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L2 processing of morphologically complex words in Chinese*

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Maeng, Junghwan and Sun-A Kim. 2023. L2 processing of morphologically complex words in Chinese. *Linguistic Research* 40(Speical Edition): 1-31. This study investigated the L2 morphological processing by examining whether L2 Chinese speakers are able to construct hierarchically structured representations of morphologically complex words as efficiently as L1 Chinese speakers. Additionally, the current study explored whether the prominence of Chinese morphemes influences L2 speakers' engagement in native-like structural processing of complex words. To tap into the morphological decomposition in the early stage of lexical processing, a masked-priming lexical decision task was employed. The findings of this study align with the Shallow Structure Hypothesis, which proposes that non-structural information takes priority over structural information in L2 processing. L2 speakers exhibited similar priming patterns to L1 speakers for morphologically related prime-target pairs, but the L2 participants also showed semantic and orthographic priming effects which were not found in the L1 group. This indicates that L2 speakers heavily rely on semantic and orthographic cues, leading to enhanced priming effects for morphologically related prime-target pairs that share the initial two characters. These findings suggest that L2 processing of morphologically complex words may prioritize non-structural information by relying more on lexical-semantic connections and surface-level orthographic information rather than deep hierarchical structure processing. **(Hong Kong Polytechnic University)**

Keywords L2 processing, Chinese, morphology, complex words, Shallow Structure Hypothesis

1. Introduction

The ability to process hierarchical structures is a fundamental component of human

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language (Chomsky 1957). Thus, in second language processing research, there has been significant attention on whether non-native speakers can process the hierarchical grammatical structures of a second language (L2) at a level similar to their first language (L1). Regarding the processing of grammar in L2, the Shallow Structure Hypothesis (SSH) posits that non-native speakers tend to rely more on non-grammatical conditions than on grammatical ones when processing in L2. Instead of processing language through the analysis of hierarchical structures, they might depend on non-grammatical information, such as semantic and orthographic information (Clahsen and Felser 2006, 2018). The SSH was initially tested with a focus on sentence processing, in which L2 speakers with near-native proficiency were found to face challenges in grammatical processing. For instance, when processing "garden path" sentences, L2 speakers heavily rely on semantics and context, failing to derive accurate interpretations through detailed grammatical analysis as L1 speakers do. Additionally, in cases involving agreement, they might focus solely on the lexical meaning of individual words, failing to recognize agreement mismatches. Based on these findings, the SSH emphasizes fundamental qualitative differences in language processing between L1 and L2 speakers.

The validation of the SSH has expanded into the domain of morphology, with many studies focusing on whether L2 speakers can analyze the hierarchical structure of morphologically complex words in the same manner as L1 speakers. Specifically, the processing of derived and inflected words has been a primary research topic. These studies mainly concern whether L2 speakers can decompose morphologically complex words into roots and affixes based on morphological structures, as depicted in Figure 1.

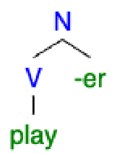

Figure 1. Hierarchical structure of a morphologically complex word

A key methodology employed in these investigations of L2 morphological processing is a masked priming lexical decision task (LDT), an experimental paradigm that has proven effective in uncovering automatic word recognition processes, particularly with morphological decomposition (Rastle 2004; Marslen-Wilson 2007). In a masked priming LDT, participants see a morphologically complex word like "player" and then quickly make a lexical decision on its stem "play". If the word "player" is decomposed into individual morphemes in the early phase of lexical processing, it speeds up recognizing "play", compared to an unrelated word prime (e.g., rest). Since prime words are presented briefly for 30-70 ms and are visually masked, it is difficult for participants to consciously recognize them. Hence, the masked priming method is mainly employed to investigate the automatic decomposition of morphologically complex words in the early stage of lexical processing. The priming effects of morphologically related prime-target pairs are often tested alongside semantic and orthographic priming (e.g., Kirkici and Clahsen 2013; Jacob et al. 2018). This is to ensure that priming effects arising from morphologically related prime-target pairs are not merely due to overlapping semantic or orthographic features. If L2 speakers exhibit a strong priming effect for morphologically related prime-target pairs while remaining unaffected by semantically or orthographically related pairs, it indicates that they have the ability to process structures at the morphological level in a target-like manner.

Using the masked priming LDT, numerous studies have reported the occurrence of non-targetlike morphological decomposition in L2 processing, which is characterized by the absence of significant priming effects when morphologically complex words were used to prime their respective roots (Silva and Clahsen 2008; Clahsen and Neubauer 2010; Clahsen et al. 2010; Clahsen et al. 2012; Kirkici and Clahsen 2013; Clahsen et al. 2015; Heyer and Clahsen 2015; Clahsen and Veríssimo 2016; Veríssimo et al. 2018). These studies ascribed the difference between L1 and L2 processing to over-dependence on non-structural information, such as lexical-semantic and orthographic cues, compared to morphosyntactic cues in the L2 processing system, which aligns with the SSH. Moreover, studies directly comparing the L2 processing of derived words and inflected words have observed divergent priming effects between these two word types. Specifically, consistent priming effects have only been found for derived words, while reliable priming effects have not been elicited by inflected words (Kirkici and Clahsen 2013; Veríssimo et al. 2018; Ciaccio and Veríssimo 2022). Based on the theoretical premise that derived words are stored and accessed as whole words, whereas inflected words are accessed through morphemic representations (Stanners et al. 1979; Feldman 1994; Marslen-Wilson 2007), these studies explain that the priming effects for derived words do not necessarily stem from L2 speakers' ability to analyze the hierarchical structure of such words. Instead, it highlights their reliance on lexical storage, which enables them to establish a connection between a root and its derived form (e.g., the lexical overlap between ‘play’ and ‘player’ through the shared root ‘play’). In contrast, these studies posit that such lexical-based priming effects cannot hold for inflected words since they are not stored as lexical items in the mental lexicon.

However, the shallow L2 morphological processing has been challenged by other masked priming studies demonstrating full priming effects of inflected words for L2 speakers (e.g., Feldman et al. 2010; Voga et al. 2014; Coughlin and Tremblay 2015; Foote 2017; Bordag and Optiz 2022). Considering the varied findings about the priming effects of inflected words for L2 learners across studies, some propose examining L2 morphological processing based on various factors such as semantic and orthographic overlap, frequency effects, and semantic salience of morphological family (Giraudo and Dal Maso 2018). Additionally, the claim for the derivation-inflection dichotomy has been questioned even by research that found different priming effects between inflected and derived words in L2 processing (Jacob et al. 2018). Unlike the SSH, which claims qualitatively different L1 and L2 processing systems, Jacob and his colleagues argue that L2 speakers are equipped with the same grammatical processing mechanism as L1 speakers but may be more sensitive to the semantic salience of individual morphemes. They propose that the likelihood of target-like structural processing in L2 increases as a function of an individual morpheme’s semantic salience. For instance, derivational affixes (e.g., “-ity” or “-ion” in English) are considered high in semantic salience as they change the meaning and grammatical form class of a word (e.g., treat-treatment). On the other hand, inflectional suffixes (e.g., treat-treats) are perceived as low-salience morphemes as they only mark grammatical information such as tense and agreement. Building on this premise, it is proposed that during the early lexical access, L2 speakers selectively engage in hierarchical processing, particularly for morphemes with notable semantic salience.

In essence, a central debate in L2 morphological processing revolves around whether structural processing is entirely inoperative in L2 as per the SSH, or if it operates selectively, influenced by nongrammatical factors, such as semantic prominence. To delve deeper into this question, the current study focuses on morphologically complex words in Mandarin Chinese for the following two main reasons:

1. Chinese encompasses morphological processes akin to inflection and derivation (Packard 2000; Liao 2018). This offers an avenue to investigate the potential for hierarchical structure analysis during L2 morphological processing within a

language that is typologically distinct.

2. Mandarin Chinese offers a unique context to assess the influence of semantic salience on the processing of morphologically complex words. Compared to their counterparts in alphabetic languages (such as -ed or -s), both grammatical and derivational morphemes in Chinese hold a relatively high level of semantic salience. This is evident as these morphemes in Chinese are homophonous, carrying multiple lexical meanings (e.g., the experiential aspect marker -*guo* 过, 'to cross' or 'to spend').

Given this background, the present study tests the SSH by investigating whether the structural analysis is completely absent in L2 morphological processing or if it is selectively operational based on certain conditions, like semantic salience. If the SSH is valid, in the masked priming task, priming effects are expected to arise only for derived compounds, lexical entries that are linked via a shared lexeme with their stem in the lexicon. In the other case, priming effects may be obtained for both grammatically suffixed words and derived compounds, but due to the sensitivity to the semantic and orthographic overlap, driven by the overreliance on non-structural information.

If the alternative view holds, a relatively high level of salience of Chinese suffixes may lead to target-like structural processing of morphologically complex words with no semantic and orthographic priming effects observed. Moreover, this study focuses on proficient Korean learners of L2 Chinese. Since their native language employs an alphabetic writing system, the current study aims to examine how the logographic characteristics of the Chinese script influence their processing of morphologically complex words. This paper is organized as follows: Section 2 discusses background information on L2 shallow morphological processing as well as descriptions of Chinese morphology; Section 3 introduces the methodology used in the present study; Section 4 reports the results of the experiment; Sections 5 discusses the main findings; and Section 6 concludes the paper.

2. Background

Several L2 processing studies using online measures have highlighted that native-like use of grammatical information during comprehension and production may be unlikely even for highly proficient or near-native L2 speakers. Concerning the L1-L2 differences in L2 grammatical processing, the SSH was initially proposed to account for the underuse of structural information in the L2 processing of syntactically complex constructions during sentence reading (Clahsen and Felser 2006). For instance, when encountered with a structurally ambiguous garden path sentence, L2 comprehension is mainly guided by lexical-semantic cues, whereas L1 speakers efficiently employ both structural and non-structural information to resolve the syntactic ambiguity. Consistent with the SSH, numerous studies suggest that the L2 grammar may provide a less intricate representation of morphologically complex words, obstructing L2 learners from processing such words as natives do (e.g., Silva and Clahsen 2008; Clahsen et al. 2010; Clahsen and Neubauer 2010; Kirkici and Clahsen 2013; Clahsen and Veríssimo 2016; Veríssimo et al. 2018; Song et al. 2020). These studies demonstrate that L2 speakers have difficulty decomposing morphologically complex words into individual morphemes as they are less sensitive to the morphological structure and rely heavily on surface-form representations stored in the mental lexicon.

In addition, some studies propose that the capacity of L2 speakers to process morphology like L1 speakers could be influenced by the type of morphological processes engaged in forming morphologically complex words (Silva and Clahsen 2008; Kirkici and Clahsen 2013; Jacob et al. 2018; Veríssimo et al. 2018). These studies revealed that L2 speakers are capable of using morphologically structured representation for derived words, yet they do not exhibit the same capability for inflected words. The inflection-derivation discrepancy in the L2 morphological processing has been explained in terms of the realization-based theories of morphology, which posit that there is a split between derivational and inflectional morphology in terms of their outcome (Anderson 1992). While derivational morphology selects a stem from the lexicon and creates another lexical entry (e.g. lazy – laziness, play – player), the output of inflectional morphological is a feature-form pairing (e.g. eat – eats, play – played), which may not require a full listing of inflected surface forms in the mental lexicon.

Silva and Clahsen (2008) performed a set of masked priming experiments to explore how L1 English speakers and advanced L2 learners process complex morphological words. The first experiment involved L2 learners of English with either Chinese or German as their first language, along with native English speakers. They were asked to make lexical decisions on target verbs preceded by identical, unrelated, or morphologically related primes. The authors found that native speakers use morphological structure in L1 word processing, decomposing both regularly inflected and derived words. Conversely, L2 learners did not show priming for inflected word forms and exhibited only partial priming for derived word forms. This suggests that L2 speakers might not use morphologically structured representations for inflected word forms during lexical processing but do so for derived word forms, albeit less effectively than natives. Silva and Clahsen theorized that the distinction between inflectional and derivational complexity might lie in the involvement of lexical entries. They argued that derivational complex words are listed in lexical entries containing morphological structure, allowing L2 learners to utilize morphological structure in processing complex forms, but inflectional complex words are not.

Regarding the L2 morphological processing in Turkish, Kirkici and Clahsen (2013) also found different processing patterns for inflection and derivation in L2 Turkish speakers. While native Turkish speakers exhibited effective morphological priming effects for regularly inflected word forms, this was not observed in L2 speakers. However, the situation differed for derivational processes, with advanced L2 speakers demonstrating more native-like performance. L1 speakers presented significant morphological priming effects for productive derivational processes akin to regular inflection across different languages. Unlike regular inflection, derived word forms also generated significant masked priming effects for L2 speakers. This study proposed that advanced L2 speakers' lexical representations of morphologically complex words mirror those of L1 speakers. However, unlike in L1, L2 processing does not leverage morphological decomposition. Therefore, masked priming effects in L2 can only occur when the prime and target words share lexical entries stored in the lexicon, as is the case with derived words and their stems.

A more recent study (Jacob et al. 2018) also found the derivation-inflection difference in the L2 morphological processing in German. However, it questions why lexically mediated priming effects are available only for derived words in L2 processing but not for inflected words that also contain a shared lexeme with their stem. It instead proposes an alternative account that the semantic salience of suffixes may allow L2 speakers to analyze the morphological structure of derived words as efficiently as L1 speakers.

Compared to inflectional morphemes, derivational morphemes contain more semantic information, which is transparently reflected in the meaning of the entire construction (e.g., -ness in English meaning the state of being ADJECTIVE). Hence, L2 speakers may be able to decompose derived words in a similar manner to the decomposition of compound words. Considering that L2 speakers can automatically decompose semantically transparent compounds as efficiently as L1 speakers (M. Li et al. 2017), target-like morphological processing can be understood as an affix-stripping process based on the semantic salience of the derivational morpheme.

Another study investigated the influence of the age of onset of L2 acquisition on the automatic, unconscious processes used for recognizing inflected and derived words (Veríssimo et al. 2018). Their key finding was that age of acquisition (AoA) significantly impacts masked morphological priming, but this impact is specific to the processing of inflected forms, not derived forms. Regardless of AoA, facilitation from derived forms was observed, implying that even with late language acquisition, the ability to access the base stem of derived words is preserved. Conversely, the relationship between AoA and inflectional priming displayed a discontinuity suggesting a sensitive period: facilitation effects indicating stem access were observed when L2 acquisition started before the age of 5, but inflectional priming declined sharply with increasing AoA. The authors posit that there is no sensitive period for acquiring "language" per se, but rather for acquiring specific types of grammatical knowledge, and therefore suggest persistent difficulties for late L2 learners to develop a native-like ability to process morphosyntactic grammar.

While previous studies have reported different patterns of L2 morphological processing depending on types of morphological processes, this topic has rarely been addressed in non-alphabetic languages like Mandarin Chinese. Like many other languages, morphological operations corresponding to inflection, derivation, and compounding can also be found in Chinese (Packard 2000). While compounding is the most common method of word formation in Chinese, a few aspect markers in Chinese, such as *–le* 了, *-zhe* 着 and *–guo* 过, correspond to verbal suffixes in Indo-European languages, and hence they are seen by some scholars as inflectional morphemes in Chinese (Packard 2000; Liao 2018). They exhibit high productivity, and regular usage patterns, and have no significant impact on the semantic information or the grammatical form class of a stem (Packard 2000, 2015). Furthermore, aspect markers are also analyzed as a functional head of aspect phrases syntactically, highlighting that they are licensed by syntactic-level grammatical operations (Sybesma 1999; Huang et al. 2009). Prior ERP studies provide evidence for the morphosyntactic nature of Chinese aspect markers by demonstrating P600 effects, indicative of morphosyntactic processing, for anomalous use of aspect markers in L1 Chinese processing (Zhang and Zhang 2008; Qiu and Zhou 2012).

Chinese also has some derivational processes, although less extensive than in many other languages. Derivation, the process of forming new words from existing ones by adding affixes, can still be observed in some Chinese words, particularly through the use of certain suffixes and compounding. One common derivational morpheme is the suffix *–jia* 家*,* which can be added to a base word to denote a specialist or expert in a certain field. For example, the term *shoucang* 收藏 'to collect', when combined with *–jia* 家, becomes *shoucangjia* 收藏家, meaning 'collector' (Pan 2004). Similarly, the suffix *–xing* 性 can create a noun indicating a characteristic or state. For instance, wending ‘stable’ can be affixed with *–xing* 性 to form *wendingxing* 稳定性, meaning 'stability' (Acordia 2012). Comparing the two morphological processes of aspect marking and derivation, we find that the former, in a sense, aligns more with the notion of inflection, given its syntactic function and the criteria proposed by Packard (2000, 2015). The aspect markers add grammatical information to the verb, altering its aspectual meaning without significantly affecting its inherent semantic meaning or grammatical form class. This pattern resembles the inflectional process in which grammatical categories such as tense, aspect, mood, person, number, gender, and case are expressed through affixation or alteration of the base word (Aronoff 1994). Conversely, Chinese derivational morphemes demonstrate behavior akin to the derivational process in English or other Indo-European languages. They not only alter the semantic meaning of the base word but often lead to a change in the grammatical form class. The process of derivation is more semantically driven and exhibits a lower degree of productivity and regularity compared to inflectional morphology (Dressler 1989). Therefore, from a comparative perspective, Chinese aspect marking bears more similarities with inflectional grammar (or rule-based grammar), whereas the process involving derivational morphemes aligns more with derivational grammar. The difference between grammatically suffixed and dervied words in Chinese can be schematized as in (1) and (2).

(1) Grammatical suffixation with an aspect marker
    a. < [V, progressive], X + -*zhe* 着>
    b. < [V, progressive, *pao* 跑 ‘run’], *pao-zhe* 跑着 ‘running’>

(2) Derivation with a nominalizing morpheme
  a. < [V, LEX], X> → <[N, LEX], X + -*jia* 家>
  b. < [V, *jiaoyu* 教育 'educate']> → <[N, *jiaoyu* 教育 'educate'], *jiaoyu-jia* 教育家 'educator'>

While previous studies have reported the inflection-derivation difference in L2 morphological processing, it has rarely been tested in a language typologically different from alphabetic languages. It is necessary to confirm whether the shallow morphological processing is observed across different languages or is a language-specific phenomenon. Furthermore, since each character corresponds to a single morpheme, which is the smallest meaning unit in the language (Packard 2000), it offers a platform to examine whether L2 speakers can engage in target-like structural processing for morphologically complex words in Chinese based on the semantic salience of individual morphemes, as suggested by the alternative view to the SSH (e.g., Jacob et al. 2018). Given this background, the present study investigated the L2 morphological processing of morphologically complex words in Mandarin Chinese. Focusing on rule-based grammar (e.g., aspect markers) and derivation (e.g., nominalizing morpheme), this study used a masked priming lexical decision task to investigate whether L2 speakers demonstrate different processing patterns for rule-based grammar (inflection) and lexically driven morphology (derivation). Furthermore, the present study aims to address whether typological properties of L2 have an influence on the L2 morphological processing of rule-based grammar. If the SSH holds for L2 processing of morphologically complex words in Mandarin Chinese, it is predicted that L2 speakers in the present study may demonstrate a reduced degree of morphological priming effect relative to L1 speakers in the masked priming lexical decision task. Moreover, L2 speakers are expected to exhibit divergent processing patterns for aspect-marked and derived words. Prior research has shown that L2 speakers tend to rely heavily on lexical storage during morphological processing, resulting in robust priming effects solely for derivation, which was triggered by lexical links between derived words and their stems stored in the lexicon (Silva and Clahsen 2008; Kirkici and Clahsen 2013). Consistent with the findings of the previous studies, L2 speakers in the present study may also show pronounced priming for derived compounds, while no priming effect is obtained from aspect-marked words.

However, it is also possible that special logographic properties of Chinese may induce L2 speakers to demonstrate different processing patterns from non-native speakers reported in the studies on the L2 shallow morphological processing. Several studies have highlighted the role of the visual structure of characters in Chinese language processing, distinguishing it from phonologically-driven alphabetic languages. Perfetti and Tan (1998) demonstrated that Chinese readers process characters as whole visual units, activating pronunciation and meaning based on the visual form. Liu et al. (2007) furthered this observation by using fMRI to show that Chinese character processing primarily occurs in regions associated with visual and spatial processing. Furthermore, Tan et al. (2001) revealed that reading Chinese characters activates brain regions associated with semantic processing, while reading in English, an alphabetic language, mainly triggers areas related to phonological processing. Considering the significance of orthographic and semantic processing in Chinese character recognition and its distinction from phonetic alphabetic languages, it can be speculated that the L2 morphological processing may be influenced by the semantic or orthographic information of the primes rather than the relevant morphological structure. If the salience of suffixes is the main contributing factor that enables target-like L2 morphological processing, as proposed by Jacob et al. (2018), L2 speakers are expected to display native-like structural processing for both aspect-marked words and derived compounds, without displaying semantic and orthographic priming effects.

3. Experiment

3.1 Participants

A total of 95 participants were recruited for the experiment. L1 Chinese group consists of 48 adults, with ages ranging from 18 to 43, who were standard L1 Mandarin Chinese speakers. L2 Chinese group had 47 adults (mean age: 26.6 years, SD = 5.10) who were L1 Korean speakers but highly proficient in Mandarin Chinese. Their Chinese proficiency level was equivalent to the highest level of a standardized L2 Chinese proficiency test (HSK 6). The L2 participants' proficiency level was further checked with a cloze test used in Chen (2020), and the mean score was 14.31 out of 16 points (SD = 1.46, range: 11-16), which confirms that they were above the highest level offered in instructional settings. All L2 Chinese speakers had lived in China (average length of residence in China: 7.84 years, SD = 5.05, range: 1-18), and the age of starting learning Mandarin

Chinese was 4 years or older (mean age: 14.59, SD = 6.44, range: 4-29). All participants had normal or normal to corrected vision.

3.2 Materials

The present study constructed a masked priming study directly comparing the early lexical processing of grammatically suffixed and derived words in Chinese. The design contained three experimental conditions: morphological priming; orthographic priming; and semantic priming. Table 1 provides examples and characteristics of the items. In the morphological set, there were 30 stem targets paired with nominalized compounds (derived prime: e.g., *daibiao-xing* 代表性 represent-property 'representativeness'), aspect-marked words (aspect prime: e.g., *daibiao-zhe* 代表着 represent-PROG 'representing'), matched unrelated control words (unrelated prime: e.g., *dianshitai* 电视台 'TV station'), or the same words as the targets (identity prime: e.g., *daibiao* 代表 'represent'). The derived word primes were created with the suffixes *–jia* 家 and *–xing* 性, which accounted for 19 and 11 items respectively. The aspect-marked primes were constructed with the progressive marker *–zhe* 着 and the experiential marker *–guo* 过, which composed 19 and 11 items respectively. All the prime types except for the identity condition consisted of tri-morphemic words. A one-way ANOVA revealed that the word form frequency, reported as occurrences in the Leiden University Weibo Corpus, was matched among the derived, inflected, and unrelated primes ($p > 0.05$). The stroke number ($p > 0.05$) was also matched among the derived, aspect-marked, and unrelated primes. The target words were matched across morphological, semantic, and orthographic sets in terms of word form frequency ($p > 0.05$) and stroke number ($p > 0.05$).

Considering that the prime-target pairs in the morphological priming set overlap in meaning and surface form, it is necessary to check whether semantic or orthographic information influences morphological priming effects obtained from the present study. Thus, semantic and orthographic priming sets were created to examine whether the morphological priming effects are genuinely morphological, or if they are due to the semantic or orthographic relatedness between the prime and the target. In both sets, targets were paired with three types of primes: related, unrelated, and identical. The semantic set included 24 semantically related primes (e.g., related prime: *ningmengcha* 柠檬茶 'lemon tea' – target: *yinliao* 饮料 'drink') and semantically unrelated primes (e.g., unrelated prime: *tuokouxiu* 脱口秀 'talk show' – target: *yinliao* 饮料 'drink'). To measure the semantic relatedness of the critical items, a separate rating test on a 7-point Likert scale was conducted with 38 Mandarin L1 speakers. The semantically related primes received an average rating of 6.43 (SD = 0.97), but the semantically unrelated primes ran average rating of 2.26 (SD = 1.64). A one-way ANOVA revealed that the semantically related and unrelated primes were matched in word form frequency ($p > 0.05$) and stroke number ($p > 0.05$).

Table 1. Mean word form frequency (WFF) and stroke number of test items

	Primes		Targets	
	(WFF)	Stroke	(WFF)	Stroke
Morphological Set				
Derived Primes	e.g. *jiaoyu-jia* 教育家 'educator' (101.37)	26.17	e.g. *jiaoyu* 教育 'educate' (8303.43)	16.9
Aspect Primes	e.g. *jiaoyu-guo* 教育过 'have educated' (99.37)	26.07		
Unrelated Primes	e.g. *paobu-ji* 跑步机 'running machine' (146.73)	23.57		
Semantic Set				
Related Primes	e.g. *putonghua* 普通话 'standard Mandarin' (255.75)	24.5	e.g. *Hanyu* 汉语 'Chinese' (6181.08)	16.75
Unrelated Primes	e.g. *jinianri* 纪念日 'anniversary' (230.61)	24		
Orthographic Set				
Related Primes	e.g. *jita* 吉他 'guitar' (255.75)	24.5	e.g. *jixiang* 吉祥 'auspicious' (3359.29)	17.54
Unrelated Primes	e.g. *mianshi* 面试 'interview' (230.6)	24		

The orthographic set included 24 morphologically simple prime-target pairs. The orthographically related prime-target pairs consisted of dimorphemic words that shared the same first constituent (e.g., related prime: *jita* 吉他 'guitar' – target: *jixiang* 吉祥

'auspicious'). It was made sure that either a prime or a target in each pair is a loan word to minimize the influence of semantic priming in the orthographic set. Although the morphological set consisted of tri-morphemic primes and targets, only dimorphemic words were included in the orthographic sets since having the first two constituents overlap makes it difficult to rule out the effect of semantic relatedness due to the logographic property of Chinese writing[1]. The unrelated primes included dimorphemic words that do not contain any overlapping characters with the targets (unrelated prime: 面试 *mianshi* 面试 'interview' – target: *jixiang* 吉祥 'auspicious'). A one-way ANOVA revealed that the related and unrelated primes in the orthographic set were matched for word form frequency ($p > 0.05$) and stroke number ($p > 0.05$).

The 78 experimental targets were randomly combined with 202 fillers. The filler items included 76 real-word targets and 154 nonword targets. The nonword targets were selected from the items that were unanimously responded to as nonwords in the lexical decision mega study by Tsang et al. (2018). The real-word targets were paired with real-word primes. The nonword targets were paired with either a real-word or nonword prime. To prevent participants from making repeated lexical decisions about the same target word, the experimental items were distributed across four presentation lists based on a Latin square design. Each list contained exactly one of the prime-target pairs from each item set. Since the semantic and orthographic sets only had three primes, a third of prime-target pairs from each of the first three lists were repeated in the fourth list following Jacob et al. (2018).

3.3 Procedure

The experiment was conducted using the E-Prime software. Each participant was randomly assigned to one of the four lists. The participants were instructed that they would be presented with a series of Mandarin words and nonwords on the computer screen and need to quickly determine whether a presented word is an actual Chinese word or not, by promptly pressing one of two distinct buttons (9 for real-word; 1 for nonword) on a keyboard.

1 A one-character overlap between a tri-morphemic word and a dimorphemic word (e.g., related prime: *gao'erfu* 高尔夫 'golf'– target: *gaokao* 高考 'college entrance exam') decreases the overall rate of orthographic overlap. Hence, dimorphemic words sharing the same first constituents were selected as the orthographically related prime-target pairs to maintain the rate of orthographic overlap at 50%.

Figure 2 displays how a prime-target was shown to the participants. The test items were displayed in the center of a computer screen. Each individual test began with a blank screen displayed for 500 ms. Following this, a forward mask, made up of the same number of hashes as the length of the subsequent prime word, was displayed in the center of the screen for the same duration. Immediately after the mask, the prime word was displayed for 57 ms, followed by the target word. This target word stayed visible until the participant made a lexical decision. After the experiment, L2 participants were provided a brief questionnaire to learn about their language background. Additionally, those participants from the L2 group were required to complete a 16-point cloze test to evaluate their proficiency.

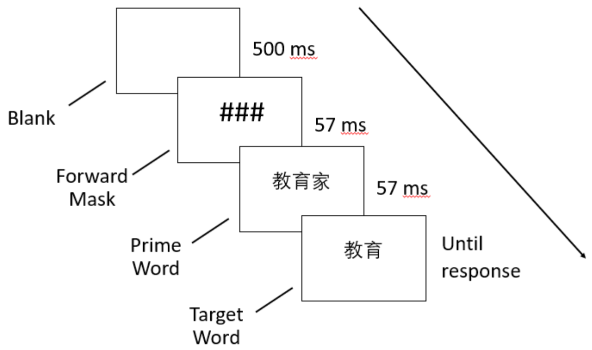

Figure 2. Prime-target pair presentation in the morphological condition

3.4 Data analysis

The first step in processing the data was to clean it based on the accuracy rates of the participants. Two L2 participants were removed from further analysis. One of them recorded a mean reaction time (RT) that was 2 SD longer than the overall participant average, and the other L2 participant failed to finish all the required tasks. Furthermore, two items from the orthographic set (*youhun* 幽魂 'ghost' and *pusha* 扑杀 'slaughter') were removed due to the low accuracy rate below 70%. The accuracy rates of the rest of the participants (93 participants) varied from 82% to 100%. Further data cleaning involved the removal of incorrect responses (4.8% of the data). Lastly, to normalize RT distributions and minimize the impact of outliers analyses were performed on the logarithm of RTs, and outliers longer than 2000 ms and shorter than 100 ms were removed following the previous masked priming studies (e.g., Boudelaa and Marslen-Wilson 2013; Verissimo 2018). The outlier removal affected 1.8% of the data, from which the incorrect responses had been removed. The analysis of response times was conducted using mixed-effects linear regression models, with crossed random effects for both participants and items (Baayen et al. 2008).

4. Results

Tables 2 and 3 provide the mean RT and accuracy rate by conditions and participation groups for the morphological, semantic, and orthographic sets. A mixed-effects model was constructed for the log-transformed RTs for targets in the morphological set, including random intercepts for the participant and the item. This model also included two fixed effects, Group (L1 and L2) and Prime Type (Unrelated, Aspect-marked, Compound, Identity), along with their interaction. The Group factor was encoded with deviation contrasts (i.e., -0.5 and 0.5). Prime Type was coded using successive differences contrasts, where each level is compared to its preceding level (Aspect-Unrelated, Compound-Aspect, and Identity-Compound). These contrasts were selected to specifically evaluate whether there is a significant difference between aspect-marked and compound priming.

Table 2. Mean RT and accuracy by condition and group for the morphological set

		Unrelated	Aspect	Compound	Identity
Morphological Set:					
L1 Group	RT	702 (229)	651 (209)	647 (196)	631 (211)
	Accuracy	99.7%	100%	99.4%	99.7%
L2 Group	RT	822 (294)	797 (314)	794 (300)	788 (341)
	Accuracy	95.4%	94.8%	93.4%	95.1%

For the model selection of the morphological set, the most articulated random-effects structure was constructed; it included a by-participant random slope for Prime Type, a by-item random slope for Prime Type, and a by-item random slope for Group, as suggested Barr et al. (2013). The most articulate model was compared with the minimal model including only by-participant and by-item random intercepts using the anova() function. The model comparison revealed that the most articulated model converged and significantly improved the model fit ($\chi2(21) = 117.91$, $p < 0.001$). The same model selection procedure was applied to the log-transformed RT data from the semantic and orthographic sets. The most articulated model also yielded a better model fit compared to the minimal model for both semantic ($\chi2(13) = 129.34$, $p < 0.001$) and orthographic set ($\chi2(13) = 48.82$, $p < 0.001$).

Table 3. Mean RT and accuracy by condition and group for the semantic and the orthographic sets

		Unrelated	Related	Identity
Semantic Set:				
L1 Group	RT	683 (199)	676 (209)	632 (213)
	Accuracy	99.7%	99.4%	99.7%
L2 Group	RT	843 (311)	778 (253)	775 (303)
	Accuracy	96.8%	96.8%	96.8%
Orthographic Set:				
L1 Group	RT	736 (222)	734 (239)	648 (205)
	Accuracy	96.1%	96.3%	96.8%
L2 Group	RT	880 (355)	888 (352)	900 (319)
	Accuracy	82.4%	80.8%	83.5%

The model output for the morphological set is provided in Table 4. The model revealed that aspect-marked primes elicited significantly faster reading times than unrelated primes (Estimate = -0.06, SE = 0.02, $p < 0.001$). RTs after aspect-marked primes and compound primes did not differ from each other, and no difference was obtained between RTs following identity and compound primes. There was a main effect of Group, indicating that the L2 group took significantly longer time to respond than the L1 group (Estimate = 0.20, SE = 0.03, $p < 0.001$). A main effect of Trial was also obtained from the model, meaning that the participants' RT accelerated with each trial (Estimate = -0.02, SE = 0.00, $p < 0.001$). The model did not yield any interaction between the Group and the contrast measures (Aspect-Unrelated; Compound-Aspect; Identity-Compound). In order to confirm whether the compound primes evoked faster response times than the unrelated primes, an additional analysis was conducted by adjusting the factor level order. The analysis with the reordered level confirmed that the compound primes also yielded faster response times than the unrelated primes (Compound-Unrelated: Estimate = -0.5, SE = 0.01, $p < 0.001$) and the difference between the prime conditions did not interact with the group factor. The results from the morphological set indicate that both types of morphologically related primes facilitated word recognition of the stem targets consistently for the L1 and L2 groups. Furthermore, the priming effect of aspect-marked and compound primes did not differ from each other for both participant groups.

Table 4. Linear mixed effects model for the morphological set

	Estimate	Std. Error	t value
(Intercept)	6.55	0.02	261.50***
Aspect-Unrelated	-0.05	0.01	-4.50***
Compound-Aspect	0.00	0.01	0.52
Identity-Compound	-0.02	0.01	-2.26
Group (L2)	0.20	0.03	5.26***
Trial	-0.02	0.00	-5.83***
Aspect-Unrelated × Group (L2)	0.03	0.02	1.23
Compound-Aspect × Group (L2)	0.01	0.02	0.57
Identity-Compound × Group (L2)	0.01	0.02	0.50

*** $p < 0.001$

Table 5 displays the model output for the semantic set. In the semantic set, semantically related primes significantly facilitated the recognition of target words relative to semantically unrelated primes (Related- Unrelated: Estimate = -0.04, SE = 0.01, $p < 0.01$). Furthermore, response times after identity primes were significantly faster than those after semantically related primes (Identity-Related: Estimate = -0.05, SE = 0.01, $p < 0.001$). Same with the morphological set, main effects of Group and Trial were obtained from the semantic set, indicating generally slower response times by L2 participants (Estimate = 0.18, SE = 0.04, $p < 0.001$) and faster response times with the progress of trials (Estimate = -0.02, SE = 0.00, $p < 0.001$). The model output also revealed an interaction of Group and the contrast between semantically related and unrelated primes (Estimate = -0.05, SE = 0.02, $p < 0.05$). In order to explore the interaction in detail, separate analyses for L1 and L2 groups were conducted.

The model selection was conducted separately for L1 and L2 groups by comparing the most articulated random-effects structure including a by-participant random slope for Prime Type and a by-item random slope for Prime Type to the minimal model including only by-participant and by-item random intercepts for both L1 and L2 groups. The most articulated model did not enhance the model fit for either L1 or L2 group. Hence, the output of the minimal model is reported in Table 6 for L1 and L2 performance in the semantic set. For the L1 group, response times following semantically related primes were not different from those after semantically unrelated primes, whereas RTs after identity were significantly faster than those after semantically related primes (Identity-Related: Estimate = -0.07, SE = 0.01, $p < 0.001$). For the L2 group, semantically related primes elicited significantly faster response times for target words than semantically unrelated primes (Related-Unrelated: Estimate = -0.06, SE = 0.01, $p < 0.001$). Same with the L1 group, RTs after identity primes were significantly faster than those following semantically related primes in the L2 group (Identity-Related: Estimate = -0.03, SE = 0.01, $p < 0.05$). In the semantic set, it was shown that only the L2 group demonstrated a reliable semantic priming effect.

Table 5. Linear mixed effects model for the semantic set

	Estimate	Std. Error	t value
(Intercept)	6.55	0.02	280.53***
Related-Unrelated	-0.04	0.01	-3.37**
Identity-Related	-0.05	0.01	-4.33***
Group (L2)	0.18	0.04	4.33***
Trial	-0.02	0.00	-5.05***
Related-Unrelated × Group (L2)	-0.05	0.02	-2.31*
Identity-Related × Group (L2)	0.03	0.02	1.46

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6. Linear mixed models for L1 and L2 groups in the semantic set

	Estimate	Std. Error	t value
L1 Group:			
(Intercept)	6.46	0.02	269.48***
Related-Unrelated	-0.01	0.01	-0.87
Identity-Related	-0.07	0.01	-4.70***
Trial	-0.01	0.00	-2.45*

L2 Group:			
(Intercept)	6.64	0.03	173.69***
Related-Unrelated	-0.06	0.01	-3.63***
Identity-Related	-0.03	0.01	-2.06*
Trial	-0.03	0.00	-4.54***

* p < 0.05, *** p < 0.001

Table 7 displays the model output for the orthographic set. In the orthographic set, identity primes significantly facilitated the recognition of target words relative to orthographically unrelated primes (Unrelated-Identity: Estimate = 6.63, SE = 0.02, p < 0.001). No difference was obtained from the contrast between RTs after orthographically related and unrelated primes. The model output also revealed an interaction of Group and the contrast between semantically related and unrelated primes (Estimate = -0.07, SE = 0.02, p < 0.05). The interaction indicates that L1 speakers had a larger repetition priming effect relative to L2 speakers. In order to further explore the interaction, separate analyses were conducted for L1 and L2 groups.

Table 7. Linear mixed effects model for the orthographic set

	Estimate	Std. Error	t value
(Intercept)	6.63	0.02	252.46***
Unrelated-Identity	0.09	0.01	6.47***
Related-Unrelated	-0.03	0.01	-1.91
Group (L2)	0.24	0.04	5.56***
Trial	-0.01	0.00	-2.90**
Unrelated-Identity × Group (L2)	-0.07	0.02	-2.76*
Related-Unrelated × Group (L2)	-0.03	0.02	-1.31

* p < 0.05, ** p < 0.01, *** p < 0.001

The same model selection procedure was conducted separately for L1 and L2 groups in the orthographic set as in the semantic set. As with the semantic set, the most articulated model did not enhance the model fit for either L1 or L2 group in the orthographic set. Hence, the output of the minimal model for the L1 and L2 groups is reported in Table 8. For the L1 group, identity primes yielded significantly faster response times than orthographically unrelated primes (Unrelated-Identity: Estimate = 0.13, SE = 0.02, $p < 0.001$), whereas RTs after identity orthographically related and unrelated primes did not differ from each other. For the L2 group, orthographically related primes induced significantly faster response times relative to orthographically unrelated primes (Related-Unrelated: Estimate = -0.05, SE = 0.02, $p < 0.001$). Also, RTs after identity primes were significantly faster than those following orthographically unrelated primes in the L2 group (Unrelated-Identity: Estimate = 0.05, SE = 0.02, $p < 0.01$). Despite the lack of difference in the Related-Unrelated contrast in the L1-L2 omnibus analysis, the separate analysis of the L1 and L2 groups revealed that only L2 speakers showed a reliable orthographic priming effect.

Table 8. Linear mixed models for L1 and L2 groups in the orthographic set

	Estimate	Std. Error	t value
L1 Group:			
(Intercept)	6.52	0.02	250.59***
Unrelated-Identity	0.13	0.01	6.80***
Related-Unrelated	-0.01	0.01	-0.69
Trial	0.00	0.00	-0.42
L2 Group:			
(Intercept)	6.76	0.04	167.07***
Unrelated-Identity	0.05	0.02	2.60**
Related-Unrelated	-0.05	0.02	-2.27*
Trial	-0.03	0.00	-3.66***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5. Discussion

The goal of the study was to establish whether the hierarchical structure processing is inoperative in L2 morphological processing in Chinese, a language typologically distinct from Indo-European languages. Additionally, the present study investigated whether the high salience of Chinese morphemes can induce L2 speakers to engage in native-like structural processing of morphologically complex words, as suggested by the alternative account (e.g., Jacob et al. 2018). In order to address the research question, a masked-priming lexical decision task was conducted with 48 Mandarin L1 speakers and 47 proficient L1 Korean L2 Mandarin speakers. The response time data revealed that both L1 and L2 groups demonstrated a morphological priming effect, with morphologically related primes inducing significantly faster response times for the stem targets compared to unrelated primes. Furthermore, the response time data in the present study also show that the effect of morphological priming did not differ across aspect-marked and compound primes for L1 and L2 groups. Yet, L1-L2 differences emerged in the semantic and orthographic sets. In the semantic set, only L2 speakers exhibited a significant semantic priming effect, with faster lexical decisions to the target after semantically related primes than after unrelated primes. Although the orthographic priming effect did not interact with the group effect in the omnibus analysis of response time data in the orthographic set, separate analyses of L1 and L2 data revealed that only the L2 group had a reliable orthographic priming effect.

The results of the masked-priming lexical decision task revealed that L2 speakers can demonstrate native-like priming effects for morphologically related prime-target pairs. Yet, the semantic and orthographic priming effects from the L2 RT data indicate that the native-like priming effects obtained from L2 speakers in the morphological priming set might have resulted from their sensitivity to non-grammatical sources such as the form and meaning of the prime-target pairs. L1 speakers in the present study exhibited a genuine morphological priming effect, as no semantic and orthographic priming effects were obtained from the L1 RT data. The results from the L1 speakers suggest that both aspect-marked words and compound words are automatically decomposed by L1 speakers based on the appropriate morphological structure in the early stage of lexical access. In contrast, it can be inferred from the processing patterns of L2 speakers in the present study that the priming effects of morphologically related words on the stem targets might have been motivated by the overlap in both form and meaning (e.g., *daibiaoxing* 代表性 'representativeness' – *daibiao* 代表 'represent') between them.

Regarding the orthographic priming effects, several studies have provided evidence for the higher level of sensitivity to orthographic information in L2 relative to L1 processing (e.g., Nakayama and Lupker 2018; Jiang 2021; Kida et al. 2022). With or without semantic overlap, L2 speakers tend to demonstrate a consistent orthographic priming effect based on the overlap in form between the prime and the target (e.g., SCANDAL as well as SCANNER priming SCAN). Also, several studies reporting native-like patterns of L2 morphological processing on different types of morphologically complex words identified significant surface form priming effects in their orthographic control conditions for the L2 group, but not for the L1 control group (Feldman et al. 2010; Diependaele et al. 2011; Heyer and Clahsen 2015; M. Li et al. 2017; J. Li et al. 2017). The orthographic priming effect observed in the L2 group under the masked priming condition could indicate a general trend among L2 speakers to rely more on the orthographic surface form during visual word recognition, as compared to L1 speakers. This might result in seemingly morphological priming effects for word pairs that are morphologically related in L2 speakers. However, these effects are not truly motivated genuinely by analysis of the relevant morphological structure, but rather by their orthographic surface form similarities.

Another notable finding from the present study is that a semantic priming effect was obtained from L2 speakers while it was absent in the L1 group. The presence of semantic priming in the response time data of L2 speakers suggests that the morphological priming effect observed in L2 speakers might have resulted from their detection of semantic similarities between the primes and targets in the morphological set. At first glance, the semantic priming effects in L2 early lexical processing seem at odds with a number of L2 processing studies using a masked priming lexical decision task, which reported no semantic priming effect for either L1 or L2 speakers in the midst of morphological and orthographic priming effects. It is generally accepted that the masked priming paradigm probes the initial phase of lexical processing, during which semantic information may not yet be accessible (Rastle et al. 2004; Marslen-Wilson 2007). The semantic processing is primarily captured in the later stage of lexical processing, typically analyzed through an overt priming paradigm using a stimulus onset asynchrony (SOA) that exceeds 200 ms (Rastle et al. 2000; Rastle et al. 2004). However, regarding the timing of semantic activation, some studies suggest that semantic information may influence even the early stage of word recognition (Feldman et al. 2009; Feldman et al. 2015). A series of masked-priming experiments using different ranges of SOA revealed that semantically related primes significantly facilitate word recognition even when presented only for as short as 34 ms (Feldman et al. 2015).

Despite the potential availability of semantic activation in the early phase of lexical processing, one may still question how the semantic priming effect influenced L2 but not L1 processing in the present study. A recent masked priming study on morphological processing by heritage speakers found a result that parallels the present study in that the non-dominant language processing may draw more on semantic information relative to dominant language processing (Uygun and Clahsen 2021). In the masked priming lexical decision task with the SOA of 50 ms, heritage speakers of Turkish demonstrated the same morphological priming patterns as L1 speakers. However, the heritage speakers diverged from the L1 speakers as the semantic priming effect was found significant only for the former group. This study attributes the semantic priming effect in the heritage language lexical processing to the limitations of online resources in the processing of a non-dominant language (Polinsky and Scontras 2020). It is assumed that heritage speakers tend to employ knowledge from other domains to compensate for constraints in their grammatical processing of the non-dominant language. Hence, heritage speakers may recruit additional resources during the morpho-lexical processing and process morphologically related words via semantic associations, which may not be utilized by L1 speakers. Although L2 speakers fundamentally differ from heritage speakers in terms of the L1 background, the two populations parallel each other in using the target language as a non-dominant language. Furthermore, similar to the online resource limitation account proposed for heritage speakers, studies in support of the SSH have provided evidence that L2 speakers rely more heavily on non-structural information compared to L1 speakers (Clahsen and Felser 2006, 2018). In the same vein, the semantic priming effect and the morphological priming effect obtained from L2 speakers in the present study can be interpreted as evidence that L2 processing may involve more non-structural information than L1 processing even at the early stage of lexical processing.

Furthermore, we can hypothesize that the logographic nature of Chinese characters may have enhanced the sensitivity to orthographic and semantic details of morphologically complex words in L2 morphological processing found in the present study. While many previous studies that have reported native-like behaviors in L2 morphological processing found either an orthographic priming effect among L2 speakers (Feldman et al. 2010; Diependaele et al. 2011; Heyer and Clahsen 2015; J. Li et al. 2017; M. Li et al. 2017) or a semantic priming effect in heritage speakers (Uygun and Clahsen 2021), the current study uncovered both orthographic and semantic priming effects in proficient Korean L2 Mandarin speakers. Unlike alphabetic languages where morphemes are written in a continuous sequence (e.g., “play” + “ed” results in “played”), each morpheme in Chinese establishes an independent visual unit (e.g., *shoucang* 收藏 meaning 'collect' + *jia* 家 'house' gives *shoucangjia* 收藏家 'collector'). Thus, based on visual cues, morphemes within the same word boundary in Chinese can be relatively easily distinguished. The fact that every character forms a standalone visual block in Chinese might have encouraged L2 speakers to leverage surface-form details more proficiently during the early phase of lexical access, in turn facilitating the recognition of surface-form overlaps between morphologically related primes and targets.

Moreover, given that every Chinese character serves as the smallest unit of meaning (Packard 2000), L2 learners might need to initially recognize the lexical-semantic information of each character before advancing to the subsequent stages of structural processing. An Event-Related Potential (ERP) research focusing on Chinese function words and morphemes has even shown that, despite their grammatical role in sentences, they provoke an N400 effect similar to that caused by content words (Liu et al. 2010). For instance, the experiential aspect marker *–guo* 过 used in the present study may have various functions depending on different contexts as it can be used independently as a verb meaning 'cross' or as a directional complement following a motion verb. The diverse lexical-semantic attributes of Chinese morphemes could enhance their semantic prominence, which, as a consequence, might assist L2 speakers in more efficiently recognizing these morphemes for the process of morphological decomposition.

In brief, the findings of the present study mainly align with the SSH, which proposes a priority of non-structural to structural information in the L2 processing (Clahsen and Felser 2006, 2018). The results from the present study contrast with the previous L2 shallow morphological processing studies on English, Turkish, and German, where L2 speakers exhibited distinct priming effects from L1 speakers for the morphologically related prime-target pairs (Silva and Clahsen 2008; Kirkici and Clahsen 2013; Jacob et al. 2018). Yet, although the same priming patterns were observed among L1 and L2 speakers in the morphological priming set, the semantic and orthographic priming effects indicate that morphological priming effects in the L2 speakers are likely to have resulted from the effect of semantic and orthographic overlap between the primes and the targets, which share the same first two constituents (e.g., prime: *shoucang-jia* 收藏家 'collector' – target: *shoucang* 收藏 'to collect'). Hence, the results of the present study imply that L2 processing of morphologically complex words may not heavily involve the hierarchical structure processing but rather is mediated by lexical-semantic connections or surface level orthographic information. Although some studies proposed semantic salience or transparency of morphemes may induce L2 speakers to employ native-like structural processing of morphologically complex words (Li et al. 2017; Jacob et al. 2018), the results of the study indicate that the semantic and orthographic salience of Chinese characters facilitates word-level semantic and orthographic processing rather than morpheme-based decomposition of morphologically complex words.

6. Conclusion

This study aimed to investigate whether proficient Korean L2 speakers of Mandarin Chinese can construct the hierarchical representations of morphologically complex words in a native-like fashion. The masked priming task results present that L2 learners can demonstrate target-like priming effects of morphologically related prime-target pairs for both grammatically suffixed and derived words. However, the L2 group exhibited significant semantic and orthographic priming effects, which were absent in the L1 group, suggesting L2 speakers might draw on additional non-structural information during lexical processing. It is assumed that the logographic features of Chinese characters, which function as independent visual and semantic units, could potentially influence the early stage of lexical processing by L2 speakers, who tend to rely more on non-grammatical sources compared to their L1 counterparts. It is expected that further research using an ERP paradigm with various ranges of SOA may provide a comprehensive picture of whether genuine morphological processing independent of semantic and orthographic influences is obtainable in L2 Mandarin processing.

Notes

1. When conducting second language processing research, if the language proficiency of non-native speakers is low, the differences in processing patterns observed between L1 and non-native speakers may not originate from fundamental differences in their target language processing mechanisms. Instead, they can be interpreted as resulting from the relatively lower language proficiency of the non-native speakers. Therefore, many preceding second language processing studies focus on non-native speakers with higher target language proficiency.

2. While there is a concern that variations in form classes between derived and inflected words might impact the morphological priming effect, past research indicates that the decomposition of morphologically complex words displays a consistent pattern, irrespective of the prime's form class differences (e.g., Crepaldi et al. 2014; Loui et al.

2021). Furthermore, it is suggested that stems are represented at the pre-lexical level of morphological processing, free of grammatical form class (e.g., Crepaldi et al. 2014). Hence, in the early stage of lexical processing, the grammatical information is assumed not to have much impact on the morphological decomposition. Given that this study uses the masked priming paradigm, which targets the early phase of lexical processing, the impact of grammatical form class isn't the main concern of our research.

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