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The effect of Cross-Linguistic Influence in Mandarin learners of English on interpreting state-change verbs in English

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ABSTRACT

State-change is a basic type of event that human beings experience on a daily basis, and it is also an important linguistic feature. Mandarin contrasts typologically with English in its lexicalization of state-change. The equivalent counterparts of English state-change verbs in Mandarin do not in themselves entail state-change unless an additional form is added to encode this meaning, which is called Resultative Verb Compound (RVC). Furthermore, English state-change verbs in past tense conflate both state-change and action completeness, whereas those two features are accomplished by RVCs and the aspectual marker *le* in Mandarin. This systematic difference in structuring state-change events between Mandarin and English raises an interesting question of whether this Mandarin-specific lexicalization pattern gives rise to any challenges for Mandarin learners of English in interpreting English state-change verbs. Mandarin-English bilinguals and English native speakers were asked to finish a Gradient Plausibility Judgement Task and a Multiple-Choice Interpretation Task after a video session. The short-term video immersion aims to bias Mandarin learners of English into either monolingual or bilingual language mode. Mandarin-English bilinguals' individual linguistic factors such as AoA, English Immersion Score, L2/L1 Dominance Score (English vs Mandarin dominance) were collected. Thus, this thesis also taps into whether and how language mode and individual linguistic experience play a role in this cross-linguistic comprehension. Results show a significant effect of L1 Mandarin influence to the interpretations of L2 English state-change verbs, but no association was found between the language mode and the cross-linguistic influence effect. Individual linguistic experience examined has been proved with no predictive power either.

This study adds to the existing data on second language acquisition and contributes to the ongoing discussions on the role of previously learned languages by investigating an understudied combination of languages and population. In addition, it adopts the Feature Reassembly Hypothesis (FRH) to examine the process of reassembling the state-change feature and investigate whether FRH can be extended to domains beyond syntax and morphosyntax.

Keywords: cross-linguistic influence; state-change events; lexical semantics; language mode; Feature Reassembly Hypothesis; language comprehension

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1. Introduction

This thesis covers the discussion of the role of L1 Mandarin in the course of L2 English acquisition. I focus specifically on state-change verbs where English and Mandarin share some properties but diverge in interpretations, as a way of examining if Feature Reassembly Hypothesis (Lardiere, 2007, 2008, 2009) is extendable to other domains of grammar that are not explicitly discussed in previous literature. Noticeably, I don't aim to test the predictions of the model in this thesis but use the model to examine the process of reassembling the state-change feature and investigate whether FRH can be extended to domains beyond syntax and morphosyntax.

When people learn a new language, their existing linguistic system inevitably interacts to some degree with the newly acquired one. Bilinguals' linguistic performances might be under the influence of this contact. In bilingualism studies, various terms defining this phenomenon have appeared in the literature, e.g. inference, transfer, convergence, influence (Grosjean, 2012). In my thesis, cross-linguistic influence (CLI) will be adopted to refer to instances in which there is evidence for the effect of one language on the other. Either creating a delay or facilitation of acquisition, CLI is well documented to occur at various linguistic levels, including phonology, syntax, semantics and morphology, in the process of second language acquisition (Döpke, 1998; Serratrice, 2007; Yip & Matthews, 2000). Work examining the underlying mechanisms of CLI has been gaining momentum since the publication of the influential work by Hulk and Muller's Cross-Linguistic Influence Hypothesis (2000). The core of this hypothesis predicts CLI occurs in areas which have been claimed to be problematic in L1 acquisition and more particularly at the interface between syntax and pragmatics. In addition, the extent to which CLI happens also depends on the structural overlap between two languages with respect to the surface level. Since then, scholars have worked on different language combinations to refine this proposal and contributed to the core of the hypothesis – with particular reference to the interfaces between syntax and discourse-pragmatics and between syntax and semantics – and on the role of structural overlap. At the same time, some scholars have also started exploring the role of language processing.

Evidence supporting processing being the drive of CLI mostly comes from syntax structural priming, and is consistent with the idea that language processing affects the second encounter of language structures and ultimately shapes learning and the resulting linguistic knowledge in a form of implicit learning (Chang, Dell & Bock, 2006). Some influential linguistic approaches also contributed to the understanding of CLI phenomenon, including Full Transfer Full Access (Schwartz and Sprouse, 1994, 1996), Full Transfer and Relexification (Sprouse, 2006) and Feature Reassembly Hypothesis (Lardiere, 2007, 2008, 2009), which will be discussed in the following sections.

There is growing research evidence of cross-linguistic influence in the course of second language acquisition looking at different language pairs in a range of language domains (Nicholadis, 2012; D'Angiulli, Siegel, & Serra, 2001; Geva & Siegel, 2000). In this paper, I focus on CLI in the interface of syntax and verb semantics domain in Mandarin English bilinguals with L1 Mandarin background. In the course of Second Language Acquisition (SLA), it is important to interpret and understand the meanings of verbs and verb related constructions in order to achieve native-like attainment. The meaning of a verb is generally assumed to be internally structured, and it is often represented as a set of semantic elements combined in a certain configuration (Talmy, 1985). In verb and verb-related constructions, there is variation in how to pack this information across languages. According to Talmy (1985, 2000), this package of information is called lexicalization, which is defined as the systematic association of particular components of meaning with particular morphemes or constructions. That is to say, native speakers of different languages have to lexicalize the relevant information in a specific language, which might give rise to language-specific lexicalization patterns in first language acquisition (Chen, 2017). Those language-specific lexicalization patterns have implications for cross-linguistic studies of semantic acquisition of verbs or verb related constructions in different populations, which points to the importance of inferring the language-specific lexicalization patterns in first language acquisition which may arise in the course of SLA and give rise to any negative interference for second language learners. To put it more explicitly, in the bilingual context, interpretations of verbs and verb related constructions can be more challenging because bilingual speakers need to isolate patterns between their native language and second language especially under cross-linguistic influence.

Mandarin contrasts typologically with English in its lexicalization of state-change verbs (Talmy, 2000). English has many verbs such as *kill* and *shoot* which generally specify the fulfillment of state change whereas those equivalents *sha, she* in Mandarin don't. State change in Mandarin is typically encoded with Resultative Verb Compounds (RVC) that consists of two root verbs: action verb (V1) and resultative verb (V2) (Li & Thompson, 1981). For example, an RVC compound *sha (V1)-si (V2)* in Mandarin means to kill something to death in English. That is to say, the encoding of state-change, a formal semantic feature, varies cross-linguistically between Mandarin and English. This systematic difference in structuring state-change events between Mandarin and English raises an interesting question of whether Mandarin learners of English utilize this specific feature, Resultative Verb Compounds, in Mandarin to deal with English state-change verbs. In sum, this thesis aims to mainly investigate whether there are cross-linguistic influence effects in Mandarin learners of English on interpreting state-change verbs in English. I hypothesize that the Mandarin Resultative Verb Construction (RVC) might play a role and give rise to such influence. This study will add to the existing data on second language acquisition and contribute to the ongoing discussions on the role of previously learned languages in the interface of verb semantics and syntax domain. In addition, this study investigates an understudied combination of languages and population.

This thesis is organized into eleven sections. The first six sections are integrated into the background part, including literature review and relevant linguistic analysis. First, cross-linguistic influence in bilingualism will be discussed including its terminology, outcomes and underlying mechanisms. Second, the more current and relevant cross-linguistic influence literature in SLA with different language combinations, particularly Mandarin and English, will be presented. Third, the linguistic phenomena and components in this thesis including lexicalization of state-change in both English and Mandarin will be introduced. This part mainly demonstrates the divergence between English and Mandarin in interpreting state change. Fourth, the linguistic approaches in the development of SLA will be presented to provide supportive hypotheses in explaining emerging CLI phenomena. Fifth, the phenomenon of language mode in bilingualism research will be mentioned. Sixth, the last part talks about the effects of linguistic experience and factors in SLA. The first six sessions form part of the introduction. The remaining five sections present research questions, predictions and empirical evidence, including the methodology of the study, data analysis, results and their interpretation. In the end, some concluding remarks are presented.

2. Theoretical Background

2.1 Bilingualism and cross-linguistic influence

"The bilingual is not two monolinguals in one person", an influential observation proposed by Grosjean over 30 years ago, has denoted the uniqueness of a bilingual individual who should not be considered as the sum of two complete or incomplete monolinguals , but rather as a 'unique specific speaker-hearer' (Grosjean, 1989). In addition, his work criticized the monolingual view of bilingualism saying that a bilingual has two separate and isolated language competencies. In the last decades, a substantial body of research is well documented that bilingual children actually are able to differentiate between their two languages (Genesee, 1989; De Houwer, 1990), which is not in line with earlier view of bilingual acquisition namely that children who are exposed to two languages from birth start out with one unitary language system (Taeschner, 1983, for example). In that sense, two languages in a bilingual context are not processed in isolation with each other, and children compare and contrast them and may use the "short cuts", which afford to transfer/borrow parsing/processing strategies from one language into the other. In such cases, we speak of cross-linguistic influence (CLI).

Speaking of cross-linguistic influence, it is necessary to briefly introduce another similar terminology. In the study of Second Language Acquisition (SLA), *Transfer* is a long-standing term, used to describe and explain L2 performances that seem to be influenced by speakers' prior language knowledge (L1). One of the influential ways to think about *Transfer* comes from Odlin (1989), and he sees it as the outcome of linguistic similarities and dissimilarities in one's languages:

Transfer is the influence resulting from the similarities and differences between the target language and any other language that has been previously (and perhaps imperfectively) acquired

Odlin, 1989, P10

However, there are ongoing debates towards the term Transfer. First of all, a number of researchers including Corder (1983) have criticized it because of its metaphoric suggestion when in fact "nothing is being transferred", which can indeed cause misunderstandings and perhaps constrain one's freedom of thinking. In addition, some researchers mentioned that

copying and cloning from one body of knowledge (L1) to another (L2) is restricted. It indicates that only nontarget language influence which is shown to obtain consistently for a given item or across items within the same paradigm is considered to be transfer (Rothman, González Alonso & Puig-Mayenco, 2019). In other words, only in the circumstances where mental representation for a certain linguistic property is actually affected, can transfer be considered. In addition, Sharwood Smith and Kellerman argued that Transfer by convention has been understood to relate only to the effect of L1 on L2 or L2 on L3 ignoring the good evidence for the effects of L2 on L1. They further argued that the term of Transfer doesn't have the advantage of subsuming terms like 'avoidance' under it, the linguistic behaviors based on the perception between L1 and L2 by learners may effectively prevent transfer of L1 structure. With an intention of replacing the term Transfer, CLI was brought up by Sharwood Smith adopted in an earlier paper on language loss (Smith, 1983) and discussed fully in Sharwood Smith and Kellerman (1986). The term is meant to cover more than the word "transfer" and includes borrowings, influence on L1 from L2, avoidance of transfer, and etc. In its broadest sense, this term covers a fairly wide range of phenomena, referring to any contact between the languages of bilingual and multilingual individuals that affects the linguistic performance of these individuals.

We have understood the term CLI, but what counts as the effect of CLI? In other words, what language scenarios can be considered as the outcome of CLI? According to Serratrice (2013), there are two manifestations minimally. The first, which is easier to understand, is that language phenomenon is observed in bilinguals' use of language A but is unattested in linguistic behaviors of monolinguals. For example, in three English-German bilingual children's spontaneous utterances, Döpke (1998) found the use of head-initial complex verb constructions, which is not attested in the complex verb constructions of monolingual German-speaking children. In such cases, we have a qualitative difference between monolinguals and bilinguals because the linguistic phenomenon exhibited by the former is not detected for the latter. Alternatively, CLI can also manifest in a matter of quantitative difference. For instance, Serratrice (2007) reported that both groups of English-Italian bilingual and Italian monolingual children are more tolerant with an overt third person pronoun as co-referential with a subject antecedent, which is disallowed in the monolingual adult grammar, than Italian adults in a sentence verification task. Additionally, bilinguals were significantly more likely to accept that than monolingual children. In such cases, there is

a quantitative difference between bilinguals and monolinguals, which can reasonably be attributed to the coexistence of English in bilinguals' environment.

For decades, researchers have proposed some explanations or underlying mechanisms towards CLI in bilingual children. The first explanation is related to language dominance or proficiency. Bilingual children, even if exposed to both languages, are often more proficient in one language than the other. The more proficient language is often referred to as the dominant language. Some studies have argued that CLI is more likely to appear in the direction of dominant language into their weaker language (Yip & Matthews, 2000; Döpke, 1998). For instance, Paradis (2001) found evidence for dominance affecting children's prosodic structure, with French-dominant children being more likely to show influence from typical French syllabification on English words. However, other studies do not show consistent findings. Nicholadis (2002) focused on children's root + root compound nouns in French-English bilingual children. These compounds are infrequent and always left-headed in French while frequent and always right-headed in English. This study aimed to explore how frequently English-French bilingual children reverse their compounds in their two languages. The results showed no correlations between the rate of reversed compounds in English and French with their proficiency in each language. The second and one of the influential explanations refers to the publication of Hulk & Muller's cross-linguistic influence hypothesis (2000, 2001). Hulk and Muller (2000, 2001) proposed an approach predicting which phenomena in a given language will experience cross-linguistic influence. Their cross-linguistic influence hypothesis brought up two conditions in which CLI in bilingual children occurs if both conditions are met. Firstly, CLI occurs in areas which have been claimed to be problematic in L1 acquisition also, called C-domain, and more particularly at the interface between syntax and pragmatics. Secondly, the extent to which CLI happens also depends on the structural overlap between two languages with respect to the surface level. In other words, only if a language A has a construction which may seem to have more than one structural interpretation and language B contains evidence for possible interpretations, leading to either problems or facilitation, would cross-linguistic happen. A range of subsequent studies have contributed to validate the cross-linguistic influence hypothesis (Yip & Mattews, 2000; Nicoladis, 2003; Döpke, 1998; Paradis & Navarro, 2003). For example, Paradis and Navarro (2003) explored the distribution of overt and null subjects in Spanish, which is a grammatical domain that belongs to the syntax-pragmatics interface, in the case of Spanish-English bilinguals. They found the explored phenomenon to be vulnerable to cross-linguistic

influence from English to Spanish. However, the cross-linguistic influence hypothesis has trouble fully explaining all instances of CLI in simultaneous bilingual children. In that case, some scholars have started exploring the role of language processing. Traditional accounts of language processing look at the real-time or online usage of language, especially in language production (Archibald, 2017). A variety of experimental techniques have been applied to assess these skills: self-paced reading, Eye-Tracking, EEG/ERPs, and priming, etc. For example, using Eye-tracking Paradigm, Hopp (2016) probed the relation between lexical gender assignment and the predictive processing of gender agreement in non-native and native German. He found that intermediate L1 English learners of German can come to show predictive processing of gender agreement after training on lexical gender agreement and the accuracy in gender assignment moderates predictive gender assignment. In other words, gender knowledge has the predictive power for gender agreement processing and L2 learners who acquire overall target lexical gender for nouns come to exploit this facilitative lexical knowledge. Chinese classifiers are also evidenced to show predictive power in L2 processing. Nominal classifiers in Mandarin Chinese simultaneously encode semantic as well as grammatical form-class cues about co-occurring nouns. Grüter, Lau & Ling (2020) compared L1 and L2 Mandarin speakers' relative reliance on these two concurrently available cues from Mandarin Chinese nominal classifiers from a visual world eye-tracking experiment in sentence processing. They found that in comparison with L1 speakers, L2 listeners rely more heavily on the semantics than on the grammatical information informativity of classifiers. Importantly, all effects emerge in a temporal window prior to the noun, indicating the evidence of predicting processing from the nature of classifiers in both the L1 and L2 group. Language processing, as opposed to offline knowledge, namely grammatical representations and the distinction between representations and processes, is central in the study of language science. Linguistic theory informs the type of representations in a range of language domains, and these grammatical representations are considered to be the targets in Second Language Acquisition (SLA). Techniques such as Grammaticality Judgment Tasks are frequently used to gain insights into what a learner's grammar looks like, which is considered as offline knowledge.

Work on cross-linguistic structural priming in both adult and children bilinguals has provided evidence supporting that processing might be the underlying mechanism of CLI. In Hartsuiker, Pickering & Veltkamp's (2004) study, Spanish-English bilingual participants described cards to each other in a dialogue game. They found that a participant who just

heard a sentence in Spanish tended to use the same type of sentence when describing the next card in English. Specifically, Spanish-English bilinguals tended to produce English passive sentences more often following a Spanish passive sentence than following a Spanish intransitive or active sentence. This finding suggested that in L2-speaking adults, structures in one language can activate similar structures in the other, even when this language is not in use. Similar effects of syntactic priming were also reported among Spanish-English bilingual five-year-olds (Vasilyeva et al., 2010), providing new evidence for shared syntactic structures in young bilinguals and co-activation of their two languages during processing. The consideration that processing mechanisms connected with priming may be the drive for cross-linguistic effects is consistent with the idea that language processing affects subsequent language processing and ultimately shapes learning and the resulting linguistic knowledge in a form of implicit learning (Chang, Dell & Bock, 2006). In order to pin down the processing mechanisms that might give rise to cross-linguistic influence, Nicoladis (2006) proposed a speech production model, arguing that a speaker who wished to convey a message would first choose the concepts (the conceptual level), then choose the specific words and syntactic frame to convey the message (the lemma level), and finally the phonological form of the words. Nicoladis (2006) also argued that cross-linguistic transfer was due to competition between choices at the lemma level. In other words, where there is overlap in the constructions available from both languages at the lemma level, these constructions will be activated no matter which language is to be spoken. For example, a Spanish-English bilingual wishing to convey a message about a green apple would activate at the lemma level both the typical English syntactic frame of adjective-noun and the typical Spanish syntactic frame of noun-adjective. The words in both languages (e.g. *green, apple, verde, manzana*) would also be activated. The syntactic frame and the words associated with the language to be spoken would have a higher degree of activation, so would be more likely to be produced.

A comprehensive understanding of cross-linguistic influence in different linguistic levels enables us to better understand how learning one language impacts the acquisition of a second language. It will help school teachers and language and reading specialists understand how two distant languages may or may not interact with each other during the process of language acquisition. This will in turn facilitate the design of suitable education and intervention programs for bilingual students.

2.2 Literature review on CLI in SLA

There is growing research evidence of cross-linguistic influence in the process of second language acquisition among alphabetic languages. Nicholadis (2012) tested predictions about cross-linguistic influence with possessive construction in French-English bilingual children. She reported that the bilingual children used more French-ordered possessive constructions with the possessed preceding the processor than English monolinguals, and more English-ordered than monolinguals in French. This study provided evidence of bidirectional cross-linguistic influence in the children's possessive constructions. In addition, at the phonological level, previous literature has provided strong evidence supporting cross-language facilitation among different populations of bilingual children with various first language (L1) backgrounds, such as Spanish–English (e.g., Cisero & Royer, 1995), Italian–English (e.g., D'Angiulli, Siegel, & Serra, 2001), and Hebrew– English (e.g., Geva & Siegel, 2000) bilingual children. A variety of studies also looked at how word class semantics could influence cross-linguistic interactions when reading in L2 (Schwartz & Kroll, 2006; Chambers & Crooke, 2009). For instance, Baten, Hofman and Loeys (2011) examined the word recognition performance of Dutch-English bilinguals who performed a lexical decision task to word targets appearing in sentence context. To detect the possible influence of word class meaning, the critical words either showed a word class overlap or not in English and Dutch. A facilitation effect was observed, where homographs belonging to the same word semantic class in both languages are more rapidly responded to than those that do not. That is, the effect of cross-linguistic activation is influenced by whether or not language-ambiguous words share categorical meaning.

Even though most research into CLI has concentrated on L1-> L2 influence, L2 -> L1 influence has been attested in the literature as well. In order to examine the influence of an L2 on L1 morphosyntactic processing, Requena and Berry (2021) administrated a self-paced reading experiment to Spanish monolinguals as well as Spanish proficient learners of English on Spanish direct object clitics in complex verb constructions. To express the Spanish equivalent of "*I want to buy it*", speakers of Modern Spanish have two choices and direct object clitics can be placed either preverbally ("proclisis") or post-verbally ("enclisis") without affecting the base interpretation of the clause (Requena & Berry, 2021). In contrast with VCP in Modern Spanish, English only permits postverbal object pronouns in analogous constructions. This partial overlap created by morphosyntactic variation in Spanish (L1) VCP

raises an interesting question that whether this overlap can constitute a site for cross-linguistic effects in non-immersed proficient learners of an L2 (English) that shows more categorical behavior. Indeed, Requena and Berry (2021) found processing facilitation when L2 learners read enclisis where English and Spanish surface structures overlap compared to monolingual speakers, indicating that morphosyntactic information in their L2 influenced their processing strategies in the L1.

2.2.1 Previous studies on CLI between English and Mandarin

Linguistic Typology is the analysis, comparison, and classification of languages according to their common patterns of linguistic systems (Velupillai, 2012). This is also called cross-linguistic typology. In the language examined in the current thesis, Mandarin and English are historically and typologically unrelated. Thus, whether and to what extent CLI occurs between them is a compelling question given the clear differences. For instance, Mandarin is phonologically different from English in terms of sound inventory, syllable structures and the use of tones to differentiate the meaning of syllables. Wang, Perfetti, and Liu (2005) investigated cross-language phonological transfer among a group of Mandarin–English bilingual children, in Grades 2 and 3 of their English and Mandarin classes. The critical finding was that Mandarin tone skill predicted English pseudoword reading over English phonemic processing. This finding suggested that even when children learn to read in two different writing systems, there is a level of phonological transfer. Mandarin and English also differ in morphology. Mandarin morphology is more transparent than English morphology for several reasons (Zhang et al., 2012). First, Mandarin morphemes consist of one syllable while English morphemes might consist of more than one. Second, Mandarin does not utilize inflectional morphemes, through which grammatical features such as tense and plurality are expressed in English. Third, with rare exceptions, morphemes in Mandarin are in one to one correspondence with the basic writing units. In terms of similarities in Morphology, both languages are productive in compounds, especially Mandarin. Given the higher productivity of compound morphology in Mandarin, Zhang et al (2009) investigated the transfer of compound structure awareness of fifth grade Chinese ESL children. Participants received instruction in the morphology of four types of compound words in either Mandarin or English. Then they completed both the Mandarin and English versions of a compound word structure analogy task. The findings suggested that compared with children who received no instruction, children who received instruction in Mandarin were able to transfer knowledge

they had acquired of compound types in Mandarin to comparable types in English. Reverse transfer from English to Mandarin was found among children with high reading proficiency. This study provided evidence for cross-linguistic transfer between two typologically distant languages of insights into the structure of compound words.

There are a number of studies focusing on the interface of semantics and other linguistic domains (syntax, morphology) when it comes to the crosslinguistic influence of L1 Mandarin to L2 English in Mandarin-English bilinguals speakers (e.g., Choi, Ionin & Zhu, 2018; Lardiere, 2008; Li, 2017). For instance, Choi, Ionin and Zhu (2018) examined the role of L1 transfer and semantic universals in the acquisition of count/mass distinction in English, which has obligatory plural marking by speakers of Korean and Mandarin, which have optional plural marking. To put it briefly, the relevant difference between Korean and English in plural marking is that atomicity, a semantic universal which underlines plural marking, is reflected in the system of plural marking in the former, but in the classifier system of the latter. In addition, the relevant difference between English on the one side and in Korean and Mandarin on the other side is that the mapping between atomicity is direct in Korean and Mandarin (all atomic nouns are count, all non-atomic ones are mass), but indirect in English (which allows atomic mass nouns). Participants were instructed to finish a Grammar Task, providing the correct morphological form of the word or phase in a single English sentence, and they were asked to complete a Picture-Matching Task on the interpretation of singular NPs. The results presented implications that despite the differences between their L1s, both L1 Korean and L1 Mandarin learners of English correctly use -*s* with count nouns and optionally overuse -*s* with mass atomic nouns such as *furniture* in English. In other words, even though plural marking is associated with atomicity in Korean but not in Mandarin, the same pattern are observed in L1-Korean and L1-Mandarin learners of English, indicating that learners' performance is not due to L1 transfer but rather to the role of the semantic universal of atomicity in L2 acquisition.

In terms of crosslinguistic influence from the semantics aspect, some of previous studies mainly, from a pedagogical aspect, focused on the lexical error analysis especially errors in word choice, caused by negative influence of Mandarin that occur in Chinese EFL writing (Yang, Ma & Cao, 2013). Here, the semantic transfer from L1 Mandarin to L2 English mainly refers to word-for-word translation and sometimes Mandarin learners of English take it for granted that English words have the same connotation and denotation with their

Mandarin definitions in the dictionary. Thus, the errors related to word choices are those semantically unacceptable but grammatically acceptable in the given linguistic context. One of the studies addressing the influence of L1 on L2 acquisition of lexical meanings came from Yu's (1996) dissertation. He sets out to examine whether Mandarin learners of English can benefit from cross linguistic lexical similarities in the use of motion verbs in English. For this purpose, another group of adult Japanese-speaking learners, whose mother tongue does not share any similarities in motion verbs with English, was selected. Three lexical tasks were included for both groups to perform. The study produced clear evidence that the Mandarin learners of English performed better than Japanese speakers in all three motion verb tasks, indicating the facilitative role of crosslinguistic similarity in English lexical acquisition.

All in all, a comprehensive understanding of crosslinguistic influence between Mandarin and English regarding phonological, syntactic, lexical, and semantical domains enables a better understanding of how learning one language impacts the acquisition of a second language when the two languages are historically and typologically unrelated.

2.3 Lexicalization of state-change

Semantics is the study of how language is used to represent meanings. To put it more precisely, semantics aims to explain how literal meaning is linguistically encoded and decoded by speakers and hearers (Stringer, 2019). One aspect of semantics is called lexical semantics, the study of how meaning is encoded in words, and how word meaning relates to sentence. There are many ways of thinking about and representing word meanings, and one that has been proved useful is to associate words with semantic features. For instance, on hearing the word *boy*, we know that the referent is +male, +human, and -adult whereas the word *girl* denotes +female, +human and -adult. Those identifiable binary components of word meaning posited with lexical items are called semantic features.

State-change is a basic type of event that human beings experience on a daily basis. 'Change of state' is conceptualized as a formal semantic feature ([+/–change of state]) which is associated with particular lexical items. This association can be termed as lexicalization. According to Talmy (1985, 2000), lexicalization is defined as the systematic association of particular components of meaning with particular morphemes or constructions. The

lexicalization of state-change varies cross-linguistically. The following section will present the lexicalization pattern of state-change in both English and Mandarin.

2.3.1 State-change encoding in English

Germanic languages like English encode state change in a number of ways. For example, verbs such as *pick, break* and *crack* themselves already encode state change. In addition, combining a state-change verb with a particle or complement phase adds further information about the state change encoded by the verb (e.g. *pick off, break down*). Thirdly, combining a verb that specifies only an action with a particle or a complement phrase specifies the result state (e.g. *blow out (a candle)).*

Children's ability to conceptualize and linguistically express state-change has undergone development. Research has revealed that children have the linguistic means to express the completion of events in general and state changes in particular from early on, even before they start to use verbs at all. It has been noted that children learning languages such as German, Dutch and English have preference for verbal particles over verbs to encode state changes before age two (Milles, 1985). For example, Greenfield and Smith (1976) reported a one-year-old English speaking child's use of *down* instead of *jump* to refer to his own action of jumping down. In their second year of life, children start to use verbs to refer to state changes. For instance, Huttenlocher, Smiley and Charney (1983) in their study observed that a two-year-old's verbs (age range 2;0-2;4), especially those relating to their own behaviors, are result verbs, which are more common than other types of verbs. In addition, some literature on grammatical marking also show young children's use of tense aspect markers is correlated with the aspectual meaning of the verbs they co occur with. For example, several studies have shown that young children's use of past tense markers is correlated with verbs specifying state changes (Bronckart and Sinclair, 1973; Bloom, Lifter and Hafitz, 1980). In other words, young children have a preference for using past tense marking on verbs referring to state changes, which suggests they are able to differentiate the semantic types of verbs and have some sense of what state-change verbs are.

However, as mentioned above, varied patterns of event encoding may cause children learning English to have difficulty in teasing apart where the state-change meaning is located- in the main verb, in the result particle, or in both. Indeed, previous studies have revealed the

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learning problem that children often misinterpret the meanings of state-change verbs and neglect their end-state.

Gentner (1978) used a verification task to access 5-9 year-old children's and adults' understandings of common cooking verbs such as *mix* which specifies a particular change of state and *stir, beat* and *shake* which specify the particular manner in which an action is performed but are non-committal about state change. She found that children were able to correctly associate three manner verbs, *stir, beat* and *shake*, with the appropriate manner, but they tend to interpret the state-change verb *mix* as if it specified only a certain manner of motion, not a particular end state. Gentner concluded that English-speaking children have difficulty acquiring meaning components relevant to changes of state than those relevant to manner in which an action is performed. In 1991, two studies by Gropen et al. corroborated Gentner's (1978) findings. They found that children roughly 4 to 6 years old did not have problems interpreting the manner verbs *pour* and *dump*, but they treated the state-change verb *fill* as if it specified only a particular action, pouring. This action may, but need not, lead to the end state of something being full.

The study by Misersky et al. (2021) shows that adult English native speakers are able to successfully interpret state-change verbs and also be aware of the cues of grammatical marking. Misersky et al. (2021) investigated whether grammatical marking (perfective vs progressive) affects mental representations of objects that are being affected in their states in events using the sentence-picture verification task adapted for EEG. Misersky et al. (2021) presented participants with sentences on which all verbal predicates suggested a change-of-state in an object, but manipulated the degree of state-change by presenting the verb phrase in the perfective aspect (e.g. *chopped*) or the progressive aspect (e.g. *was chopping*). All sentences were followed by either a picture showing the state-change of the object or no state-change or unrelated objects. The participant's task was to indicate whether the object in the picture was mentioned in the sentence. Comparing ERPs between sentence types, the processing of state-change pictures shows a more positive P300 following perfective tense than progessive tense, indicating that participants indeed evaluated object states in detail and confirmed that a holistic event representation as cued by perfective would include the beginning state as well as the resultant state of an object undergoing change (Hindy et al., 2012). In other words, the grammatical aspect marker overall modulates the state-change comprehension, and the perfective tense focuses on event completion and object-state

change. What is more, even though the focus of their study is ERP response, the findings of their sentence pretest regarding state-change verbs contributed to our understanding on how adult English native speakers perceive and interpret change-of-state. They tested verb-object compounds particularly in state-change verbs, which describe an action which would irreversibly change the physical appearance of an object (e.g. *chop an onion*). Participants were asked to rate the degree of change of the object by the action described on a Likert scale ranging from 1 (= not changed at all) to 7 (= changed substantially). The results showed that verbs suggesting state change received significantly higher ratings than those did not, showing they described more substantial state change. The 34 target state-change verbs remained including verbs including *tore, spilled, cracked, broke, peeled, boiled*, etc.

Summing up, children learning English show early awareness of the end state of state-change verbs. However, at an early age, they have difficulty correctly understanding the state-change meaning of state-change verbs and most of the time they tend to neglect their end-state. As language abilities develop, adult English native speakers are able to successfully interpret state-change verbs, understanding their resultant features, moreover, they are aware of grammatical cues in state-change event representation, namely, the perfective tense drives more attention to the end-state of an object.

2.3.2 State-change encoding in Mandarin with Resultative Verb Compound (RVC)

Mandarin contrasts typologically with English in its lexicalization of state change (Talmy, 2000). The equivalent counterparts of English state-change verbs in Mandarin do not in themselves entail state change unless an additional form is added to encode this meaning, which is called Resultative Verb Compound (RVC).

Being a type of compound structures, the resultative verb compounds (RVC) are especially productive and important in Mandarin, which are widely used in both speech and writing. The RVC is always composed of two elements, with the first element (also conventionally referred to as V1) indicating an action and the second (referred to as V2) denoting some results of the action or process conveyed by V1(Chao, 1968; Li & Thompson, 1981).

RVCs can be further classified depending on the type of results that the complement verb expresses. However, previous studies slightly differ in classifications. Chao (1968), a pioneering Chinese grammarian, identified five types of RVCs in his book '*A Grammar of Spoken Chinese*' as shown in (1):

(1)
(i) Phase complements express the phase of an action in the first verb. In other words, the V2 expresses the degree to which the V1 is carried out. For example,

   a. *Wo peng-jian   le   yi ge pengyou.*
      I   met-see ASP one   ClF friend.
      'I met a friend.'

   b. *Wo men ju ran   gan-dao   le   huo che.*
      We   surprisingly   reach-arrive ASP   train.
      'Surprisingly, we caught the train.'

(ii) Intensifying complements are exclamatory modifiers which intensify the action denoted by V1. For example,

   c. *Wo re-si   le.*
      I   hot-death ASP.
      'I am hot to death.'

   d. *Ta huai-tou   le.*
      He bad-throughly ASP.
      'He is horribly bad.'

(iii) Potential complements refer to those in which an infix is inserted between V1 and V2 to express possibilities or impossibilities of the results. For example,

   e. *Wo xie-bu-wan   zuo ye.*
      I   write-no-finish homework.
      'I cannot finish my homework.'

f. *Wo kan-de-jian   lu.*

I   see-'able'-see road.

'I can see the road.'

(iv) Directional complements indicate the displacement or direction of a V1 denoted. For example,

g. *Ta   zou-jin   le   yi ge hua yuan.*

She walked-into ASP one CL   garden.

'She walked into a garden.'

h. *Wo chuan-shang le   xin   yi fu.*

I   Wear-ascend ASP new clothes.

'I put on new clothes.'

(v) Lexical potential directional complements refer to those directional complements that are only or mainly in potential form. For example,

i. *Ta   xia-bu-lai   chuang.*

He descend-no-come bed.

'He cannot get out of the bed.'

j. *Ta chi-de-xia fan.*

He   eat-'able'-descend food.

He has an appetite for the food.

In 1981, Li and Thompson acknowledged four RVCs types on their volume '*Mandarin Chinese: A Functional Reference Grammar*' as shown in (2):

(2)

(i) Directional RVCs consist of a V1 implying a displacement and a V2 indicating the direction.

(ii) Phase RVCs are certain RVCs in which the V2 expresses something more like the type of action described by the first verb or the degree to which it is carried out.

(III) Metaphorical RVCs are often used in a metaphorical sense, as shown in example c and d above.

(iv) RVCs obligatory in potential form refer to a few result verbs, V2, whose presence in a RVC means that the compound can occur only in the potential form.

If we look in the categories in detail, both of the work by Chao (1968) and Li & Thompson show redundancy. For example, the type (iii) and type (v) of Chao (1968) seem redundant since the latter can be legitimately grouped into the former. In my opinion, Chao (1968) studied spoken Mandarin which might give rise to redundancy. With the same logic, in Li & Thompson (1981), the type (iii) can be legitimately regarded as the metaphorical extension of either the type (i) or the type (ii) complements. Comparing two category systems, overlaps are observed in the classification of RVCs between Chao (1968) and Li & Thompson (1981)'s work. Firstly, they agreed on the categories of directional RVCs and phase RVCs. Moreover, the RVCs Obligatory in Potential form in Li & Thompson (1981) correspond to potential complements in Chao (1968). In addition, it is more reasonable that both of them seem to be a shared property of all types of RVCs, rather than a standalone type of RVCs. Even though intensifying complements in Chao (1968) and Metaphorical RVCs in Li & Thompson (1981) are not identical by definition, the former type does overlap with the latter. In order to avoid the above-mentioned confusions. Chinese linguists have agreed on a categorization of RVCs into three types: directional RVCs, completive RVCs and result-state RVCs. The three types display their own characteristics that distinguish one from each other, thus they have been commonly adopted in the most recent work on the linguistic accounts of RVCs (Chen, 2007; Deng, 2010; Packard, 2000; Smith, 1990, 1991, 1997).

The typical way to encode state-change events in Mandarin is to use completive RVCs and result-state RVCs respectively. Completive RVCs refer to those in which the complement expresses completion or termination of the action denoted by the first verb (V1). For example, in example *k* the action verb *kan* 'look' is followed by the complement *jian* 'perceive' which adds a completion meaning to the first verb, consequently changing the situation type from action to achievement.

k. *Ta kan-jian le yi zhi lu*

He look see ASP one CL deer

'He saw a deer'

Result-state RVCs refer to those in which the complement verb (V2) expresses the resulting-state of the action or event denoted by the first verb (V1). For example,

l. *Wo xi-gan-jing le yi fu.*

I   wash-clean ASP clothes.

'I washed the clothes clean.'

Here *xi ganjing* is a result-state RVC, which makes explicit that the clothes are clean as a result of the V1 *xi* 'wash'. In result-state RVCs, the V2s are an open set. That is to say, most adjectives and some verbs can occupy the complement position in result-state RVCs. For instance, adjectives such as *hao* 'good' and *qiang* 'strong' indicate positive entailment while *si* 'dead' has negative entailment. According to the native Chinese corpus study of Zhang (1999), native speakers of Mandarin tend to use neutral adjectives, such as *tou* 'transparent' or *xing* 'awake'. In addition, it is important to note that Mandarin RVCs frequently occur with the perfective aspectual marker *-le*. The perfective *-le* presents a situation in its entirety, as an event bound at the beginning and the end. It has been argued that *-le* by itself may indicate completion or termination, depending on the predicates with which it occurs. According to Tai (1984), when *le* is used with a verb that encodes a situation with a clear boundary, as with an RVC, it signals the situation comes to its natural end point, that is, completed. Whereas when the verb encodes a situation with no clear boundary, as with a standalone action verb (V1), it only signals the termination of the action. To put it more precisely, for instance, in sentence *wo xi-gan-jing le yi fu* meaning *I washed the clothes,* the use of marker *le* with RVC *xi-gan-jing* indicates that not only the action (*wash*) is completed but the state-change has occurred (clothes were clean after being washed). However, if we use marker *le* in sentence *wo xi le yi fu* with only action verb *xi (wash*), it only indicates the termination of action *xi,* meaning the action of *wash* has been performed regardless whether the clothes are clean or not. In this thesis, two linguistic features, namely action completeness and state-change are of interest here, but state-change is the main focus.

RVCs, a verb compound construction, have drawn attention from researchers on children's language development. Xu (2006) in her longitudinal study of two Mandarin-speaking children identified that RVCs emerged as early as 1;7. Some studies (Chen, 2007; Chen, 2017) reported that Mandarin children as young as 2;6 years old already showed adult-like interpretations of RVCs as entailing a state-change. Moreover, children are found to use RVCs frequently and productively in an adult-like manner at around 3;6 (Zhang, 2011). Since Mandarin constantly utilizes this single linguistic form to encode state-change, it sounds reasonable perhaps that children learning Mandarin will have an easier time in teasing apart where the state-change meaning is located. Interestingly, based on an experiment on four groups of Mandarin-speaking children (mean ages 2;6, 3;6, 4;6 and 6;1), Chen (2005) found that at 2;6, children had no difficulty in understanding the state-change meaning conveyed by RVCs. However, they had trouble determining where the state-change meaning is encoded: in V1, V2, the whole RVC or the perfective aspect marker -*le*. Even as late as 6 years of age, children still mistakenly treated V1 of the RVC as if it entails a state-change. This suggests that while young children know that the state-change is critical to an RVC, they are not conscious of its event structure. They regard the action verb V1 as equivalent to an RVC.

As language ability develops, adult Mandarin native speakers are shown to be able to comprehend the meaning of state-change correctly, which is accomplished by V2 in the RVCs structures. Some of the evidence came from studies that examined the role of adult input in Mandarin children's acquisition of RVCs to reveal whether the acquisition process of early RVCs is usage-based or rule-based. For example, in the comprehension task, Deng (2019) tested 10 adult native Mandarin-speaking parents, where they were asked to point at the correct video consistent with the audio signal. The audio signals included both novel RVCs (e.g. *ga-xialai* meaning 跳下来 *jump-down*, and *fo-dao* meaning 撞倒 *strike-fall*) and real RVCs (e.g. 打破 *break-broken*, 爬下来 *crawl-down*, etc.). As for the results, Adult Mandarin native speakers not only 100% correctly interpreted the real RVCs stimulus and chose the correct video clip showing the result of the action, also they decomposed the novel RVCs stimulus that they have never heard before and chose the correct corresponding video clip. It revealed that adult Mandarin native speakers are conscious of RVC's event structure, where V1 specifies the action and V2 encodes the following result or change of state.

As mentioned, V1s only denote the action and V2s entails the result or process of the action in RVCs structures in Mandarin. However, a study showed that adult Mandarin native speakers actually did not treat V1s as solely denoting the action but entailing a state-change on a continuum degree. Chen (2018) conducted a semantic acceptability rating survey on adult native Mandarin speakers (age range 18-23) and they were asked to rate Mandarin sentences like 他关了门，但是门没关上 'He closed the door, but the door was still open' on a 5-point acceptability scale based on the whole scenario. The findings reported a continuum of state-change strength from strong state-change strength (verbs like 摘 zhai 'do.picking' and 关 guan 'do.closing) to weak state-change strength (e.g. 洗 xi 'wash', 吹 chui 'blow', 倒 dao 'pour'), with intermediate strong/weak state-change strength verbs in between (e.g. verbs like 杀 sha 'do.killing', 切 qie 'cut', 闹 nao 'make.noise', etc.). Chen's (2018) study showed that adult Mandarin native speakers did not treat V1 of an RVC as equally entailing a state-change. This finding about Mandarin speakers' sensitivity to the state-change implicature corroborates Tai's (1984) observation that the strength (degree) of the implicature of state change varies across Mandarin action verbs. In this context, the term 'implicature' here refers to the intended resultant state (Tai ,1984; Talmy, 2000). In all, several empirical studies provided evidence that there is a nuanced state-change implicature lexicalized in Mandarin state-change verbs and speakers of Mandarin are sensitive to the cline of the implicature of state change (Chen, 2008; Chen, 2017; Chen, 2018).

Chen's (2018) study has implications for cross-linguistic studies of semantic acquisition of state-change verbs in various populations of learners such as adult second language acquisition. The nuanced state-change implicature in Mandarin counterparts of English state-change verbs, namely the Mandarin-specific lexicalization of state-change, raises an interesting question whether it will give rise to any challenges for Mandarin learners of English on interpreting English state-change verbs. Thus, to echo what Chen (2018) did, in my study, a Multiple-Choice Interpretation Task was included as a task both in Mandarin and English, aiming to compare the preferred cross-linguistic interpretations of state-change verbs which are assumed to be the source of cross-linguistic influence. The experiment design and results will be elaborated in the following section.

Summing up, RVCs are a very productive type of verb compounds in Mandarin Chinese. It is the Mandarin specific way of encoding state-change events, with the first verb (V1)

specifying the causal action and the second verb (V2) the result. Mandarin constantly uses this linguistic feature to encode state-change.

2.3.3 The divergence in interpreting state-change verbs in English and Mandarin

The meaning of a verb is generally assumed to be internally structured, and it is often represented as a set of semantic elements combined in a certain configuration (Talmy, 1985). This package of information, namely lexicalization, varies across languages. To correctly understand the meaning of a verb or verb related constructions, people need to determine which semantic elements play a role in their meanings, and to discover the patterns by which they are typically combined in the language they are acquiring.

In general, English and Mandarin differ in typical lexicalization of state change (Talmy, 2000). English has many state-change verbs like *kill, break, crack* that themselves indicate the fulfillment of a state change. While Mandarin shows the opposite pattern: state-change counterparts like *sha, da, za* themselves do not entail state change and RVC as a whole entail a state change. Additionally, English state-change verbs in past tense such as *killed, broke, cracked* indicate action completeness whereas in Mandarin action completeness is achieved with an aspectual marker *le,* which is frequently used with RVC structures in Mandarin. In other words, there is a cross-linguistic difference in English and Mandarin that English state-change verbs in past tense (e.g. *killed, broke*) conflate both state change and action completeness but these two features are encoded with both RVC and external aspectual maker *le* in Mandarin. To put it more clearly, for instance, the Mandarin counterpart of the English state-change verb *picked* is the RVC *zhai-xia le* 'do.picking.action-descend', which consists of two verbs, *zhai* (V1) 'do.picking.action' and *xia* (V2) 'descend' and the aspectual marker *le* indicating the completion of the action. In other words, the meaning of English state-change verbs in past tense inherit both action completeness and state change features whereas in Mandarin these two features are encoded with both RVC and the external aspectual marker *le.* To the best of my knowledge, from a cross-linguistic perspective, no previous studies have examined this systematic cross-linguistic difference in Mandarin and English. Thus, it is worth investigating whether this language-specific lexicalization gives rise to any challenges for Mandarin English bilinguals in L2 learning due to the negative influence of different lexicalization patterns in the first language.

The first research question in my study mainly sets out to capture this potential negative L1 influence from Mandarin RVC structure attached with aspectual marker *le*, which might make an impact in Mandarin learners of English on interpreting English state-change verbs. In other words, given what is explained about the use of RVC in Mandarin in the previous section, it is interesting to look at whether Mandarin learners of English allow English state-change verbs not to entail state-change. The research question will be elaborated in detail in the following sections.

2.4 Linguistic approaches to L2 acquisition

One of the most influential hypotheses of linguistic approaches to L2 acquisition is the Full Transfer Full Access model (Schwarz & Sprouse, 1996). Full Transfer Full Access (Schwartz and Sprouse, 1994, 1996) contends that all the principles and parameter values as instantiated in the Ll grammar immediately carry over as the initial state of a new grammatical system on first exposure to input from the target language (TL). Full transfer means that the initial state is made up of the L1 grammar excluding specific lexical items. Full access means that UG is fully accessed during L2 development when interlanguage is needed to restructure. This makes it possible to reset parameters during the L2 acquisition. There are a variety of studies testing FTFA hypothesis in a range of linguistic elements (Dugarova, 2007; Jiang, 2011; Barbu Revencu, 2016). For example, Dugarova (2007) investigates the Russian speaking and English speaking groups learning Chinese reflexive "*ziji*". The cross-linguistic variation between English, Chinese and Russian lies in that, first, English reflexive '*himself*' must be bound locally both in finite and non-finite clauses, and the Chinese reflexive "*ziji*" can be bound either long-distance or locally both in finite and non-finite clauses whereas the Russian reflexive "*sebja*" must be bound locally in finite clauses but can be bound locally or long-distance in non-finite clauses; second, the Chinese reflexive can only take a subject as its antecedent and so does the Russian reflexive, while the English reflexive can take both a subject and an object as its antecedent. Dugarova wanted to validate whether the L2 acquisition has benefited from a similar grammar structure between L1 and L2. All the subjects are asked to perform a multiple-choice comprehension task. Dugarova found that Russian speakers of all proficiency levels acquire long-distance subject binding in finite clauses at rather low rates (5%-28%). This can be addressed by L1 influence on the L2 grammar, because long-distance subject binding in finite clauses is not allowed in Russian. In non-finite clauses, Russian speakers accept long-distance binding at higher rates (36%-51%),

which is also evidence of L1 transfer. English speakers of all 30 groups manage to master long-distance subject binding both in finite and non-finite clauses. This suggests that English learners are able to acquire the long-distance subject binding property which is not present in English.

Later on, Sprouse (2006) in his Full Transfer and Relexification extends FTFA beyond syntax and phonology to include lexical knowledge. By comparing FTFA (Schwartz and Sprouse, 1994, 1996) with an influential model of creole genesis called Relexification Hypothesis (RH, Lefebvre, 1988), Sprouse claimed a significant similarity in conceptualizing the same basic phenomenon in L2 acquisition. RH claimed that a co-creator of a creole languages seeks to relabel any given entry of his L1 lexicon with the appropriate label of the corresponding entry in the lexifier language and the creole lexical entries are mainly created by the process of relexification (Lefebvre, 1988). Following this logic, Sprouse claimed that the relevant information in a lexical item created by this relexification process is presumably part of the "abstract properties" that Full Transfer claims are transferred. In other words, Full Transfer and Relexification (Sprouse, 2006) argues that in L2 acquisition of the lexicon, words initially maintain the syntactic and semantic packaging associated with them in the L1 and are labeled with the perceived L2 phonology. For example, if the learners' initial assumptions about word meaning stem largely from previous linguistic knowledge, then on hearing a new word, such as *gohan* 'rice' in Japanese, which only refers to cooked rice, an English native speaker will initially assume that it also refers to uncooked rice. If we take the meaning of verbs as examples, it basically indicates that native speakers of different languages have to discover how to pack or unpack the relevant information of verb meanings that is often represented as a set of semantic components combined in a certain configuration in L2 acquisition. A study investigating L2 acquisition of the count/mass distinction provided evidence of lexical transfer, in line with Sprouse (2006)'s proposal (Tang, Fiorentino & Gabriele, 2021). Using acceptability judgment tasks, Tang, Fiorentino & Gabriele (2021) examined whether L2 learners of English rely on L1 transfer and atomicity in the acquisition of count/mass distinction by L1-Mandarin and L1-French learners of English. In classifier languages, such as Mandarin, plurality is encoded in the classifier system and there is a neat alignment between atomicity and the count/mass distinction, with count nouns being atomic and mass nouns being non-atomic. However, French and English are number-marking languages, and count/mass distinction is expressed morpho-syntactically. Thus, by comparing L1-Mandarin and L1-French learners, they test whether both learner groups are guided by

semantic universals (Choi et al., 2018) or whether learners transfer their L2 knowledge at the syntactic level (Schwarts and Sprouse, 1994, 1996). It is important to note that like English, French also has a group of atomic mass nouns that presents a mismatch between morphosyntax and semantics. However, the specific lexical items that are atomic mass only partially overlap between the two languages. For example, English word *slang* and its French equivalence *argot* are both mass nouns taking plural markers. Other items such as mass noun *furniture* in English but *meuble* in French is a count noun. This difference in atomic mass nouns between two languages presents a case to test the potential effects of lexical transfer. They further examine L1-French learners' performance on nouns that either share count/mass status in English and French or differ in the two languages. The results showed that both L1-French and L1-Mandarin learners showed a grammaticality distinction for count nouns and mass nouns, not supporting evidence of syntactic transfer. However, both learner groups had more difficulty with atomic mass nouns, suggesting that learners indeed utilized atomicity to acquire count/mass distinction. In addition, they found that L1-French learners did show greater sensitivity on items that are congruent in count/mass status between French and English, suggesting the effect of lexical transfer could override atomicity. Their study also revealed that frequency plays an important role for both native speakers and L2 learners. The results showed that in cases where lexical transfer is not facilitated (for L1-Mandarin learners in general and L2-French learners on incongruent items), learners showed a greater grammaticality distinction for items with higher frequency. In all, their study provided evidence of both lexical transfer and the role of frequency, providing support for Sprouse's (2006) proposal. It also implies that lexical relativity and lexical transfer indicate that learners from different L1 backgrounds will have different assumptions and paths of acquisition regarding the L1 lexicon.

Since Full Transfer and Relexification (Sprouse, 2006) is built on both FTFA (Schwartz and Sprouse, 1994, 1996) and creole genesis RH model (Lefebvre, 1988), one of the concerns regarding it lies in the difference between canonical L2 acquisition and creole L2 acquisition. According to Sprouse (2006), he argued that canonical L2 acquisition and creole genesis didn't differ in underlying mechanisms. He suggested that Full Transfer and Relexification naturally extend to each other. Following Chomsky's Minimalist Program, the only way for the "abstract properties" of the L1 to transfer and comprise the initial state of L2 acquisition is via retention of the L2 lexicon (minus phonetic labels). That is, Full Transfer's "abstract properties" appear to correspond in Minimalist terms to Relexification's lexical "features"

(minus phonetic features). Thus, the real difference between canonical L2 acquisition and creole genesis lies not in distinct underlying mechanisms but in the quantity and quality of input available for language learning. He claimed that The Target Language input in the case of Canonical L2 acquisition is rather robust and persistent to enhance the acquisition, whereas the lexifier language input in the course of creole development is rather rare or even absent in the emerging creole speech community. In such cases, the early L2 learner and early creole co-creator are cognitively and epistemologically indistinguishable. Thus, Sprouse (2006) further argued that the quality and quantity of input is important for recategorizing the relevant lexical properties in the process of learning.

In the domain of lexical semantics in SLA, Stringer (2019) brought up one fundamental pair of related observations. He claimed that comparing any two languages, it is apparent that near-exact lexical translational equivalence is either rare or nonexistent (Stringer, 2010) and the learners' initial assumptions about word meaning in an L2 are largely based on knowledge of their native language (L1). The first phenomenon is called lexical relativity, and it specifies the fact that the meaning of any lexical item is relative to its ambient lexicon. To put it more clearly, following the traditional distinction between reference and sense articulated by Frege (1980) and Saussure (1983), a paired translation in two languages may hold for a shared reference (what the word denotes to) in a particular context, but the senses of the two words(the words' meaning in relation to the linguistic system) will necessarily differ across multiple contexts. For instance, In Japanese, one can "drink" medicine, even in solid form whereas the English verb *drink* is used only of liquids (Stringer, 2010). Even this basic human activity can vary according to the form of the object, implying that perfect translational equivalence is virtually non-existent. In addition, according to Stringer (2019), lexical relativity not only apply to open-class lexical items, those freely admit new members such as nouns and verbs, but it is also relevant to closed-class items, which refers to functional classes of grammatical words that do not easily allow new members, such as modal verbs, articles or quantifiers. In other words, the meanings of those functional features bundled into lexical items are also relevant to their surrounding lexicons. In the area of L2 acquisition and its stages, especially in the realm of L1 transfer, a focus on feature bundles and their lexical realizations holds a lot of promise in explanation.

Within the Principles and Parameters framework (Chomsky, 1981), researchers hypothesized that language acquisition relies on setting a number of parameters to their appropriate values.

With respect to L1 acquisition, a child who is acquiring her native language has an innately available universal set of features. One of the acquisitional tasks is to select from this set the features that are realized in her native language based on the primary linguistic data available to the child (Shimanskaya, 2015). The remaining features that do not lead to formal contrasts in the native language are later disregarded. Once the necessary features have been selected, specific functional categories and lexical items can be assembled (Chomsky, 2001). As for SLA, following this view, it implies that L2 learners start the process with features selected and assembled into L1 bundles, which makes parameter resetting a much more delicate task. For instance, Ionin et al. (2004) tested whether L2 learners of English, whose native languages (Russian and Korean) do not have articles and do not have any other direct way of encoding definiteness or specificity, could set the Article Choice Parameter. The analysis focused on two features: [specificity] and [definiteness]. The experimental results indicate that the errors produced by L2 learners are systematic and reflect two developmental paths. L2 learners of English either choose [definiteness] as the basis for distinguishing between definite/indefinite articles or they fluctuate between the two features ([definiteness] and [specificity]). Their study indicates that L2 acquisition involves processes that might be more complex than simple parameter setting and feature selection. Built on this research finding, Lardiere urged L2 researchers to go beyond individual features and their acquisition in Feature Reassembly Hypothesis (FRH, Lardiere, 2007, 2008, 2009).

From Lardiere's case-study data of Patty (2008), a native speaker of Mandarin and Hokkien Chinese who was born in Indonesia, moved to China as an adolescent and then to Hong kong to complete high school and acquired most of her English as an adult immigrant to the United States, Lardiere analyzed the oral and written production data over eight and half years. The linguistic properties under examination included definiteness and number, plural marking, wh-movement, case-marking, relative clauses, existential and universal quantifiers and subject-aux inversion. Generally, the speaker performed quite accurately on all of the properties with accuracy rates ranging from 63% to 100% depending on the specific property, condition and time of testing. These results strongly suggest that new features can be acquired and parameter values can be reset. However, high degrees of variability in Patty's production led Lardiere to believe that the problem must be in specific lexical realization of linguistic features in both the second and the native language. Hence, her proposal is different from the previous principles and parameters approaches to L2 acquisition. Lardiere offers the Feature Reassembly Hypothesis (FRH), and the idea that reorganization of functional features

is fundamental to L2 acquisition is at the heart of it. FRH is a model of asymmetric acquisition of syntax and morphology in adult L2 acquisition. Instead of focusing on whether a certain functional category is present in an L2 grammar and whether the parameter is (re)set to its target-like L2 value, Lardiere (2007, 2009) suggests comparing how features are bundled into lexical items in L1 and L2. Following in the steps of the Full Transfer Full Access hypothesis (FTFA, Schwartz & Sprouse, 1994, 1996), the FRH assumes that adult learners bring a system of formal features, already assembled into the native lexical items, to the L2 acquisition task. The FRH refines the FTFA proposal by insisting that successful L2 acquisition ultimately depends on reconfiguring the feature bundles of L1 lexical items into those of the L2, in cases where differences exist. To put it in detail, the task of L2 learners is twofold: first, she needs to map a lexical item to its closest L2 equivalent; next, she reassembles the features that do not coincide within the same lexical item in both L1 and L2. At the first mapping stage, in her own words, Lardiere predicts that L2 learners will attempt to "look for morpho-lexical correspondences in the L2 to those in their L1, presumably on the basis of semantic meaning or grammatical function (the phonetic matrices will obviously differ)" (Lardiere, 2009: 191). Therefore, the FRH views L1 transfer as an initial attempt by L2 learners to establish a direct mapping between L1 and L2 forms. In cases when these direct mappings fail, learners have to modify the feature combinations they transferred from the L1 and reassemble features that belong to different feature bundles in the L1 and L2. At the reassembling stage, L2 learners might abandon features distinctive in L1 but not in L2 or acquire new features.

The hypothesis formulated by Lardiere relies on several assumptions. First, as discussed above, Lardiere assumes that all features are ultimately acquirable. Second, the hypothesis only applies if the formal contrast is detectable in the L2. In addition, FRH formulates predictions about feature mapping and reassembly at the level of linguistic representations but leaves unanswered the question of whether L2 users can use the reassembled feature information in the real time. In other words, the FRH lacks predictive power in the domain of online language processing.

Summing up, I have mentioned three linguistic approaches in L2 acquisition, FTFA (Schwarz & Sprouse, 1996), Full Transfer and Relexification (Sprouse, 2006) and FRH (Lardiere, 2007, 2008, 2009). FTFA and Full Transfer and Relexification historically contributed to the construction of FRH. To the thesis's interest, FRH seems to provide the most predictive

power and can be used to examine the process of reassembling the state-change feature and investigate whether FRH can be extended to domains beyond syntax and morphosyntax.

2.5 Language mode

As a bilingual speaker who has reflected on my bilingualism, I have found that I change my way of speaking depending on whether my interlocutors are monolinguals or bilinguals. For example, the use of mixing language and code-switching are more frequent when I speak to bilinguals who share my languages compared to monolingual interlocutors. This interesting phenomenon was first mentioned in Weinrech (1966)'s book, *Languages in Contact*, saying that bilinguals restrict interferences (he used this term to refer to any element of the other language) when talking to monolinguals, whereas, when speaking to bilinguals, there is hardly limits to interferences and they can be used freely. That is to say, in language behaviors, the bilingual has to decide which language to use and how much of the other language is needed. If the other language is not needed at all, it will not be called on. On the other hand, if it is needed, it will be activated but is active to varying degrees. Over the years, Grojean (1985, 1989, 1994, 2008) has investigated and developed this phenomenon in a series of publications. He claimed that this state of activation of the bilinguals' language and language processing mechanisms, at a given point of time, has been called the language mode. Given that activation is a continuous variable ranging from no activation to partial activation to total activation, bilinguals can be in three modes depending on their position on the language-mode continuum. First, they will usually be in a monolingual mode when they are interacting with monolinguals who cannot use their other language. In such cases, bilinguals have to inhibit and deactivate the other language, usually unconsciously, so that it is not produced. Second, bilinguals can be in an intermediate mode where the other language is partially activated. For instance, when they interact with bilinguals who don't like mixing languages or are not proficient in the other language, a selection of base language is needed and the other language is partially activated. Third, bilinguals will be in a bilingual mode when both of their languages are active but one language is slightly less active than the other language as it is not currently the main language of processing. At all three positions, the base language remains fully active, as it is the main language that governs language perception and production.

As mentioned, bilinguals seem to naturally and continually find themselves on a situational continuum of language activation, and this positioning is under the influence of a number of factors. Grojean (2008) finds that the participant(s), the situation, the content and form of the message being uttered or listened to, the function of the language behavior and specific research factors can play a role. For example, if a bilingual is speaking with or listening to a monolingual relative/friend, watching a TV program in one specific language, or taking part in a study in which only one language is utilized, then the bilingual is probably in a monolingual mode. A bilingual mode will arise when two bilinguals share the languages and feel comfortable interacting with each other. This will be even reinforced if the content and topic of the conversation cannot be covered without referring to the other language in the form of code-switching and borrowings. As for the intermediate mode in the continuum, we would expect it to arise if the conversation is more formal, if the topic has to be covered in the other language from time to time, or if only a few stimuli in the experiment are similar in the two languages. In sum, movement along the language-mode continuum can happen at any point in time depending on the factors mentioned above. It is usually an unconscious behavior that takes place effortlessly but based on a range of factors related to language use.

Given that language mode plays an important role in language activation, it likely should be considered a modulating factor in language processing. As a study carried out by Dunn and Fox Tree (2014) shows, language mode has an effect on bilinguals' lexical decision in processing real words and non-words. 107 participants including English monolinguals and Spanish-English bilinguals were involved in the lexical decision experiment. 200 real words and 200 non-real words were selected in the lexical decision task and the experiments included 3 parts. In part 1, participants were greeted by a non-Latino instructor and asked to perform the lexical decision task in English including 100 real words and 100 non-real words. In part 2, participants were asked to retell the story after watching a video where half of the bilinguals were told to use English and the remaining half use Spanish. Part 3 is another lexical decision task with the remaining 100 real words and 100 non-real words. Noticeably, bilingual participants were randomly assigned to either the monolingual mode group or the bilingual mode group. The results showed that Spanish-English bilinguals in English monolingual mode behaved like English monolinguals, but bilinguals in Spanish-English bilingual mode behaved differently. They took longer to reject non-words than Spanish-English bilinguals in monolingual mode because of the main effect of bilingual dominance on the recognition of the identification of non-words. Consequently, encountering non-target

language items during the experiment changes the language mode and exerts immediate and severe effects on bilingual lexical access during language processing. In addition, the impact of language mode on processing can manifest in the production of spoken or written language. In situations when bilinguals are positioned on the bilingual mode, the use of mixed language in the form of code-switches and borrowings are observed. A code-switch is a complete shift to the other language for a word, a phrase, or a sentence whereas a borrowing is a morpheme, word, or short expression taken from the less active language and adapted morpho-syntactically to the base language (Grojean, 2008). For instance, in a laboratory based experiment (Grojean, 1997), French-English bilinguals were told to retell French stories that contained English code-switches in manipulated language modes. The three French interlocutors they had to retell stories to were described to participants before the experiment started in different language mode. The first interlocular induced a monolingual mode, the second an intermediate mode, and the third a bilingual mode. Grojean found that the number of guest language syllables, number of base language syllables, and number of hesitations were all affected by the manipulation language mode. Noticeable, the number of guest language syllables in the form of code-switching and borrowings increased significantly as the participants moved from monolingual to a bilingual mode while the number of base language syllables decreased.

Given that language mode is a cognitive phenomenon that plays an important role in all types of bilingual behavior, it is necessary that it be controlled for if it is not the main variable being studied. In my thesis, using a short-term video immersion which artificially creates a language context mode, I will compare the performance of Mandarin learners of English in monolingual mode and bilingual mode respectively in order to investigate whether any potential modulating effect might arise when interpreting English state-change verbs. To put it more precisely, in my study, using the video manipulation, the second research question aims to test whether the co-activation of Mandarin and English in bilingual mode, which should activate the representation of Mandarin RVC, make an impact in Mandarin learners of English on interpreting English state-change verbs. If detected, it is expected to be a negative influence from L1 Mandarin, resulting in lower L2 English ultimate attainment, compared to Mandarin learners of English in bilingual mode. Using this manipulation, we also tested whether any potential effect might arise when answering research question one as acceptable to processing manipulation over short-term immersion videos.

2.6 The effects of linguistic factors in L2 acquisition

Learners vary enormously in how successful they are in learning a language. In the case of L1 acquisition, children vary in their rate of acquisition but all, except in cases of severe environmental deprivation, achieve full competence in their mother tongue. However, in the case of L2 acquisition (SLA), learners vary not only in the speed of acquisition but also in their ultimate level of achievement. This native-like competence is considered as an important measurement in L2 acquisition.

Variabilities in native-like competence had been linked to a variety of linguistic factors, including age of acquisition (AoA), extent of L2 immersion, and extent of daily L2 vs L1 usage. For instance, the robust relationship between AoA and the ultimate L2 attainment level has been proved in a range of studies (Flege, Yeni-Komshian et Liu, 1999; Flege, Munro and Mackay, 1995; Albirni, 2018). Although there is still on-going controversy on the interpretation of age effects in SLA, and inconsistent finding showing evidence for critical-period effects[1] in L2 acquisition (Flege, Yeni-Komshian et Liu, 1999) as well as evidence against them, the link between AoA and L2 proficiency is no longer debated. For example, certainly in the domain of phonology, Flege, Munro and Mackay (1995) rated the L2 English pronunciation of 240 Italian natives, all with a minimum of 15 years of residence in English-speaking Ontario, Canada. As results showed, the AoA systematically predicted accent ratings, indicating that as AoA increases, the foreign accent grew stronger. Similar evidence for the linear relationship of accent and AoA was reported by Flege, Yeni-Komshian and Liu (1999) for 240 native speakers of Korean who differed according to AoA in the United States (1 to 23 years), but were all experienced in English (mean length of residence = 15 years). Another study carried out by Albirni (2018) provided evidence of the link between AoA and L2 native-like attainment targeting various syntactic and morphosyntactic phenomena in Arabic-English heritage speakers. Focusing on subject-verb agreement, plural morphology and relative clauses, the findings revealed significant differences among the bilingual and monolingual group that an older AoA correlated positively with children's performance in HL Arabic in three targeting tasks. In addition, AoA is increasingly being considered as a major variable that influences the semantic processing of word and pictures. Ghyselinck, Custers and Brysbaert (2004) investigated

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[1] Critical Period effect is part of Critical Period Hypothesis which refers to the fact that there is a threshold age after which language acquisition is much more difficult and ultimately less successful.

whether the meaning of visually presented words is activated faster for early-acquired words than for late-acquired words. Dutch speakers participated in the experiment and were instructed to decide whether a stimulus word is printed in uppercase or lowercase letters. However they need to respond with a verbal label "living' or "nonliving" that is either congruent with the meaning of the word (e.g. saying "living" to the stimulus DOG) or incongruent (e.g. saying "nonliving" to the stimulus dog). The chosen words were controlled on frequency, familiarity, word length and numbers of syllables. Results showed a significant congruency effect that was stronger for early-acquired words than for late-acquired words suggesting that early-acquired concepts can be activated more easily than those of later-acquired concepts. Ghyselinck, Custers and Brysbaert (2004) concluded that AoA is an important variable in the activation of the meaning of visually presented words.

Another linguistic factor, the extent of L2 immersion, though received less attention than AoA, is also proved to have an impact on attained L2 proficiency. Granena and Long (2012) conducted a study to investigate the potential roles of L2 immersion and language aptitude in three different domains, including phonology, morphology-syntax and lexis and collocations. 65 Chinese-English bilinguals and 12 native speakers participated, where bilinguals were grouped by age of onset (AO)- 3-6, 7-15 and 16-29 years. Taking the length of residence (LOR) as an important indicator for L2 immersion, the results showed that LOR was non-significantly correlated with ultimate attainment of phonology and morphology-syntax when AO was controlled for but LOR showed predictive power in the domain of lexis and collocations, even after controlling for AO. Jimenez (2022) also considered LOR as an indicator of L2 immersion and examined how L2 learners of Spanish with different proficiency levels and native Spanish speakers discussed imprecise quantities during oral interviews in which they responded to money-related questions. Taking the length of residence (LOR) in Spanish speaking countries as an indicator, it investigated the effect of L2 proficiency and cumulative length of immersion abroad in the learners' lexical knowledge of approximators (APs). For example, *casi* '*almost*', *como* '*like*' and *y pico* '*-ish*' in Spanish provide instructions for utterance interpretation by establishing upper limits (e.g., *casi*), lower limits (e.g., *y pico*), or no specific limits (e.g., *como*), and APs make semantic boundaries fuzzy. The results showed a significant predictive power of the extent of L2 immersion to accelerate lexical acquisition, promoting a more target-like expression of numeric imprecision. Besides offline research, a study carried out by Serrander (2011) tapped into the effects of L2 immersion in Swedish-Spanish bilingual lexical processing in single word

production. Swedish-Spanish bilinguals named pictures in Spanish in two picture-word interference experiments, one with only non-cognates, and one including cognates. The results showed that cross-linguistic influence is dependent on length of immersion, and the more immersed participants performed very similarly to what is usually the case in highly proficient bilinguals while the less immersed didn't.

In SLA literature, it has been noted that one language usually dominates the other even in cases of simultaneous acquisition of two languages from birth (Grojean, 1982; Döpke, 1992). A range of studies have highlighted the evidence of exposure as a causal factor of language dominance in bilingual learners. Thus, language dominance is taken in the sense of the language to which the bilingual is predominantly exposed in the majority of social situations, particularly the language in which bilinguals obtain more input on a regular basis (Argyri, & Sorace, 2007). In that sense, the bilinguals' amount of exposure to each of their two languages can be used as an indicator of language dominance. This extent of daily L2 vs L1 usage is proven to have an impact on bilinguals' L2 proficiency (Jia et al., 2002; Flege, Yeni-Komshian and Liu, 1999). In Flege, Yeni-Komshian and Liu's (1999) study, by comparing two groups of 20 native Korean participants who differed in self-reported language use but were matched for AoA, they found that the Koreans who used English relatively often and Korean relatively seldom had a significantly better pronunciation of English than those who used English relatively seldom. The conclusion that language use affected Koreans' pronunciation of English independently of AoA agrees with the results of English by Italian/English bilinguals (Flege et al., 1995a). In addition, comparing Mandarin-English bilingual immigrants' performance in L2 (English) grammaticality judgment tasks in the domain of morphology and syntax, Jia et al (2002) found the association between better performance on L2 tasks with more people speaking the L2 at home and a higher frequency of speaking the L2 at home. In other words, they found the extent of daily L2 vs L1 usage did influence attained L2 proficiency and the higher extent is the higher L2 proficiency could be.

To my thesis's interest, I mainly included three linguistic factors, AoA, L2 cumulative immersion, and the extent of L2 vs L1 usage (termed L2 vs L1 dominance ratio here) and investigated their potential predictive power in Mandarin learners of English's interpretations of English state-change verbs. I expect all three factors to show modulating power. To put it more precisely, I expect that the lower the AoA, the higher the L2 cumulated immersion, and the higher L2 vs L1 dominance ratio, the more likely Mandarin learners of English are to

pattern English native-like on interpreting English state-change verbs. I will expand on this further below.

3. Current study

Overall, the cross-linguistic difference in lexicalizing state-change verb and state-change verb related structures is observed between Mandarin and English (Chen, 2018; Tai, 2003) with English state-change verbs in past tense convey both action completeness and state change whereas these two features are encoded with RVC and an external aspectual marker *le* in Mandarin. However, little is known about whether the systematic cross-linguistic difference could give rise to the differential linguistic behaviors in Mandarin learners of English and English native speakers. In addition, it is unclear whether and how language mode and individual linguistic experience play a role in this cross-linguistic comprehension. Therefore, I compared Mandarin-English bilinguals to English native speakers living in English speaking countries respectively with two comprehension tasks, namely a Gradient Plausibility Judgment Task and a Multiple-Choice Interpretation Task.

My thesis aims to answer three research questions:

1. Cross-linguistic influence is assumed: do mandarin learners of English interpret state-change verbs in the same way as English native speakers?
2. Does language mode play a role among Mandarin learners of English?
3. Do individual differences, namely AoA, L2 English immersion and the extent of daily L2 vs L1 usage have an impact on the extent of CLI?

3.1 Predictions

3.3.1 R1: Cross-linguistic influence is assumed: do mandarin learners of English interpret state-change verbs in the same way as English native speakers?

Generally, Mandarin learners of English are expected to find it challenging to interpret English state-change verbs due to the negative influence from their L1 Mandarin. In other words, the Mandarin specific way of encoding state-change with the help of RVCs, brings up challenges in the process of interpreting English state-change verbs which themselves achieve the

fulfillment of state-change among Mandarin learners of English. A significant response difference is expected in the critical trials across participant groups.

3.3.2 R2: Does language mode play a role among Mandarin learners of English?

Language mode is expected to have an impact on Mandarin-English bilinguals' judgements. Mandarin learners of English who had a boost of Mandarin from the video are more primed into Mandarin thinking, making them activate the use of RVCs in the following tasks whereas those who had English immersion comparatively had lower activation level of that specific feature of Mandarin. Following R1 prediction, the language mode is expected to strengthen the divergence, namely a significant response difference in the critical trials.

3.3.3 R3: Do individual differences have an impact on the extent of CLI?

The last research question aims to test the effects of individual differences in the context of crosslinguistic influence. In other words, it sets out to answer the following questions: does the AoA, the amount of L2 English immersion, and the extent of daily L2 vs L1 usage modulate the extent of CLI.

In the course of L2 acquisition, AoA has been proved to contribute to higher L2 performance in a range of studies in domains including phonology, semantics processing and morphosyntax (Flege, Yeni-Komshian et Liu, 1999; Flege et al., 1995a ; Flege, Munro and Mackay,1995; Jimenez, 2022; Albirni, 2018; Ghyselinck, Custers and Brysbaert, 2004). In addition, the L2 immersion has been proved to have predictive power in bilinguals' L2 ultimate attainment in lexis domain both in offline and online research (Granena and Long, 2012; Jimenez, 2022; Serrander, 2011). The extent of daily L2 vs L1, though received less attention, has also been documented to associate significantly with L2 proficiency level in the domains of morphology and syntax (Jia et al., 2002). Based on those findings, I assume that the earlier Mandarin learners of English start L2 learning, the more dominant they are in English, the longer they have been living in English-speaking countries, and the more intensive they are engaged with English in a regular basis, are more likely to interpret and pattern state-change verbs and related structures more English native-like, namely statistically higher ratings in the critical trials.

4. Methodology

4.1 Participants

Two groups of people participated in my study. 52 English native speakers (mean age 36 years, age range 18-78) were recruited via Prolific who live in English speaking countries (UK, Canada, New Zealand and Australia). All of them completed the experiments and filled out the Language History Questionnaire (LHQ3) (Li et al., 2019) and their data were included in the analysis. On the other hand, 105 Mandarin learners of English (mean age 30 years, age range 16-58) living in English speaking countries (USA, UK, Canada, New Zealand, Australia and Ireland) were recruited via both Prolific and social media. Noticeably, there were twice as many Mandarin speakers than English speakers. The reason is due to the fact that a between-factor (Video Immersion, see below) was included in the experiment design which taps on the third research question. In this case, the number of Mandarin learners of English was doubled to make sure that half the group of them were assigned with the same version of video as English native speakers.

4.2 Materials

In the present study, a short video session and three types of data gathering methods including a Gradient Plausibility Judgment Task, a Multiple-Choice Interpretation Task and a Language History Questionnaire (LHQ3) (Li et al., 2019) were employed. The video session and two behavioral tasks were implemented on Gorilla, while the language history questionnaire was implemented on Qualtrics.

4.2.1 Gradient Plausibility Judgment Task

The Gradient Plausibility Judgment Task was used to collect participants' semantic plausibility ratings of the stimulus. It tapped into my first research question whether there are cross-linguistic influence effects on interpreting state-change verbs in English in Mandarin learners of English.

It was a 2x2 experiment task with two main factors: Plausibility (Logical or Illogical) and Verb Type (English verbs which have either an RVC or a non-RVC translation equivalent in Mandarin). A total of 4 conditions were tested (See Table 1) and each list consisted of 8 tokens per condition, for a total of 32 items per list. Each participant saw one of the four lists

that counterbalanced items and conditions of experimental trials. 32 target action verbs were employed (i.e. 夹 *jia* 'cracked', 打 *da* 'shoot', 吹 *chui* 'extinguished', 填 *tian* 'filled', 锤 *chui* 'broke', see more in Appendix 1). The selection of the target verbs was based on the approximate English counterparts, which are typical verbs of state change, e.g. verbs of killing (e.g. *kill*), break verbs (e.g. *break, smash, crack*), cooking verbs (e.g. *cook*), verbs of cutting (e.g. *chop*), bend verbs (e.g. *bend*) (Levin, 1993). The Mandarin counterparts (i.e. 夹 *jia*, 打 *da*, 关 *guan*) are solely action verbs (V1) and they do not entail a state change if presented alone without V2 indicating the result. Except target verbs, a total of 32 filler verbs were interspersed with the target trials in the judgment task, and they are English verbs that have non-RVC translation equivalent in Mandarin (See line 3 and 4 in Table 1). Non-RVC verbs do not entail any state-change and they are expected not to activate any representations of state-change for Mandarin learners of English. It is important to note here that the frequency of each target verb and filler verb is recorded. The Frequency represents the log-transformed lexical frequency of verbs from SUBTLEXus, a corpus of American subtitles which is argued to effectively capture frequency of occurrence in every language use (Brysbaert and New, 2009). In order to rule out the effect of frequency on participants' performance in this task, a t-test was conducted to check the frequency difference between critical conditions where 32 target verbs are RVCs and experimental (control) conditions where 32 verbs are NonRVCs. The results showed no statistically significant divergence between two groups (t(61)=1.3111, P=0.1947).

Each target sentence was composed of two clauses, the first clause describing someone perform an action on an object, and the second clause describing an event either logically following from the event described in the first clause, or an event that is not logical given the event described in the first sentence or canceling the result of the event described in the first sentence. Table 1 below shows one example target sentence in each condition. Illogical RVC condition is the critical trial in the experiment design whereas Logical conditions are the control trials.

Table 1. Sample target sentences in plausibility judgment task

Logical/RVC	She killed a chicken but it took her a long time.
Illogical/RVC	She killed a chicken but it didn't die.
Logical/Non-RVC	I owned this house but I didn't like it at all.

| Illogical/Non-RVC | I owned this house but I didn't have any property under my name. |

The participants were instructed to read each sentence carefully and rate them as fast as possible on a 5-point scale, with 1 being "completely implausible", 2 "implausible", 3 "unsure", 4 "plausible" and 5 "completely plausible". Acceptance of the critical trials (Illogical RVC condition) suggest that the resultant state change is not crucial to the meaning of the target verb and thus can be canceled while rejections of the sentences indicate the opposite.

4.2.2 Video Immersion

In my study, in order to tap into the role of language mode, a short video immersion was presented. It aimed to bias Mandarin learners of English into either monolingual- or bilingual language mode. That is to say, in the Gradient Plausibility Judgment Task, Mandarin learners of English who watched English version video are expected to behave more English native-like, whereas those who watched the Mandarin video are expected to activate both Mandarin and English, so that they should behave as bilinguals who are expected to activate the representations of RVCs in Mandarin. One of two 2-minute YouTube videos was presented. These varied in language but were identical in food context. Mandarin learners of English were assigned either with an English version or a Mandarin version video whereas all the English native speakers watched the same English video. To account for the possible limitation of between-subject design, I compared the two video immersion groups on their language background variables, including AoA ($t = -0.61355$, $df = 94.287$, p-value $= 0.541$), L2 immersion ($t = 0.47559$, $df = 94.172$, p-value $= 0.6355$) and L2 vs L1 usage ($t = -1.2326$, $df = 92.827$, p-value $= 0.2208$), and no significant differences were found between the groups.

4.2.3 Multiple-choice Interpretation Task

A Multiple-Choice Interpretation Task was used to elicit the preferred interpretations of those chosen 32 target state-change verbs both in Mandarin and English. Once the interpretations of the majority of the equivalent English state-change verbs show moot attainment (the resultant state change may not have occurred) in Mandarin but not in English, it provides direct confirmation that the Mandarin linguistic feature, RVCs, which is used with aspectual marker

le, gives rise to the CLI. Thus, the Multiple-Choice Interpretation Task was designed to boost my prediction of the main research question.

The Multiple-Choice Interpretation Task included a total of 32 target sentences that contained the same target verbs in the first Gradient Plausibility Judgment Task and 32 filler sentences. Each sentence was composed of a simple clause stating someone did an action on an object, and three interpretation options to tap into the participants' preferences for the most likely result of the action. English native speakers finished the task in English whereas Mandarin learners of English in Mandarin. In the Mandarin version, the target sentence with a simple clause was used with the perfective aspect marker *le* to describe that someone has completed an action. Example sentences are shown below.

Table 3. Sample target sentences in multiple-choice interpretation task

他杀了一只鸡。	He killed a chicken.
鸡死了。	The chicken was dead.
鸡可能死了，可能没有。	The chicken might have been dead, might not.
鸡没死。	The chicken was not dead.

In order not to bias participants' choices, filler sentences were counterbalanced with 16 sentences where the end results were ambiguous and 16 sentences where the choices were unambiguous and the third choice was always the default one (See Appendix 3). Two example sentences of each type in both Mandarin and English are presented. Participants were instructed to read each sentence carefully and choose the most likely result of the completed action as entailed in the test sentence.

Table 4. Filler sentences with ambiguous results

他今天抽了一袋的烟 。	He smoked a whole pack of cigarettes today.
他很心烦。	He was annoyed.
他可能很心烦，可能没有。	He might have been annoyed, might not.
他不心烦。	He was not annoyed.

Table 5. Filler sentences with unambiguous results

他用手指戳了轮胎	He poked the tire with his finger.
轮胎破了	The tire was blown
轮胎可能破了，可能没有	The tire might have been blown, might not
轮胎没有破	The tire was not blown

4.2.4 Language History Questionnaire

Research in language studies finds it important to assess the language background of language speakers in order to predict or correlate with speakers' linguistic behaviors. As a dynamic web-based research tool, LHQ3 has much to offer for this purpose by collecting data on the context and habits of language use, proficiency in multiple languages, and dominance and cultural identity of the languages acquired (Li & Zhao, 2020).

In terms of the content of the Language History Questionnaire in my study, four main domains were involved (See Appendix 4). They include language background, language proficiency, language usage and language dominance. Four aggregate scores are designed by LHQ3 (Li et al., 2019) to represent participants' overall proficiency, dominance and immersion levels of each language they have acquired. The aggregate scores related to my study are language immersion, especially the L2 English immersion score in Mandarin English bilinguals and the language dominance, namely L2 English dominance. To put it more clearly, the aggregated scoring of L2 English immersion here is based on participant's age, Age of Acquisition(AoA), and Years of Use of language (*e,g. Indicate your native language(s) and any other languages you have studied or learned, the age at which you started using each language in terms of listening, speaking, reading and writing, and the total number of years you have spent using each language*). A participant's overall immersion score of English can be written as:

$$Immersion_i = \frac{1}{2}\left[\sum_{j=\{R,L,W,S\}} \omega_j \left(\frac{Age - AOA_{ij}}{Age} + \frac{YoU_i}{Age} \right) \right]$$

Shortly speaking, a Mandarin participant's English immersion score is based on her Age, Age of Acquisition (AoA) of four language components (reading, listening, speaking and writing) and Years of Use (YoU) of English. In addition, LHQ3 applies a scaling factor (1/2) to the

function to ensure AoA and YoU have equal weight on calculating the overall immersion score, and to normalize the score to a range between 0 and 1 (with 1 indicating the most native-like immersion level into a language).

In addition, the aggregated scoring of L2 English dominance is based on both the participant's self-reported proficiency (e.g. *Rate your current ability in terms of listening, speaking, reading, and writing in each of the languages you have studied or learned*) and the time (hours per day) spent on different components of each language (e.g. *Estimate how many hours per day you spend engaged in the following activities in each of the languages you have studied or learned; Estimate how many hours per day you spend speaking with the following groups of people in each of the languages you have studied or learned*). The self-rated proficiency is calculated as :

$$Proficiency_i = \frac{1}{7} \sum_{j=\{R,L,W,S\}} \omega_j P_{i,j}$$

Here, {R,L,W,S} stands for Reading, Listening, Writing and Speaking components of a language. $P_{i,j}$ stands for a participant's self-rated proficiency level to the jth component of his i^{th} language. Since it is rated on a 7-point Likert scale, we use a scaling factor of 1/7 to normalize it into a range between zero and one (with 1 indicating the native language-like proficiency level). ωj represents a weight assigned to the jth linguistic component (Li & Zhao, 2020). In all, a participant's overall dominance score of his $_i^{th}$ language can be written as:

$$Dominance_i = \sum_{j=\{R,L,W,S\}} \omega_j [\frac{1}{2}\left(\frac{P_{ij}}{7}\right) + \frac{1}{2}\left(\frac{H_{ij}}{K}\right)]$$

Here, $H_{i,j}$ stands for the total estimated hours per day a participant spent on the jth linguistic aspect (e.g., speaking) of her j^{th} language. K is a constant serving as a scaling factor, currently set to be 16. Another scaling factor 1/2 is applied to the function to ensure the proficiency and the daily usages of a language to have equal weight on calculating its dominance score. {R,L,W,S} stands for Reading, Listening, Writing and Speaking components of a language..

In my study, all participants' aggregated scores representing their overall proficiency, dominance and immersion levels of each language they have learned were calculated and recorded based on the aggregated calculation system from LHQ3.

As for the procedure of the study, participants were assigned to either an English or Mandarin video and finish the Gradient Plausibility Judgment Task, the Multiple Interpretation Task and the Language History Questionnaire (LHQ3).

5. Analysis and Results

Based on the selection parameters which were specified in language background on Prolific, 52 English native speakers took part in the study and all of their data were included for analysis. They watched the English video before all the experiment kicked off and each of them was assigned to one out of four lists in the Gradient Plausibility Judgment Task, making the number of participants per list balanced. As indicated in Table 6, 39 of them are female and the remaining 13 are male. They are between 18 to 78 years old, and the mean age is 36.

In terms of English participants' language background, as Table 7 indicates, 30 out of 52 are English monolinguals, while the rest are bilingual and multilingual speakers. A diverse range of languages was recorded in the questionnaire, including French, Spanish, Italian, German, Latin, Welsh, Swedish, Swahili and Japanese. The Multilingual Language Diversity (MLD) score is calculated across language groups according to which we can better describe bilingualism through language usage in terms of context and diversity (Gullifer & Titone, 2019). MLD will be in range between 0 and 2, where a monolingual participant's MLD generates a zero and a bilingual with a more balanced usage and fluency of her two languages generates one. For example, the average MLD in bilingual group (2L) is 0.8, indicating most of bilingual participants' balanced language usage and fluency of two languages.

Table 6. English participants' demographic information

Education Level				Sex		Age
Non-degree	Bachelor	Master	Doctor	Female	Male	Participants' Age
16	28	6	2	39	13	18-78 (M = 36)

Note: 'non-degree' participants are those who did not join a college or university and did not receive an academic degree.

Table 7. English participants' language diversity and MLD score

	Number of participants			Multilingual Language Diversity (MLD)		
1L	2L	3L	4L	2L	3L	4L
30	13	3	6	0.41-0.93 (M = 0.8)	1.25-1.46 (M = 1.35)	1.61 - 1.78 (M = 1.71)

Note: Participants are grouped according to how many languages they use. For example, 1L indicates English monolinguals. Noticeably, when a participant is monolingual, her MLD generates a zero which didn't show in the table.

As for another group of participants, a total of 105 Mandarin learners of English took part in the study. Among them, 64 were recruited via Prolific based on the specified selection criteria, and the remaining 41 were recruited through Facebook and personal contact. Among these participants, two of them were excluded due to the poor quality of Language History Questionnaire(LHQ3) on Qualtrics. Before experiments started, 52 participants were assigned to watching English version video, and the remaining 51 watched Mandarin video. The number of participants per list in the Gradient Plausibility Judgment Task was pretty balanced, with 26 were assigned to list one, 27 to list two, 26 to list three and 24 to list four. Summing up, 103 out of 105 participants finished all the experiments and the questionnaire, and were included in the final analysis. Over 75% of participants were female, and the age range was 16 to 58, with the average age being 30.

Regarding the Mandarin participants' language background, 77 out of 103 were Mandarin English bilinguals, while the rest were multilingual speakers (Table 9). As reported in the questionnaire, except English, bilingual and multilinguals also speak French, German, Spanish, Italian, Portuguese, Hakka, Japanese, Korean, and some Chinese dialects (Fuzhou dialect, Chaoshan dialect). The age of L2 English onset ranged from 0 to 33 among Mandarin learners of English but most of them started to learn English at the age of 10.

Table 8. Mandarin participants' demographic information

Education Level				Sex			Age	
Non-degree	Bachelor	Master	Doctor	Female	Male	Non-binary	Participants' Age	Age of L2 onset
8	36	43	16	76	27	1	16-58 (M =30)	0-33 (M=10)

Note: 'non-degree' participants are those who did not join a college or university and did not receive an academic degree.

Table 9. Mandarin participants' language diversity and MLD score

Number of participants			English Dominance score	Dominance Ratio	English Immersion score
2L	3L	4L			
77	19	7	0.0971- 0.9219（M=0.504）	0.2083 - 3.1072 (M=0.9745)	0.2697- 0.9857（M= 0.6480）

Note: Participants are grouped according to how many languages they use. For instance, 2L indicates Mandarin English bilingual speakers. Noticeably, both the English Immersion score and English Dominance score will be in a range between 0 and 1 with 1 indicating the most native-like immersion and dominance level into English. Here, Dominance Ratio refers to the ratio of the dominance score of English against that of the Mandarin. Using the ratio, it can easily determine if a participant is balanced multilingual, or is someone having one language dominant over another language

5.1 The effect of cross-linguistic influence

The rating score for each sentence by each participant was recorded and analyzed. 52 English native speakers and 52 Mandarin learners of English watched the same English version video before experiments began. The total observations received were 3328 (104 participants * 32 target sentences). The dependent variable Response was coded as categorical data: A = score '5'; B = score '4'; C = score '3'; D = score '2', and E = score '1'.

The structure of my experimental data is nested and grouped, with multiple subjects responding to multiple items. A common statistical model that reflects this structure of experimental data is a Mixed-Effects Model (Baayen, 2008). However, mixed-effects models are primarily used to explore data with nominal binomial dependent variables (Yes/No, 0/1,

A/B) or continuous numerical dependent variables, for instance reaction time. In order to account for multinomial ordinal dependent variables by means of a Mixed-Effects Model, here I used the Mixed-Effects Regression Model for ordinal data that belongs to a family of cumulative link mixed models (CLMMs). Cumulative link models are a powerful model class for ordinal data since observations are treated rightfully as categorical. These models use regression methods similar to linear models while respecting the ordered nature of the observations (Chirstensen & Brockhoff, 2013). I used the package Ordinal (Christensen, 2015) in its version 2019.12-10 available in R version 4.1.3. I used the function clmm() which can handle the crossed random-effects structure of two factors- Subject and Stimulus[2], generalizing over the bias of individual subjects and stimuli. The formula takes Response as the dependent variable, Verb, Plausibility, and Participant Group as independent variables. As for data visualization, shown in Figure 1, English native speakers generally rated logical conditions higher than Mandarin learners of English, and the average rating score difference between Logical RVC and Logical NonRVC looks minor in both participant groups. In terms of the control condition, Illogical NonRVC, two groups' average response scores were almost identical, however, numerically, there was a difference in the critical condition, Illogical RVC.

The model explains 58% variance through both fixed and random effects in my data (condition R2 = 0.586). Summing up the outcomes of the Mixed Effects Ordinal Regression model, according to Table 10, the model finds a main effect of Plausibility (β = 4.2878, SE=0.2211, z=19.390, p<0.001) and a significant three-way interaction among Verb, Plausibility and Participant Group (β = -0.9535, SE=0.2934, z=-3.250, p=0.001). To be given a clear picture of where the interaction appeared, a post hoc comparison was conducted. I picked up four specific factors that are relevant to the first research question shown in Table 12. As we can see, the results showed a significant difference of ratings between English group and Mandarin group in Illogical RVC condition (β = -1.0322, SE=0.198, z=5.201, p < 0.0001), where Mandarin group rated target stimulus with higher grades than English group. In addition, there was a significant divergence in rating condition Logical RVC (β = 0.9295, SE=0.220, z=-1.494, p = 0.0006) and Logical NonRVC (β = 0.7152, SE=0.215, z=3.327, p =0.0198) between two groups, where the English group rated stimuli with higher grades

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[2] My data is also grouped by verbs, because of the paris of sentence that same verb used in two conditions (illogical/logical). I also checked the model taking Verb as one of the random effects (see Appendix 5)

compared to the Mandarin group. No significant difference of ratings was found in the Illogical NonRVC condition (β = -0.2930, SE=0.196, z=-1.494, p =0.8110). In addition, there was no statistically difference between Illogical RVC and Logical RVC in Mandarin participants (β = -0.4365, SE=0.198, z=-2.201, p=0.3511).

Figure 1. Average response score per condition across participant group
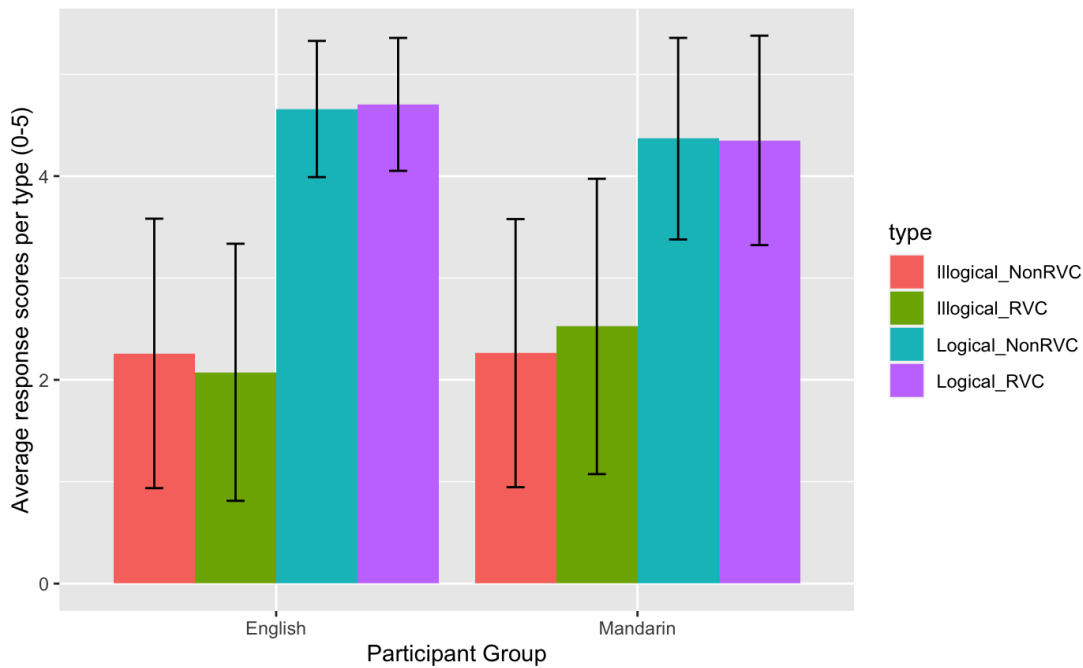
Note: The error bar here represents how spread out the participant's responses are across different stimuli types.

Table 10: Fixed-effects factors

Predictors	Odds Ratios	std. Error	CI	p
Verb [RVC]	0.74	0.15	0.50 – 1.09	0.128
Plausibility [Logical]	70.82	15.65	45.92 – 109.22	**<0.001**
participant group [Mandarin]	1.30	0.26	0.89 – 1.91	0.179
Verb [RVC] * Plausibility [Logical]	1.71	0.51	0.95 – 3.07	0.074
Verb [RVC] * participant group [Mandarin]	2.08	0.39	1.44 – 3.00	**<0.001**

Plausibility [Logical] * participant group [Mandarin]	0.37	0.08	0.25 – 0.55	**<0.001**
(Verb [RVC] * Plausibility [Logical]) * participant group [Mandarin]	0.38	0.11	0.21 – 0.67	**0.001**
Observations	3328			
Marginal R^2 / Conditional R^2	0.472 / 0.586			

Table 11: Random-effects factors

Groups	Name	Variance	Std.Dev.
sentence	(Intercept)	0.3499	0.5915
ID	(Intercept)	0.5565	0.7460

Table 12. Output of Post Hoc test

Condition	P-value	SE	Estimate
Illogical RVC	P<0.0001 *	0.198	-1.0322
Illogical NonRVC	P=0.8110	0.196	-0.2930
Logical RVC	P=0.0006 *	0.220	0.9295
Logical NonRVC	P=0.0198 *	0.215	0.7152

5.2 The effect of video immersion

Data from 103 Mandarin learners of English were included in this analysis, and the total number of responses is 3296 (103 participants * 32 target sentences). 52 Mandarin speakers were assigned with English version video and the remaining 51 watched the Mandarin version video. The dependent variable Response was coded the same way as in the previous analysis, and Mixed Effects Regression Model for ordinal data was also used handling the two crossed random-effects, Subject and Stimuli. The formula takes Response as the dependent variable, Verb, Plausibility, and Video Type as independent variables.

As for the data visualization, shown in Figure 2, ratings in Logical conditions (RVC, NonRVC) were generally higher than Illogical conditions, and the differences in the average response scores between two video groups looks minor. In Illogical conditions, the average

response score is below 3, suggesting that Mandarin participants were rejecting the illogical sentences. Specifically, participants who watched English video generally gave higher ratings than Mandarin video group, and some divergence of average response scores is observed.

Figure 2. Average response score per condition across video group
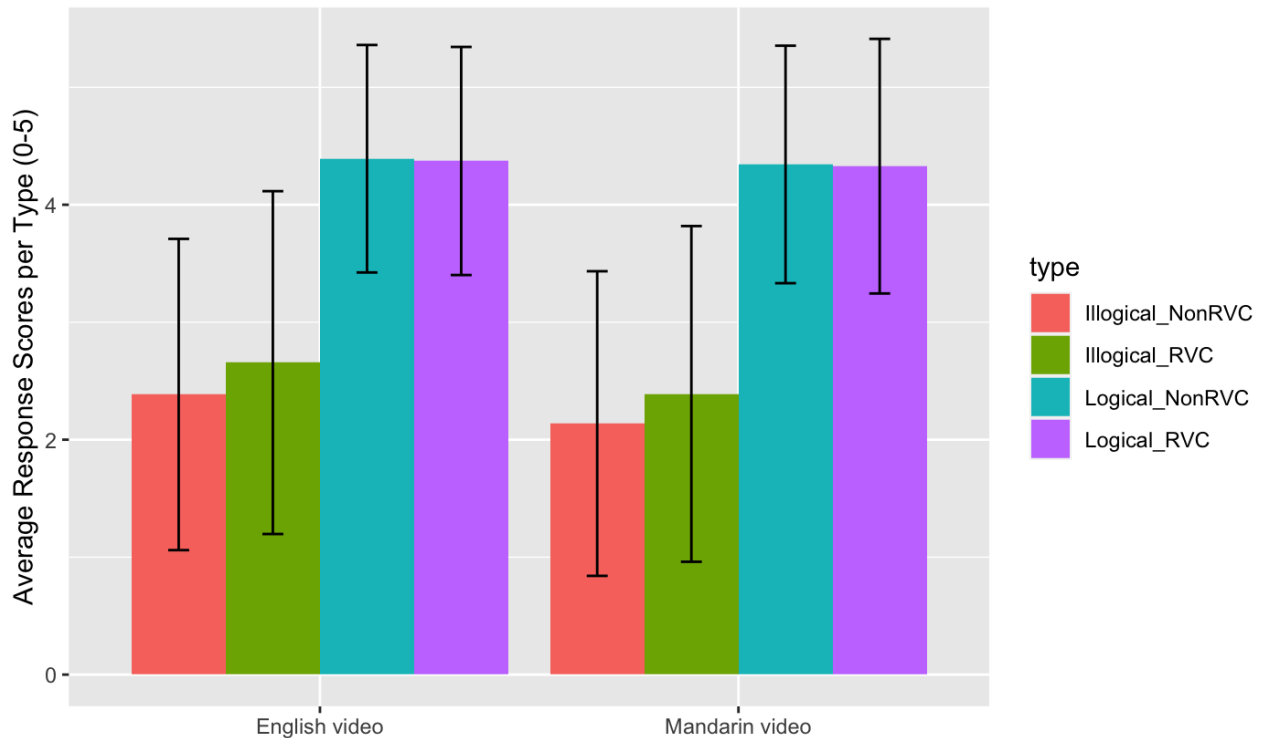
Note: The error bar here represents how spread out the participant's responses are across different stimuli types.

The regression model covers 55% of variance through both fixed and random effects in the data (condition $R^2 = 0.55$). Speaking of the outcome of the model, it finds significant effects of the main factors, Plausibility ($\beta = 3.30363$, SE=0.24823, z=13.309, p<0.001) and Video Type ($\beta = -0.56358$, SE=0.21009, z=-2.683, p=0.007). In addition, a significant two-way interaction was found between these two($\beta = -0.02486$, SE=0.29373, z=-0.085, p=0.004). A post-hoc test was further conducted to dig deeper into the effect of interaction on participants' responses. The results showed that there is no significant difference of ratings in Logical conditions ($\beta = -0.0389$, SE=0.193, z=-0.202, p=0.9971) across Video Groups, but a significant divergence was found in Illogical conditions ($\beta = 0.5447$, SE=0.186, z=2.932, p=0.0177).

Table 13. Fixed-effects factors

Predictors	Odds Ratios	std. Error	CI	p
Verb [RVC]	1.53	0.36	0.96 – 2.44	0.071
Plausibility [Logical]	27.21	6.75	16.73 – 44.26	**<0.001**
video type [Mandarin]	0.57	0.12	0.38 – 0.86	**0.007**
Verb [RVC] * Plausibility [Logical]	0.63	0.22	0.32 – 1.24	0.181
Verb [RVC] * video type [Mandarin]	1.04	0.20	0.71 – 1.52	0.846
Plausibility [Logical] * video type [Mandarin]	1.81	0.38	1.20 – 2.74	**0.004**
(Verb [RVC] * Plausibility [Logical]) * video type [Mandarin]	0.98	0.29	0.55 – 1.73	0.933
Observations	3200			
Marginal R2 / Conditional R2	0.390 / 0.555			

Table 14. Random-effects factors

Groups	Name	Variance	Std.Dev.
sentence	(Intercept)	0.5879	0.7667
ID	(Intercept)	0.6251	0.7906

5.3 The effect of individual linguistic differences

The Language History Questionnaire (LHQ3) in my study provided four aggregated scores per participant including language proficiency, language dominance ratio, language immersion and MLD. As mentioned before, to my thesis's interest, I mainly included three linguistic factors, AoA, L2 cumulative immersion, and the extent of L2 vs L1 usage (termed L2 vs L1 dominance ratio here) and investigated their potential predictive power in Mandarin learners of English's interpretations of English state-change verbs. As there was not good theoretical ground of the effect of MLD towards crosslinguistic influence, I decided not to take MLD into account. Thus, 103 Mandarin learners of English finished the language history questionnaire, and their AoA score, L2 English immersion score and ratio of English dominance were calculated according to the aggregated system on LHQ3 (Li et al., 2019). In order to simplify the Regression Model, only RVC conditions were included .
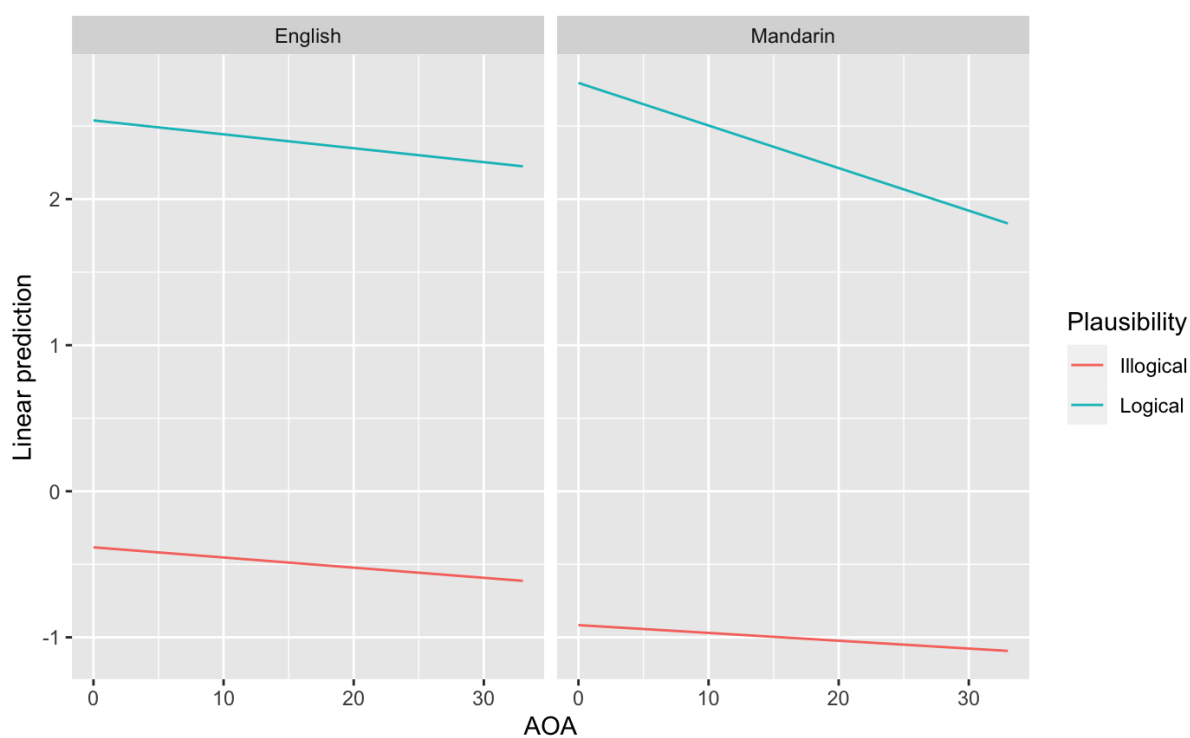
Firstly, the formula takes Response as the dependent variable, Plausibility, Video Type and AoA score as the independent variables. AoA here stands for the participants' age of starting using L2 English and it is calculated in the way that age minus self-reported years of use. As shown in Table 15, the outcome of the Regression Model told us that there is a significant two-way interaction in Plausibility and Video Type (β = 0.825221, SE=0.385391, z=2.141, p=0.032). From Figure 3 we can see that in Illogical RVC condition, both video groups witnessed a slight downward trend, showing that as AoA increases the rejection rate goes higher in both Video Groups. However, no further significant interaction was found in the post hoc test, indicating that even if the ratings in Illogical RVC condition decreases as AoA increases across video groups, the slopes are not significantly different. The Regression Model explained 55% variance of the data (condition R^2 = 0.55).

Table 15. Fixed-effects factors

Predictors	*Odds Ratios*	*std. Error*	*CI*	*p*
Plausibility [Logical]	18.53	6.59	9.24 – 37.19	**<0.001**
AoA	0.99	0.03	0.95 – 1.04	0.785

video type [Mandarin]	0.59	0.25	0.26 – 1.37	0.219
Plausibility [Logical] * AoA	1.00	0.02	0.95 – 1.04	0.911
Plausibility [Logical] * video type [Mandarin]	2.28	0.88	1.07 – 4.86	**0.032**
AoA * video type [Mandarin]	1.00	0.03	0.94 – 1.07	0.974
(Plausibility [Logical] * AoA) * video type [Mandarin]	0.98	0.03	0.92 – 1.04	0.451
Observations	1600			
Marginal R2 / Conditional R2	0.344 / 0.559			

Figure 3. Linear prediction of AoA across participant groups

In addition, in order to find out whether there is a predictive power of L2 English immersion on Mandarin-English bilinguals' interpretations of English state-change verbs, the formula takes Response as the dependent variable, Plausibility, Video Type and L2 English Immersion score as the independent variables. Summing up, the Regression Model explained around 56% variance of the data (condition $R^{2=}0.561$). The outcome of the model shown in Table 16 indicates an effect of the main factor, Plausibility (β = 3.5870, SE=0.75, z=4.764, p<0.001) and a significant three-way interaction among Plausibility, L2 English Immersion score and Video Type (β = 3.3515, SE=1.43, z=2.328, p=0.020). However, no further significant interaction was found in the post hoc test, indicating that there is no effect of L2 English Immersion on judgements on RVC conditions.

Lastly, I tested whether the amount of L2 English dominance has an impact on the judgment of RVC conditions. Here, noticeably, to overcome the large individual difference on participants' self-estimation of their daily usage of one or more languages, I used another new measurement of language dominance, expressed as a ratio between English dominance and Mandarin dominance scores, as:

$$Ratio_{Dominance} = \frac{Dominance_i}{Dominance_1}$$

It can give us a standardized estimate of language dominance that is more comparable across participants (Li et al., 2019). Summing up, the Regression Model explained around 56% variance of the data (condition $R^{2=}0.559$). As shown in Table 17, only an effect of the main factor, Plausibility (β = 2.3182, SE=0.3666, z=5.357, p<0.001) came up.

All in all,[3] the individual differences, AoA, L2 immersion and L2 English dominance ratio, showed no predictive power in modulating the judgements of RVC conditions among Mandarin participants.

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[3] I ran three different models because Plausibility and Video Type are always included as predictors and the interaction terms. If the individual factors are their interaction are included into the model, it would be extremely complex to interpret.

Table 16: Fixed-effects factors

Predictors	Odds Ratios	std. Error	CI	p
Plausibility [Logical]	36.13	27.20	8.26 – 158.01	**<0.001**
Immersion English	1.34	1.60	0.13 – 13.89	0.806
video type [Mandarin]	1.58	1.71	0.19 – 13.07	0.669
Plausibility [Logical] * Immersion English	0.35	0.37	0.04 – 2.78	0.322
Plausibility [Logical] * video type [Mandarin]	0.20	0.19	0.03 – 1.33	0.096
Immersion English * video type [Mandarin]	0.22	0.35	0.01 – 5.19	0.347
(Plausibility [Logical] * Immersion English) * video type [Mandarin]	28.54	41.09	1.70 – 479.57	**0.020**
Observations	1600			
Marginal R2 / Conditional R2	0.344 / 0.561			

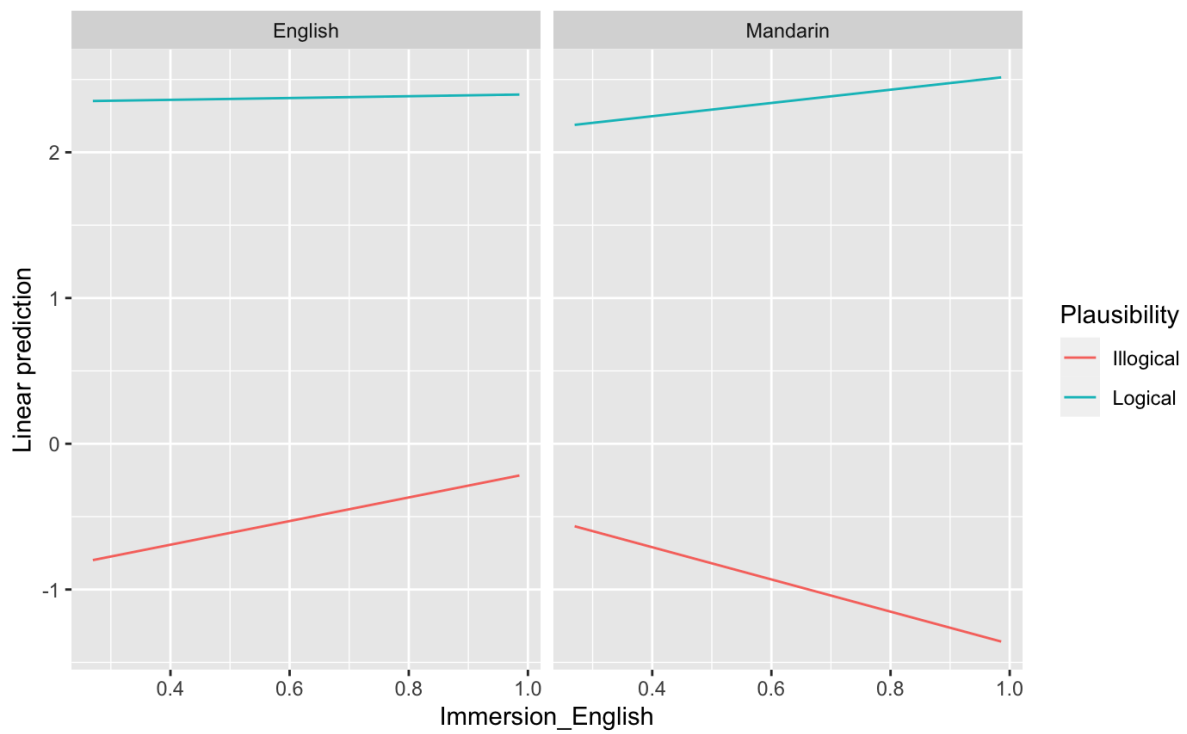**Figure 4. Linear prediction of English immersion score across participant groups**

Table17: Fixed-effects factors

Predictors	Odds Ratios	std. Error	CI	p
Plausibility [Logical]	10.16	4.40	4.35 – 23.72	**<0.001**
Ratio DominanceL1L2	0.71	0.28	0.34 – 1.52	0.383
video type [Mandarin]	0.45	0.25	0.15 – 1.33	0.149
Plausibility [Logical] * Ratio DominanceL1L2	1.85	0.68	0.90 – 3.79	0.094
Plausibility [Logical] * video type [Mandarin]	1.40	0.74	0.49 – 3.96	0.527

Predictors	Odds Ratios	std. Error	CI	p
Ratio DominanceL1L2 * video type [Mandarin]	1.32	0.67	0.49 – 3.55	0.586
(Plausibility [Logical] * Ratio DominanceL1L2) * video type [Mandarin]	1.17	0.58	0.44 – 3.10	0.757
Observations	1584			
Marginal R^2 / Conditional R^2	0.347 / 0.559			

Figure 5. Linear prediction of L1L2 Dominance ratio score across participant groups
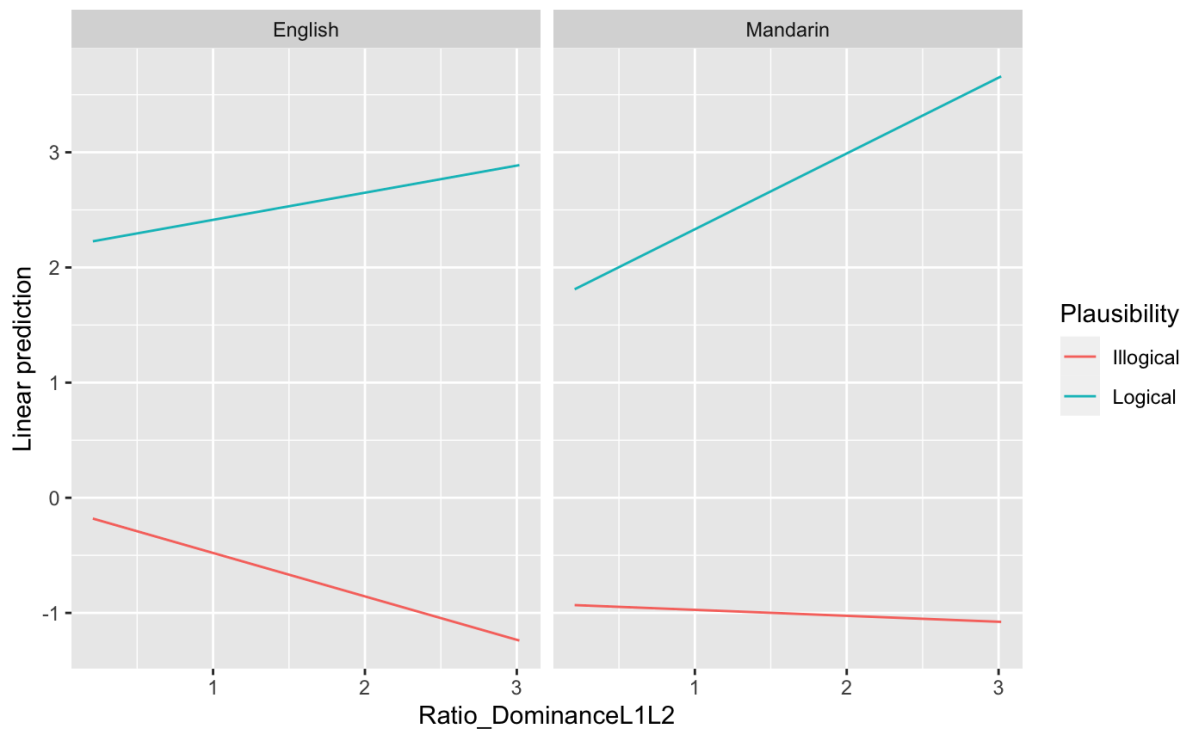
5.4 Multiple-Choice Interpretation Task

The choices for each target sentence were recorded and coded into one of the three categories, i.e. attainment, moot or no attainment. For instance, in the target sentence *She killed the chicken*, choice a *The chicken died* is considered attainment of a state change (i.e. the resultant state change of death has been realized), choice b *The chicken might have been died, might not* is moot attainment (i.e. the resultant state change of death may or may not have occurred), and choice c *The chicken didn't di*e is no attainment (i.e. the resultant state change of death did not occur).

The total number of responses by English speakers is 1664 (52 participants * 32 target verbs). Generally, the choice of attainment accounted for around 75% of overall responses, followed by 14% of no attainment choice and 11% of moot attainment. Figure 6 shows a decreased preference for attainment and an increased preference for moot attainment for the verbs from the left to the right ends on the horizontal axis. For example, target verbs like *spilled, caught, extinguished, torn, tossed*, received about 90% or above the choice of attainment. Noticeably, verb *shot* received around 77% the choice of moot, suggesting that this particular state change is only implied not entailed. In addition, around 48% of the English participants rated verb *peel*ed as moot attainment, which indicates that the verb does not in itself make any assertion about a state change.

A Chi-square analysis of independence was conducted to examine the relation between the preferred interpretations (choices) and the target verbs. The result shows a significant effect of Verb on the preferences (X-squared = 893.46, df = 62, p-value < 2.2e-16). This confirms that the English participants' interpretation of the verb meanings is significantly related to specific verbs.

Figure 6. The distribution of preferences for state change verbs in English speakers
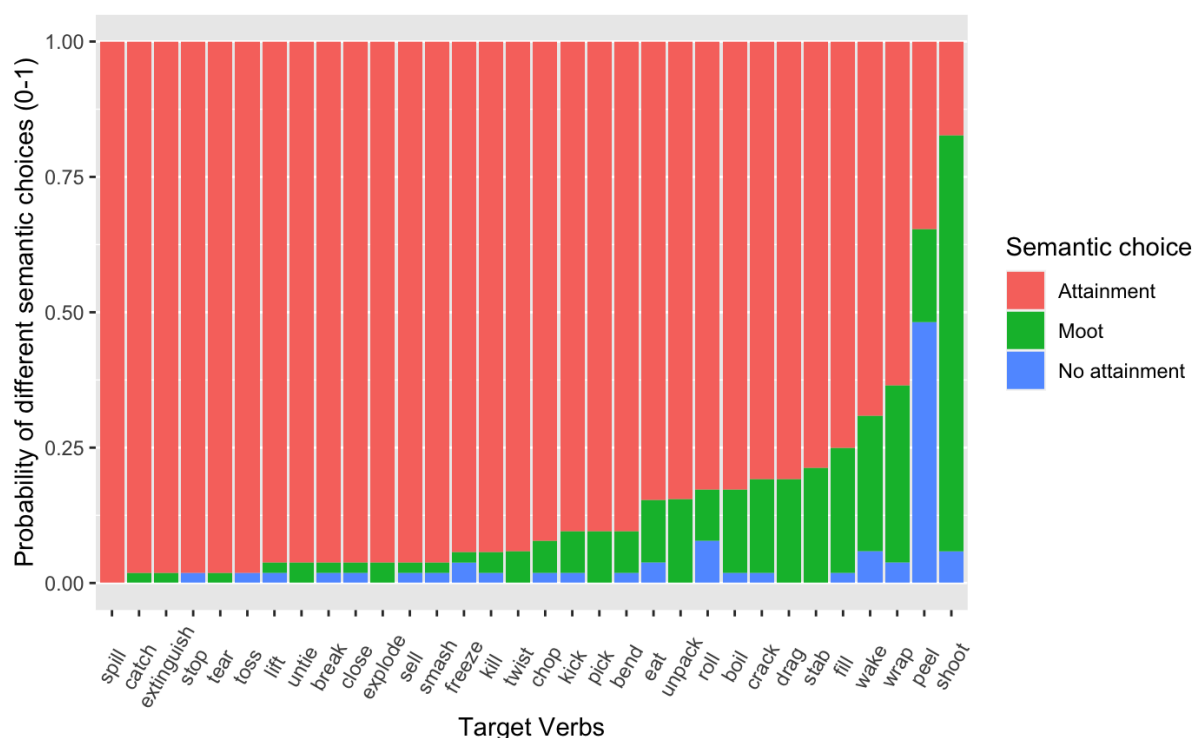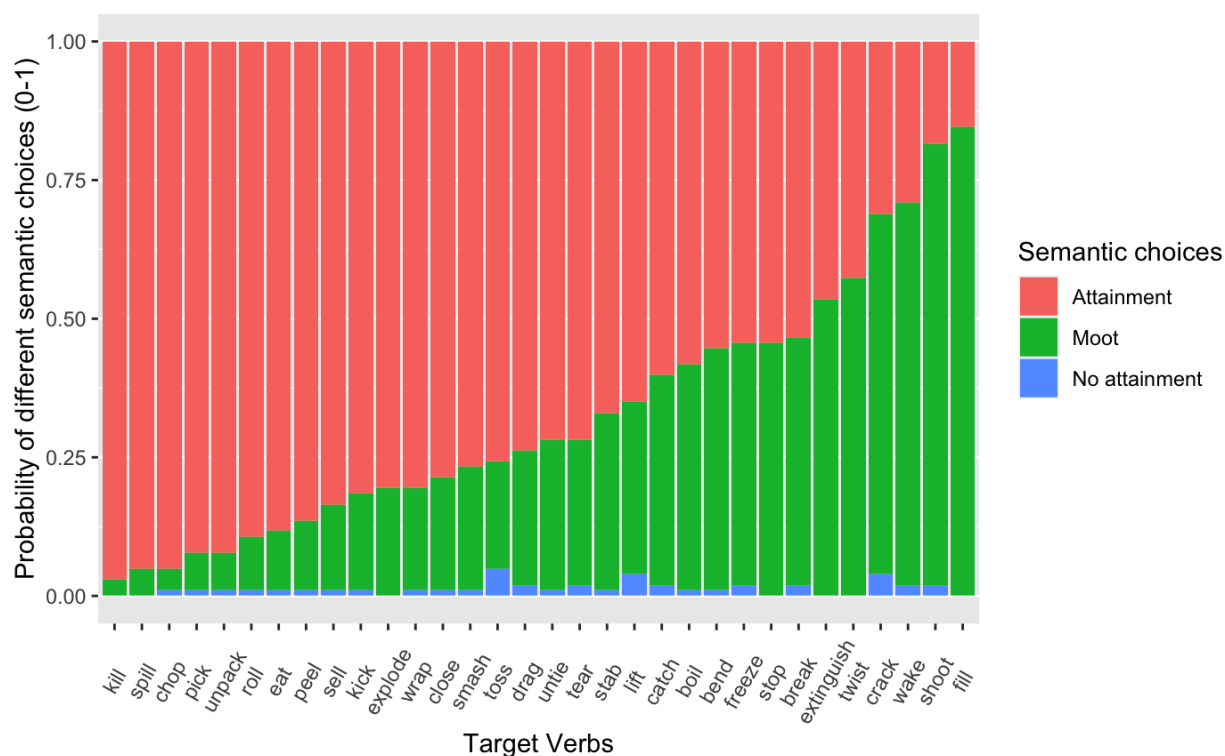

Note: the target verbs shown in the figure were not in past tense for the ease of presentation

The total responses received by Mandarin learners of English is 3296 (103 participants * 32 target verbs). For ease of presentation, the Mandarin verbs are shown in their approximate English counterparts in Figure 3. In general, 67% and 31% of responses refer to attainment and moot attainment respectively. The choice of no attainment is overall very minimal (mean proportion 1%). Shown by Figure 3, the implicature of state-change strength is observed, for example, verbs like 杀 *sha* 'killed', 切 *qie* 'chopped', 撒 *sa* 'spilled', 捡 *jian* 'picked', 拆 *chai* 'unpacked' received about 90% or above the choice of attainment, while the verbs like 填 *tian* 'fill' and 射 *she* 'shoot' received only 15% and 18% respectively the choice of attainment.

A Chi-square analysis of independence was also conducted. The result shows a significant effect of Verb on the preferences (X-squared = 778.32, df = 62, p-value < 2.2e-16). This confirms that the Mandarin participants' interpretation of the verb meanings is significantly related to specific verbs.

Figure 7. The distribution of preferences for state change verbs in Mandarin-English bilinguals

Note: the target verbs shown in the figure were not in past tense for the ease of presentation

In sum, by the comparison of the graph (Figure 8), English native speakers in general provided more attainment choices (75%) than Mandarin participants (68%), suggesting the state-change meanings of the target verbs in the sentence level are more accepted for English speakers, which is in line with what has been noted earlier that the fulfillment of state-change is realized by state-change verbs and English native speakers are aware of it. Noticeably, Mandarin speakers gave around three times more moot attainment responses (31%) than English groups (11%) and it reveals that Mandarin speakers are more tolerant and open to considering the both outcomes of the state-change verbs interpretation (attainment or moot option).

Figure 8. Distribution of the proportion of choice across participant groups
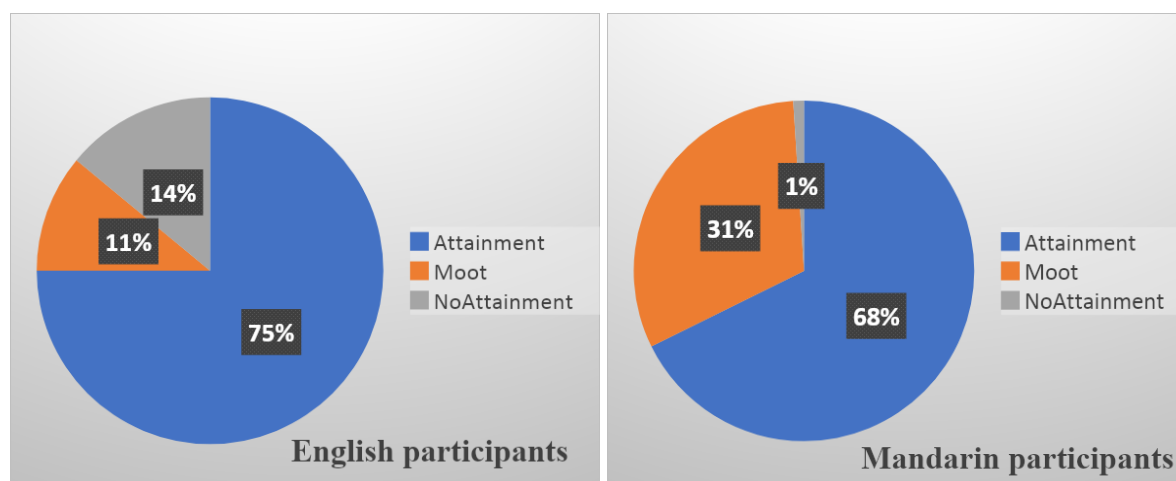
6. Discussion

Given the systematic differences in the lexicalization of state-change verbs and related structures in English and Mandarin, the aim of the present study was mainly to examine the cross-linguistic influence from L1 Mandarin to L2 English in Mandarin English bilinguals on interpreting state-change verbs in English. My thesis also examined whether and to what extent the language mode and individual linguistic differences modulate the effects of cross-linguistic influence in the domain of verb semantics.

I discuss the result of the Multiple-Choice Interpretation Task first. Following Chen (2018), the Multiple-Choice Interpretation Task was mainly used to elicit the preferred interpretations of target verbs both in English and Mandarin. Recall that Chen (2018) found that Mandarin speakers are sensitive to the state-change implicature, which varies from strong state-change implicature verbs (e.g. 关 guan '*close*'; 摘 zhai '*pick*'), to weak state-change implicature verbs (e.g. 煮 zhu '*boil*'; 洗 xi '*wash*'), with intermediately strong state-change implicature verbs (e.g. 切 qie '*cut*'). This continuum of state-change implicature indicates that there are equivalent English state-change verbs in Mandarin in which either the verb itself does not make any assertion about a state-change or a particular state-change is only implied but not entailed. Unlike Mandarin, English state-change verbs generally specify the fulfillment of the state-change. In my thesis, I hypothesized that this systematic difference will affect the interpretation of English state-change verbs by Mandarin learners of English.

Indeed, the results in my study were in line with what Chen (2018) claimed in the group of Mandarin speakers, showing a lexicalization of state-change implicature from strong state-change implicature (verbs like 杀 *sha* 'killed', 洒 *sa* 'spilled' and 切 *qie* 'chopped') to weak state-change implicature verbs (e.g 填 *tian* 'filled', 射 *she* 'shot' and 闹 *nao* 'woke'), with intermediately strong/weak state-change implicature verbs in between (e.g verbs like 煮 *zhu* 'boiled', 冻 *dong* 'froze' and 拦 *lan* 'stopped', etc.). In English, the results showed the fact that the majority of English state-change verbs (75%) do entail a state-change. Thus, following this different lexicalization pattern in state-change, my result provided insights into cross-linguistic variation between Mandarin and English and it confirms my prediction of RVC together with the aspectual marker *le* being the source of crosslinguistic influence when a Mandarin learner of English interpret English state-change verbs. In other words, it is because Mandarin contrasts typologically with English in its lexicalization of state-change by utilizing the specific RVC feature, which is frequently used with aspectual marker *le*, that the divergence in the performance of the plausibility judgment task should be evidence-based. This multiple-choice interpretation task motivates the following Gradient Plausibility Judgment Task and it serves as the interpretation ground, providing the evidence for the theoretical speculation.

With respect to the first research question, Mandarin learners of English provided significantly higher ratings in the critical conditions (Illogical RVC) compared to English native speakers, which confirms the prediction. Further results showing no significant divergence in the control condition (Illogical Non-RVC), indicating the effect of verb type (RVC) on how two participant groups responded. From the results, it is reasonable to argue that the use of RVC structure together with the aspectual marker *le* in Mandarin indeed gives rise to the challenges for Mandarin learners of English in the acquisition of English state-change verbs. English native speakers generally rated Logical conditions higher than Mandarin speakers, which was not expected. One reason for this could be that English native speakers are in general more confident in judging sentences in English whereas Mandarin learners of English are likely to be more conservative and thus give lower ratings. The data suggest a negative influence from L1 Mandarin in the Mandarin English bilingual population because of the knowledge of RVC structure, which is frequently used with aspectual marker *le*.

These results are also interpretable within several models discussed earlier, namely the, Full Transfer Full Access (FTFA; Schwarz & Sprouse, 1996), Full Transfer and Relexification (FTR; Sprouse, 2006) and Feature Reassembly Hypothesis (FRH; Lardiere, 2007. 2008, 2009). To the best of my knowledge, the FTFA model (Schwarz & Sprouse, 1996) has been widely tested in the domains of phonology and syntax but less so in the domains of lexical semantics and morphology. The FTR model (Sprouse, 2006) extends the predictions of the FTFA to lexical knowledge, but has not been applied to morphology and has limitations due to the concern of the difference between interlanguage and creoles, namely, the difference between canonical L2 acquisition and creole L2 acquisition. For the purposes of this thesis, the FRH seems to provide the most explanatory power for understanding the pattern of results herein, which I discuss below. In my thesis, I would like to apply FRH to explain how the processing of acquiring English state-change verbs unfolds
for Mandarin learners of English.

The FRH (Lardiere, 2007, 2008, 2009) is a model of asymmetric acquisition of syntax and morphology in adult L2 acquisition. It argues that adult learners bring a system of formal features assembled into their L1 lexicon to the L2 acquisition. In addition, in L2 acquisition, L2 learners will attempt to look for and match morpho-lexical correspondences in the L2 to those in their L1 particularly on the basis of semantic meaning or grammatical function (Lardiere, 2009). Therefore, the FRH views L1 transfer as an initial attempt by L2 learners to establish a direct mapping between L1 and L2 forms. In cases when these direct mappings fail, learners have to modify the feature combinations they transferred from the L1 and reassemble features that belong to different feature bundles in the L1 and L2.

In the present study, the features bundles of L1 lexical items are action completeness and state-change. In Mandarin, action completeness is conveyed with the aspectual marker *le* and state-change is conveyed with RVC. For instance, both *m* and *n* examples below used aspectual marker *le*, but only example *m* indicates the completion of action *eat* and the state-change of food being eaten up afterwards. Example n, in which *le* is used with an independent action verb (吃 chi, 'eat') only signifies termination but not state-change.

m. *wo chi wan   le   fan*
   I   eat finish ASP food.

I ate up the food.

n. *wo chi le fan.*

I eat ASP food.

I ate the food.

Recall that, in English, action completeness is conveyed with simple past and state-change is conveyed with state-change verbs. These two features are borne out and conflated into the meaning of verbs such as *killed, broke,* and *cracked*, whereas in Mandarin these two features are situated in the interface of semantics and morphology. This cross-linguistic difference might challenge Mandarin learners of English. As is claimed by Lardiere (2007, 2008, 2009), at the reassembling stage, L2 learners might abandon features distinctive in L1 but not in L2 or acquire new features. In order to successfully acquire English state-change verbs in simple past tense (i.e. *killed, broke, cracked*), a Mandarin learner of English would need to learn that there is no need to add extra aspectual marker *le*, because English state-change verbs in simple past already inherit action completeness feature. At the same time, a Mandarin learner of English should learn that the use of RVC in Mandarin indicate state change feature as English state-change verbs do, and the equivalent translational English verbs in Mandarin (i.e. 杀 *sha,* 打 *da,* 砸 *za*) don't. This functional feature reorganization which is fundamental to L2 acquisition is at the heart of FRH (Lardiere, 2007, 2008, 2009). Thus, following FRH, the acquisition task of a Mandarin learner of English could be, first, she needs to map a lexical item to its closest L2 equivalent. For instance, the equivalent translational lexical item in Mandarin 杀了 *sha le* in English is *killed*. However, here, in 杀了 *sha le*, the verb 杀 *sha* is a standalone action verb (V1) which doesn't entail any state-change whereas *killed* indicates the fulfillment of a state change in English. In that case, the direct mapping between L1 and L2 forms fails on the basis of semantic meaning. Then, she needs to reassemble the features that do not coincide within the same lexical item in both L1 and L2. In other words, at the reassembling stage, she needs to abandon the morphologic feature distinctive in L1 (external aspectual marker *le*) but not in English and remap features from external added morphology (aspectual marker *le*) to those now applied to simple past in English. Meanwhile, she needs to abandon the assumption of non-resultative Mandarin state-change verbs. After that, she has to reassemble the semantic features that belong to English which are bundled into the equivalent state-change verbs.

Taken together, the effects of cross-linguistic influence from L1 Mandarin is observed in my study in Mandarin learners of English when interpreting English state-change verbs. The language-specific lexicalization pattern of state-change in Mandarin using both RVC structure and the aspectual marker *le* gives rise to challenges for Mandarin English bilingual in acquiring English state-change verbs.

Turning to the second research question, recall that it sets out to test the effect of video immersion manipulation in the way Mandarin learners of English judge English state-change verbs, especially those in Illogical conditions. The initial assumption was that showing them a 2-minute long Mandarin video will prime and pull them into bilingual mode. In that case, Mandarin learners of English with an extra boost of Mandarin will be in a bilingual mode when both of their knowledge of Mandarin and English are active. Thus the RVC representations were expected to be activated and played out in the Gradient Plausibility Judgment task. In comparison, those who had the English boost are expected to stay in a monolingual mode and decrease the activation of their linguistic knowledge of Mandarin unconsciously. Statistically, a significant three-way interaction (Verb*Plausibility*Video Type) was predicted, and the Mandarin video was expected to cause a significant increase in the strength of rejections of Illogical conditions compared to English video. Interestingly, only a significant two-way interaction was found (Plausibility*Video Type), and the marginal estimated means from the post hoc test suggested that the English video group seem to elicit more acceptance responses of the Illogical condition, both RVC and non_RVC. In other words, the Mandarin video caused a slight reduction in the strength of rejection of the Illogical conditions than English, which is the opposite to what was predicted. From the data visualization (Figure 2) rejection rates are largely consistent in terms of the difference between RVC and NonRVC constructions in Illogical conditions, and the effect that the Mandarin video was hypothesized to have was to change that interaction, which was not supported by these results.

Taken together, the results showed that the mode of Mandarin and English by video didn't seem to have any notable impact on participants' judgments, at least for the properties being tested. It is interesting to witness a significant two-way interaction, but it is not what I expected to be the crucial interaction and introducing or altering a language mode doesn't seem to affect how Mandarin learners of English perceive English state-change verbs.

There are several possible reasons why the expected effects did not obtain as a result of the video exposure. Firstly, it could be the case that the video manipulation undertaken was not sufficient to put the Mandarin learners of English into the expected language mode. That is to say, due to the short length of the video, those who watched Mandarin video were not sufficiently primed into bilingual mode, and speakers with a boost of English were not kept at the monolingual endpoint of the continuum. In addition, as the data collection was conducted online, there is a potential limitation that there is no guarantee that the participants actually watched the video. Thus, the nature of the experiment could give rise to the unexpected results. Lastly, as mentioned in the previous section, the movement along the language mode continuum takes place smoothly and effortlessly depending on factors such as the speech style, the interlocutor, the context, etc. According to Grojean (2008), it is not easy to position the bilingual speakers at the monolingual end point of the continuum. In other words, it is difficult to prevent the bilinguals from activating, to some extent at least, the other language (Mandarin). If interest is shown in the participants' bilingualism, or if the task requires both languages, which was explicitly stated within the participant selection criteria, then any of these factors could be sufficient to put the participant in a bilingual mode and thus activate both languages. That is to say, Mandarin learners of English who watched the English video are expected to stay in English monolingual mode, but since it is difficult to position the bilingual speakers at the monolingual end point of the language mode continuum, it is possible and easily for them to move to a bilingual mode. In such cases, RVC knowledge could be activated and intervene their semantic judgments, leading to less divergence in the results. Indeed, any subtle change can help position and reposition a bilingual speaker at a particular point on the language mode continuum.

The third research question aimed to check the predictive powers of three individual differences, AoA, L2 immersion and English dominance ratio, on rejection rates of RVC conditions, especially the Illogical RVC condition. The initial prediction was that for Mandarin learners of English, the lower AoA they have, the more dominant in English they are and the higher English immersion they have, the more they are expected to display task performance patterns that overlapped with the English native speakers , specifically that they should correctly reject Illogical conditions, especially the Illogical RVC stimulus.

Starting with AoA, the result shows that there is no predictive power found in projecting the rates of rejection in Mandarin learners of English. This unexpected result can be interpreted

in several aspects. First, AoA in many cases is used as a proxy for overall duration of bilingual experience, including here. In my study, the AoA range among Mandarin speakers is 0-33 and the age range is 16-58. Imagine comparing a 18-year-old Mandarin speaker who started learning English at the age of 0 with a 58-year-old who started L2 acquisition at 33, even though previous studies confirmed that earlier AoA contributes to higher L2 proficiency, it can be that the latter person with 25 years' exposure could be more L2 native-like. The point here is that the huge range of age in participants is not controlled in my study and might raise a concern. Thus, instead of looking at raw AoA, it is better to qualify AoA by either including age or calculating the duration of language use. Second, it is possible that for whatever variability is found here, AoA does not provide any explanatory power for it, at least for the examined domains herein, namely the interface of semantics and morphology. Further studies are needed to explore more into the role of AoA for this specific linguistic domain.

The remaining two individual factors, L2 immersion and English dominance ratio, were not found to predict rejection rates for the RVC control. An explanation for this could be that our sample of Mandarin learners of English were already highly immersed and highly dominant in English. It would appear that for the features examined in the present study, the participants have already passed the threshold we would have needed to have seen an effect. The knowledge of the features are already stabilized and the individual differences in L2 immersion and English dominance ratio depending on the nature of the outcome are not going to make a change that is noticeable.

Taken together, the individual differences in language experience used in the present study did not appear to predict task performance, which goes against predictions. Possible explanations could be, firstly, from a participation perspective, we tested people who were not in mainland China but immersed in an English environment, and with comparatively higher English proficiency. If we look closer at the group level aggregate shown in Figure 1, Mandarin learners of English didn't behave in the same way as English native speakers in the critical condition (Illogical RVC), but the crucial thing here is that they are not randomly doing so. That is to say, they seem to more often than not correctly reject Illogical RVC even if not as often as English native speakers. This should indicate that the population in my study immersed in an English context should have the best chance of performing more they can to English native speakers. Thus, from the aspect of participant population, there might

be some effects of individual differences in the domain that is studied but not detected because of the limitation of the participant pool this thesis looked at. Second, considering the nature of Language History Questionnaire (LHQ3) which is based on self-rating and self-calculation, if there is something else that we are not capturing in terms of language pattern, it is totally possible.

In the end, speaking of the limitation of my thesis, the experiment design in video immersion could be one. In my study, the video immersion was a between-subject manipulation where two groups of Mandarin learners of English did the task. Even though their language background seems comparable, on the group level, a between-subject manipulation is not sufficient enough to tell whether the variation detected is because of the specific participant with specific background or because of the video manipulation. To overcome the limitation, the video immersion section in my study, which taps into the language mode manipulation, should be a within-subject manipulation where one group of Mandarin learners of English are manipulated into both English and Mandarin version videos.

As for future directions, future research could expand the participant pool to people who are immersed in the Mandarin environment and increase the variability in English immersion. In addition, it is worth looking at how individual factors interact with each other. For example, it is interesting to examine the performances of someone who learned English later in life but has stronger immersion in English.

7. Conclusions

The present study corroborates Chen's (2018) research showing the existence of nuanced state-change implicatures among Mandarin verbs that are consistently used with the perfective aspectual marker *le*. The implicational hierarchy of the Mandarin state-change verbs and related structures suggests a language specific lexicalization pattern of state-change in Mandarin, and it is typologically different from that in English. Thus, this study is the first to empirically investigate whether the language-specific lexicalization patterns in Second Language Acquisition (SLA) gives rise to any challenges due to the negative influence in the first language, namely due to the fact that there is a variation of how to pack or unpack the meaning of verb and verb related structures across languages.

It sets out to examine whether the different lexicalization pattern of state-change cross-linguistically in Mandarin and English would have any impact on Mandarin-English bilinguals' lexical semantics acquisition of English state-change verbs. Moreover, this study also taps into whether and how language mode and individual linguistic experience modulate the cross-linguistic influence here.

To conclude, an effect of cross-linguistic influence has been found among Mandarin learners of English on interpreting English state-change verbs. However, no association was found between the language mode and the cross-linguistic influence effect. Individual linguistic experience including AoA, L2 English immersion and L2 English dominance ratio has been proved with no predictive power either. This study adds to the existing data on second language acquisition and contributes to the ongoing discussions on the role of previously learned languages by investigating an understudied combination of languages and population. In addition, it adopts the Feature Reassembly Hypothesis (FRH) to conceptualizing the influence from L1 Mandarin to L2 English and looks at the interface of verb semantics and morphosyntax domain, which is in line with FRH's call for a careful analysis how semantic and morphosyntactic features are bundled together and encoded in L1 and L2 lexical items.

Appendix 1. Target English state-change verbs and their counterparts in Mandarin

English state change verb (past tense)	Mandarin counterparts
cracked	夹 *jia*
shot	打 *da*
extinguished	吹 *chui*
filled	填 *tian*
broke	锤 *chui*
woke	闹 *nao*
closed	关 *guan*
picked	摘 *zhai*
killed	杀 *sha*
torn	撕 *si*
unpacked	拆 *chai*
bent	掰 *bai*
dragged	拖 *tuo*
boiled	煮 *zhu*
ate	吃 *chi*
wrapped	包 *bao*
smashed	砸 *za*
stopped	拦 *lan*
kicked	踢 *ti*
untied	解 *jie*
stabbed	捅 *tong*

sold	卖 *mai*
spilled	撒 *sa*
chopped	切 *qie*
froze	冻 *dong*
peeled	剥 *bo*
tossed	扔 *reng*
lifted	提 *ti*
exploded	炸 *zha*
twisted	拧 *ning*
rolled	卷 *juan*

Appendix 2. Experimental stimuli (Gradient Plausibility Judgment Task)

List 1

He cracked the walnut but it hurt his fingers.

He shot the deer but it was too heavy to carry.

She extinguished the candle but burnt her hair.

He filled the cup with water but some spilled out.

She broke the plate with a hammer but also damaged the table.

I woke her with an alarm but she got upset.

He closed the door but still heard the argument outside.

She picked the apple on the tree but it was rotten.

She killed a chicken but it didn't die.

He tore the shirt but it was undamaged.

I unpacked the box but it was still sealed.

She bent the straw but it remained straight.

He dragged the suitcase but it didn't move.

He boiled the water but it was still cold.

She ate the apple but it was still intact.

She wrapped the gift but the gift was still unwrapped.

She exhibited art work in the gallery but few people came.

The teacher criticized the boy but he didn't care at all.

He managed two departments but he resigned yesterday.

The boy chose the ice cream but he regretted his choice.

He struggled with the test but he passed eventually.

He presented his proposal in the meeting but it was rejected.

I appreciated their gift but I never told them about it.

That work challenged him but he still enjoyed it.

They surrounded him but he was not there.

He browsed the newspaper but never looked at it.

He commanded the army but only took orders.

This hotel provided free breakfast but it didn't serve any food.

He possessed the house but he didn't have any property.

She lost all her money but she still had all of it.

They maintained silence in class but everyone kept talking.

The teacher inspected his work but didn't look at it.

List2

She killed a chicken but it took her a long time.

He tore the shirt but he didn't care.

I unpacked the box but it took me 10 minutes.

She bent the straw but she could still drink through it.

He dragged the suitcase but nobody helped him.

He boiled the water but he didn't use it.

She ate the apple but it was very sour.

She wrapped the gift but it didn't look nice.

I chopped the onion but it remained intact.

I froze the drink but it was still liquid.

She peeled the banana but there was skin on it.

He tossed the coin but the coin stuck in his hands.

He lifted the table but the table didn't move.

They exploded the car but the car was intact.

He twisted the lid but it didn't move.

She rolled the yoga mat but it was still flat.

She displayed her photos but no one was amazed.

He followed his friends but he got lost in the end.

The man observed people in the street but few people were out.

My family supported me financially but I still can't make ends meet.

He admired his partner but they got divorced eventually.

He offered some useful advice but I didn't follow his advice.

He scrutinized the document but it only took him 10 minutes.

I tested positive for covid but I recovered from it two days ago.

She exhibited artwork in the gallery but she hid it.

The teacher criticized the boy but only praised him.

He managed two departments but he was unemployed.

The boy chose the ice cream but he made no choice.

He struggled with the test but he found it very easy.

He presented the proposal but he kept the proposal secret.

I appreciated their gift but I took it for granted.

That work challenged him but he found it easy.

List 3

He smashed the vase but it went everywhere.

The driver stopped the car but it made a loud noise.

The player kicked the ball but it didn't go too far.

I untied the knot but it took me some time.

I caught the ball but dropped it right afterward.

She stabbed her lover but he was sent to the hospital right away.

We sold the house but no one offered the price we wanted.

He spilled the soup but only on his mattress.

He cracked the walnut but it remained intact.

He shot the deer but he missed it.

She extinguished the candle but the candle didn't go out.

He filled the cup with water but the cup was mostly empty.

She broke the plate with a hammer but the plate didn't break.

I woke her with an alarm but she didn't wake up.

He closed the door but the door was still open.

She picked the apple on the tree but it was too high to reach.

They surrounded him but he managed to escape.

He browsed the newspaper but only for 5 minutes.

He commanded the army but they lost the war.

This hotel provided free breakfast but with low quality.

He possessed the house but he didn't like it that much.

She lost all her money but she was able to start over.

They maintained silence in class but it was difficult.

The teacher inspected his work but it only took him 10 minutes.

I owned this house but I didn't have any property under my name.

They communicated online but they never contacted each other.

He contacted my parents but he never reached out to them.

They discussed the matter but they never communicated.

She celebrated her birthday but she neglected it.

I demonstrated my biking skills but I have never ridden a bike.

The boat floated but it was on the bottom of the sea.

He traveled to Thailand but he never left home.

List 4

I chopped the onion but it hurt my eyes.

I froze the drink but forgot about it.

She peeled the banana but the banana was rotten.

He tossed the coin but the coin dropped into the sewer.

He lifted the table but the files on the table dropped.

They exploded the car but there was a lot of debris.

He twisted the lid but the lid hurt his fingers.

She rolled the yoga mat but forgot to take it home.

He smashed the vase but it was still intact.

The driver stopped the car but it kept moving.

The player kicked the ball but he missed it.

I untied the knot but it remained knotted.

I caught the ball but I missed it.

She stabbed her lover but there was no wound on his body.

We sold the house but no one bought it.

He spilled the soup but nothing spilled out.

I owned this house but I didn't like it at all.

They communicated online but they only met in person once.

He contacted my parents but they never got back to him.

He discussed having children with his wife but they didn't reach an agreement.

She celebrated her birthday but only a few people joined.

I demonstrated my biking skills but my friends were not amazed.

Leaves and oil floated in the pool but no one cleaned it.

He traveled to Thailand but he didn't like it.

She displayed her photos but she never showed them.

He followed his friends but he was ahead of them.

The man observed people in the street but he was blind.

My family supported me financially but they never spent any money on me.

He admired his partner but he disrespected her.

He offered her some advice but he never communicated with her.

He scrutinized the document but he never looked at it.

I tested positive for Covid but I never took a test.

Appendix 3: Experimental stimulus (Multiple interpretation task)

Critical stimulus:

He cracked the walnuts.
Walnuts were broken
Walnuts might have been broken, might not
Walnuts were not broken

He shot the deer.
The deer was dead
The deer might have been dead, might not
The deer was not dead

She extinguished the candle.
The candle went out
The candle might have been out, might not
The candle didn't go out

He filled the cup with water.
The cup was full of water
The cup might have been full of water, might not
The cup was not full of water

She broke the plate with a hammer.
The plate was broken
The plate might have been broken, might not
The plate was not broken

I woke her with an alarm.
She was awake
She might have been awake, might not
She was not awake

He closed the door.
The door was closed
The door might have been closed, might not
The door was not closed

She picked the apple on the tree.
The apple was picked off
The apple might have been picked off, might not
The apple was not picked off

She killed a chicken.
The chicken was dead
The chicken might have been dead, might not
The chicken was not dead

He tore the shirt.

The shirt was torn
The shirt might have been torn, might not
The shirt was not torn

I unpacked the box.
The box was opened
The box might have been opened, might not
The box was not opened

She bent the straw.
The straw was bent
The straw might have been bent, might not
The straw was not bent

He dragged the suitcase.
The suitcase moved
The suitcase might have been moved, might not
The suitcase didn't move

He boiled the water.
The water was bubbled
The water might have been bubbled, might not
The water was not ready

She ate the apple.
The apple was intact
The apple might have been intact, might not
The apple was not intact

She wrapped the gift.
The gift was packed
The gift might have been packed, might not
The gift was not packed

He smashed the vase.
The vase was intact
The vase might have been intact, might not
The vase was not intact

The driver stopped the car.
The car was stopped
The car might have been stopped, might not
The car was not stopped

The player kicked the ball.
The ball moved
The ball might have moved, might not
The ball didn't move

I untied the knot.
The knot was untied
The knot might have been untied, might not
The knot was not untied

I caught the ball.
The ball was caught
The ball might have been caught, might not
The ball was not caught

She stabbed her lover.
Her lover was injured with wounds
Her lover might have been injured with wounds, might not
Her lover was not injured with wounds

We sold the house.
The house was sold
The house might have been sold, might not
The house was not sold

He spilled the soup.
The soup was spilled
The soup might have been spilled, might not
The soup was not spilled

I chopped the onion.
The onion was intact
The onion might have been intact, might not
The onion was not intact

I froze the drink.
The drink was frozen
The drink might have been froze, might not
The drink was not frozen

She peeled the banana.
There was skin on the banana
There might have been skin on the banana, might not
There was no skin on the banana

He tossed the coin.
The coin was tossed
The coin might have been tossed, might not
The coin was not tossed
He lifted the table.

The table was lifted up
The table might have been lifted up, might not
The table was not lifted up

They exploded the car.
The car was intact
The car might have been intact, might not
The car was not intact

He twisted the lid.
The lid was twisted
The lid might have been twisted, might not
The lid was not twisted

She rolled the yoga mat.
The yoga mat was rolled up
The yoga mat might have been rolled up, might not
The yoga mat was not rolled up

Fillers:

She played badminton this morning.
She was exhausted
She might have been exhausted, might not
She was not exhausted

He chased the bus.
He got on the bus
He might have gotten on, might not
He did not get on the bus

I drove my daughter to school.
My daughter was excited
My daughter might have been excited, might not
My daughter was not excited

I dropped my phone into the sink.
I was annoyed
I might have been annoyed, might not
I was not annoyed

He punched the punching bag.
He was hurt
He might have been hurt, might not
He was not hurt

She sliced the lemon.
Her finger was hurt
Her finger might have been hurt, might not
Her finger was not hurt

She shouted loudly in the café.
She was kicked out
She might have been kicked out, might not

She was not kicked out

I ran a marathon today.
I won a prize
I might have won a prize, might not
I did not win a prize

I walked the dog this morning.
The dog was exhausted
The dog might have been exhausted, might not
The dog was not exhausted

We shoveled snow this afternoon.
It took us an hour to finish
It might have taken us an hour, might not
It did not take us an hour to finish

I visited a haunted house.
I was terrified
I might have been terrified, might not
I was not terrified.

She twirled around the dance floor last night.
She was dizzy
She might have been dizzy, might not
She was not dizzy

He climbed the mountain.
He was amazed by the view
He might have been amazed by the view, might not
He was not amazed by the view

She smeared my glasses.
She apologized
She might have apologized, might not
She didn't apologize

We rode the roller coaster today.
We were happy
We might have been happy, might not
We were not happy

I sang a ballet song in the competition.
I was the winner
I might have been the winner, might not
I was not the winner

I ran into my professor today.
My professor spoke with me
My professor might have spoken with me, might not

My professor did not spoke with me

She heard the loud argument from upstairs.
She was annoyed
She might have been annoyed, might not
She was not annoyed

He wrote a letter to his lover.
The letter was sent out
The letter might have sent out, might not
The letter was not sent out

He smoked a whole pack of cigarettes today.
He was anxious
He might have been anxious, might not
He was not anxious

She stomped on the penny.
The penny was broken
The penny might have been broken, might not
The penny was not broken

She pushed on the granite statue.
The statue was damaged
The statue might have been damaged, might not
The statue was not damaged

He leaned on the sturdy fence.
The fence was bent
The fence might have been bent, might not
The fence was not bent

He tapped the wooden desk.
The desk was broken
The desk might have been broken, might not
The desk was not broken

The waves crashed on the rock.
The rock was cracked
The rock might have cracked, might not
The rock was not cracked
She stepped on the pebble.
The pebble was intact
The pebble might have been intact, might not
The pebble was not intact

He scraped the pavement with nails.
The pavement was scratched
The pavement might have been scratched
The pavement was not scratched

He poked the tire with his finger.
The tire was blown
The tire might have been blown, might not
The tire was not blown

I plugged the bathtub.
The bathtub was leaky
The bathtub might have been leaky, might not
The bathtub was not leaky

She knocked the glass container.
The container was broken
The container might have been broken, might not
The container was not broken

We saved the plant.
The plant did not recover.
The plant might have been recovered, might not
The plant recovered

I soaked the sponge.
The sponge was dry
The sponge might have been dry, might not
The sponge was not dry

Appendix 4. Language History Questionnaire(LHQ3)

1. What is your age?

2. What is your gender?

Female; Male; Non-binary; Non-relevant

3. What is your education level?

Graduate school (Doctor); Graduate school (Master); College (Bachelor); High school;
Middle school; Elementary school; Other

4. What is your father's education level?

Graduate school (Doctor); Graduate school (Master); College (Bachelor); High school;
Middle school; Elementary school; Other

5. What is your mother's education level?

Graduate school (Doctor); Graduate school (Master); College (Bachelor); High school;
Middle school; Elementary school; Other

6. What is your handedness?

Right-handed; Left-handed; Ambidextrous

7. What is your country of origin?

8. What is your country of residence?

9. Indicate your native language(s) and any other languages you have studied or
   learned, the age at which you started learning the language in terms of listening,
   speaking, reading, and writing, and the total number of years you have spent using
   each language.

*For Years of Use, you may have learned a language, stopped using it, and then started using
it again. Please give the total accumulative number of years.

** If you have not studied or learned four different languages, please fill in 'None' in the text

entry field (e.g. if you studied two languages, fill in 'None' in the text entry field for Language 3 and Language 4).

10. If you have lived or traveled in countries other than your country of residence for three months or more, then indicate the name of the country, your length of stay (in Months), the language you used, and the frequency of your use of the language, for each country.

* You may have been to the country on multiple occasions, each for a different length of time. Add all the trips together.

If you have not lived or traveled in countries other than your country of residence for three months or more, please skip the question.

11. Indicate the way you learned or acquired your non-native language(s). Check one or more boxes that apply.

* e.g., immigrating to another country where the dominant language is different from your native language so you learn this language through immersion in the language environment. If you have not learned or acquired other languages than your native language(s), please proceed to the next question.

12. Indicate the age at which you started using each of the languages you have studied or learned in the following environments (including your native language).

13. Indicate the language(s) used by your teachers for instruction at each educational level. If the instructional language switched during any educational level, then also indicate the "Switched to" language. If you had a bilingual education at any educational level, then write the names of the languages and check the box under "Multiple Languages".

14. Rate your language learning skill. In other words, how good do you feel you are at learning new languages, relative to your friends or other people you know?

15. Rate your current ability in terms of listening, speaking, reading, and writing in each of the languages you have studied or learned (including your native language).

1 = very poor ; 2 = poor; 3 = limited; 4 = average; 5 = good; 6= very good ; 7 = excellent

16. Rate the strength of your foreign accent for each of the languages you have studied or learned. If you have not studied or learned any other languages, please go to the next question.

17. If you have taken any standardized language proficiency tests (e.g., TOEFL, IELTS, TOEIC, etc.), then indicate the name of the test, the language assessed, and the score you received for each. If you do not remember the exact score, then indicate an "Approximate score" instead. If you did not take any standardized language proficiency tests, please go to the next question.

18. Estimate how many hours per day you spend in the following activities in each of the languages you have studied or learned (including your native language).

19. Estimate how many hours per day you spend speaking with the following groups of people in each of the languages you have studied or learned (including your native language).
* Include significant others in this category if you did not include them as family members (e.g., married partners).
** Include anyone in the work environment in this category (e.g., if you are a teacher, include students and co- workers).

20. If you use mixed languages in daily life, please indicate the languages that you mix and estimate the frequency of mixing in normal conversation with the following groups of people.

21. In which language do you communicate best or feel most comfortable in terms of listening, speaking, reading, and writing in each of the following environments? You may indicate the same language for all or some of the fields below.

22. How often do you use each of the languages you have studied or learned for the following activities (including your native language)?

* This includes shouting, cursing, showing affection, etc. ** This includes counting, calculating tips, etc.

*** This includes telephone numbers, ID numbers, etc.

1 = never; 2 = rarely; 3 = sometimes; 4 = regularly; 5 = often; 6 = usually; 7 = always

23. What percentage of your friends speaks each of the languages you have studied or learned (including your native language)?

24. Which cultures/languages do you identify with more strongly? Rate the strength of your connection in the following categories for each culture/language.

1 = none; 2 = very weak; 3 = weak; 4 = moderate; 5 = strong; 6 = very strong; 7 = extreme

25. Use the comment box below to indicate any additional answers to any of the questions above that you feel better describe your language background or usage.

26. Use the comment box below to provide any other information about your language background or usage.

27. Do you also speak/use any dialects of the languages you know? Please indicate the name(s) of the dialect and the degree you use them.

28. Do you have any questions filling out this questionnaire? If so, feel free to write them down.

Appendix 5. R script

Please see my OSF link:

https://osf.io/pwxb4/?view_only=71b138e069844328b99adb7a174fca16

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