lexicon and grammar (Bybee & Hopper, 2001; Croft, 2001; Diessel, 2015; Langacker, 2000; Lieven & Tomasello, 2008; Tomasello, 2003). The emergence of linguistic knowledge is based on the frequency and complexity of forms or structures instantiated in a given language as well as the consistency of form-function mapping. Moreover, the use of a given language in different social interactions and certain cognitive processes (e.g. analogy, statistical learning) also play an

important role in shaping language grammar. According to the usage-based approach, incomplete acquisition of the lexicon, specific classifiers, and verb-based restrictions on the use of the aspect marker *zai* could be attributed to a reduced input situation, which might cause some difficulties in form-function mapping. For example, perhaps the phonetic profile of the specific classifiers and the semantic function associated with these classifiers might be difficult to discern in HL acquisition settings due to less frequent exposure than would be the case for monolinguals. Moreover, the non-target-like use of the incomplete aspect marker *zai* with achievements and statives was probably due to Mandarin HL children having difficulties sorting out the possible verb types paired with *zai*, given that they were exposed to reduced L1 input.

The usage-based approach could also account for some native-like performance exhibited by Mandarin HL children. For example, regarding the perfective aspect marker *le,* given that it occurs more frequently than the imperfective aspect marker *zai* and *zhe* in the input (Chen & Shirai, 2010), it might be relatively easy for Mandarin HL children to instantiate the schema for *le* + activity/accomplishment/achievement/stative verb. For the acquisition of RCs, perhaps the frequency of exposure to other modifying constructions in turn facilitates the acquisition of the complex RC structure since Mandarin RCs are a sub-type of the modifying construction. Thus, Mandarin HL children's production of RCs eventually became convergent with monolingual use perhaps due to connections between RCs and other constructions. This *construction conspiracy* account has already been discussed with respect to acquiring complex grammatical constructions in English-speaking children (Croft, 2001; Goldberg, 1995).

While both approaches offer explanations for many of the strengths and weaknesses found in Mandarin HL children in my studies, I would argue that the usage-based account is better placed to describe how internal and external factors account for the protracted development of RCs and the acquisition of post-verbal clauses used in first mentions. The usage-

based approach does not make a distinction between abstract core syntax and other levels of grammar (Croft, 2001; Langacker, 2000; Tomasello, 2003). Given that input frequency varies for different constructions, it is expected that some complex constructions might be more difficult than others, and consequently, take a longer timeframe to acquire. For example, regarding the Mandarin RC construction, this is a relatively complex modifying construction as compared to other simple modifying constructions (e.g. an adjective modifying a noun), because the modifying element is a clause. Moreover, one can speculate that simple modifying constructions might appear more frequently than complex RCs in day-to-day use. Thus, Mandarin HL children are expected to take a longer timeframe to accumulate a great deal of input so that they can instantiate the schema *modifying clause + noun* for RC construction. For the post-verbal clauses used by Mandarin HL children in first mentions, given that the study found that exposure to a rich and complex Mandarin environment significantly accounted for the variation among Mandarin HL children, it is possible to speculate that external input factors play a decisive role in acquiring post-verbal clauses by Mandarin HL children. This also provides support for the usage-based approach, which emphasizes the role of language experience in the formation of linguistic knowledge.

5.4   Individual differences

The results of the three studies clearly point to the role of children's chronological age, age of arrival in Canada, the use of Mandarin at home, the richness of the Mandarin environment, Mandarin schooling, and the mother's level of education in accounting for the variation among Mandarin HL children. Among these factors, children's older age of arrival was a significant and positive predictor of HL ability in all three studies, suggesting that it has a global impact on the acquisition of the L1 in HL children. This finding is consistent with previous studies on age of

arrival effects in HL speakers (Anderson, 2001; Bohman, Bedore, Peña, Mendez-Perez & Gillam, 2010; G. Jia, 2008; G. Jia & Aaronson, 2003; G. Jia, Aaronson, Young, Chen & Wagner, 2005; Kondo-Brown, 2005; Montrul, 2002), which reported that HL speakers who arrived in a host country at a younger age tended to develop and maintain lower levels of the HL, while those with an older age of arrival significantly predicted more HL use in various language environments and better HL proficiency. One reason for this may be that age of arrival is usually associated with the amount of L1 experience, the onset of L2 (pre) schooling, cultural and peer preferences (G. Jia, 2008; G. Jia & Aaronson, 2003). Thus, in comparison to HL children who arrived in a host country at a later age, HL children who were born in a host country or immigrated with their parents at a younger age would have less L1 experience, more L2 exposure, and more rapidly shift to L2 dominance, which in turn affects their HL learning to some extent.

The three studies presented in this dissertation also examined the effect of quantity and quality of the HL input in the acquisition of Mandarin first mentions, RCs and aspect markers. The results indicate that exposure to several sources of language input and output in the HL in different contexts is crucial for HL development and maintenance. For example, in the study of first mentions abilities of Mandarin HL children, an interesting result was that the richness of the Mandarin environment contributed to individual differences among Mandarin HL children in English-only schools. This finding suggests that, in the absence of formal schooling in the HL, continuous exposure to a rich HL environment, such as reading HL books, watching HL TV programs, and interacting with peers, is extremely important for HL children to develop and maintain their HL abilities. Moreover, the study of the production of RCs revealed that the amount of Mandarin spoken at home significantly accounted for the variation among Mandarin HL children in the longer term. This finding points to the importance of using the L1 for

developing grammatical knowledge in HL children. However, it should be pointed out that the studies contained in this dissertation did not examine some additional factors that have a direct impact on the exposure and use of the L1, such as children's motivation and attitudes towards their HLs (He, 2006; Lu & Li, 2008). Future research could examine the extent to which these factors affect the exposure and the use of the L1 by HL children in different social contexts.

In short, the findings mentioned above mirror the results obtained from previous studies on the acquisition of the HL, which found that the amount of exposure to the HL and the complex L1 input gained through various language-related activities were associated with levels of HL proficiency (G. Jia, 2008; G. Jia & Aaronson, 2003; G. Jia *et al.,* 2005; Kondo-Brown, 2005). The predictive power of these language environment factors demonstrates that in order to develop and maintain high levels of HL proficiency, it is crucial to increase the presence of the HL in immigrant homes and to maximize the use of the HL with parents, other family members and peers.

Another significant factor accounting for the variation among Mandarin HL children was their chronological age. In the study of the acquisition of RCs in Mandarin HL children, the results showed that the older children outperformed the younger children regarding comprehension and production of RCs. Given that children's chronological age is associated with their language experience, the finding suggests the important role of cumulative L1 experience in HL development. However, it should be noted that age also indexes cognitive maturity. It may be that, in comparison to the young Mandarin HL children, the older Mandarin HL children who had greater cognitive maturity tended to show better performance in a comprehension and a production task. Future longitudinal investigation is still needed to ascertain the effect of accumulative L1 experience on the acquisition of other grammatical knowledge in HL children.

Regarding the role of socioeconomic status (SES) in the acquisition of the L1 in Mandarin HL children, the role of mother's level of education was examined only in the first mentions study. It was found that a higher level of mother's education predicted significantly better first mentions performance. This finding is consistent with the studies by Amastae (1982) and Hammer, Komaroff, Rodriguez, Lopez, Scarpino and Goldstein (2012) with Spanish HL speakers, which found that higher maternal education was associated with greater awareness of the importance of the HL and heritage culture, and subsequently, would increase more HL use in all situations. However, the study presented in Chapter 2 did not directly examine real mother-child interactions. Future research could record mother-child interactions to see how they are different based on mother's level of education, which would further our understanding of the role of the L1 exposure in HL development and maintenance.

In sum, the input-related factors discussed above indicate the important role of L1 exposure in HL development and maintenance, which is in line with the usage-based theory that emphasizes the role of language experience in shaping language grammar.

5.5   Implications for parents, educators and policy-makers

This dissertation examined Mandarin HL children's L1 abilities across different linguistic domains and the factors accounting for individual differences. The results have several implications for parents, educators and policy-makers. First, the results show Mandarin HL children tended to exhibit inferior abilities regarding some language specific information, such as the lexicon, the large repertoire of classifiers, and the specific use of aspect marker *zai*. These findings suggest that these areas need extra support from parents and educators in order to develop fully. For example, parents and heritage language teachers could increase literacy activities both at home and in the school setting to encourage Mandarin HL children to learn

more vocabulary and more specific classifier-noun pairings. Moreover, when teaching aspect grammar at heritage language schools, teachers could place more emphasis on some restrictions of using the imperfective aspect marker *zai* and *zhe* with certain verbs to help Mandarin HL children achieve native-like aspect knowledge.

Second, the three studies revealed several input factors in accounting for individual differences among Mandarin HL children. The results indicate that parents and heritage language teachers could maximize the use of the available HL resources to facilitate children's HL development and maintenance. For example, school teachers and parents could encourage HL children to read or tell stories in their L1s in home and school settings to improve their literacy skills in their minority languages. Moreover, in order to maintain children's HL abilities in the long term, school teachers and parents could encourage HL children to speak their L1s to interact with family members as well as peers from the same cultural and linguistic background. Furthermore, parents could take their children to participate in some heritage cultural activities to ensure them expose to diverse L1 contexts. By doing so, children would appreciate their heritage culture and then have great motivation to learn their HLs.

None of the three studies found a significant impact of English exposure on the acquisition of the L1 in Mandarin HL children, suggesting that perhaps HL children do not need to sacrifice their HLs for acquiring the societal language. This finding is consistent with the Interdependence Hypothesis proposed by Cummins (Cummins, 1978, 1979), which explained the fact that, for children from minority backgrounds, learning their L1s has no adverse consequences on the development of their majority language (L2). On the contrary, certain L1 knowledge and skills can be positively transferred during the process of acquiring their L2 (Cummins, 1979, 2000; Cummins, Mirza & Stille, 2012). Thus, for educators and policy-makers, it is crucial to make policy and develop practices to preserve immigrant children's

bilingual/multilingual abilities. It would not only enhance immigrant children's cognitive, linguistic, and academic growth, but it would also contribute to both cultural diversity and global economic opportunities for Canada.

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