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## Learning Chinese as a Second Language: Implications of the Character-Word Dual Function Model

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### Abstract

Learning new words is fundamental in both first and second-language reading. There are, however, divided opinions on the best instructional approaches. Two widely used approaches across languages are whole-word focus and word-constituent focus. The appropriateness of each approach has varied historically, even within a single language (e.g., the debate between whole-word instruction and phonics in English). In teaching Chinese, both approaches are applied but to different learner groups. Whole-word instruction predominates in teaching Chinese as a second language (L2), while instruction for Chinese children focuses more on character-level mappings. It may seem reasonable in L2 Chinese instructions to focus on direct mappings between Chinese words and their L1 equivalent words. However, this raises a question: Is whole-word instruction the most efficient approach in L2 Chinese instruction? Based on an analysis of the Chinese writing system, we proposed a Character-Word Dual Function model of Chinese and tested its application of a dual-focus approach on both characters and words in L2 Chinese classroom instruction. Empirical findings support the advantage of this new approach compared to conventional whole-word instruction. We discuss the alignment between our findings and the Unified Computational Model and its implications for word instruction across languages.

**Keywords:** *Word Instruction, Chinese, L2, Dual Focus*

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## **<sup>1</sup>Introduction**

Words play a critical role in learning to read (Perfetti, 2007), and vocabulary size is closely related to reading performance (Adlof et al., 2006; Braze et al., 2007; Cromley & Azevedo, 2007; Ouellette & Beers, 2010). However, differing views on word instruction often emerge regarding whether it should emphasize the whole word or its constituent parts—a phenomenon observed in many languages. For instance, in English, debates exist as to whether we should prioritize whole words or focus on grapheme-phoneme mappings (Bowers, 2020; Castles et al., 2018; National Reading Panel, 2000; Rayner et al., 2001). Similarly, such debates exist in Chinese instruction, where the question arises regarding whether Chinese word instruction should prioritize the entire word or its constituent characters (T. Li, 2005; Pine et al., 2003). These debates highlight the significance of word instruction and the pressing need to identify efficient approaches for learning and teaching words. Moreover, these debates raise questions about universal principles in word instruction across various writing systems and how a writing system influences word instruction (Verhoeven & Perfetti, 2017, 2022).

We address these questions by reviewing a classroom study on learning Chinese as a second language (L2) (Chen et al., in press). In this study, we proposed an instructional approach that has a dual focus on both the word and its constituent characters in Chinese word instruction based on our Character-Word Dual Function (CWDF) model (Chen et al., 2023) and tested its application in L2 Chinese instruction. In this review, we consider and discuss how the study's findings align with Brian MacWhinney's Unified Computational Model of language acquisition (2005, 2018) and explore the broader implications for word instruction across different writing systems.

In the following sections, we first review current instructional approaches in Chinese word instructions and their apparent rationales.

## **Word Instructional Approaches for Chinese Children and L2 Learners**

There are two widely used approaches in Chinese word instruction: whole-word focus and character focus. These approaches are applied to different groups, with whole-word instruction for L2 Chinese learners and character instruction for Chinese children, respectively (T. Li, 2005; Pine et al., 2003). The application of different instructional approaches for different learner groups aligns with the assumption that instruction should take a learner's prior knowledge into account (MacWhinney, 2005). Thus, instruction for L1 children and L2 Chinese learners should differ because they have different prior knowledge before learning to read Chinese.

Chinese children typically acquire a number of words in spoken Chinese before learning to read and have established sound-meaning mappings of those words. Thus, the primary learning objective for children is to acquire mapping between written units and spoken units and, more generally, how a writing system encodes its spoken language. As characters serve as writing units in the Chinese writing system, Chinese children's word instruction heavily focuses on explicitly learning the character-level orthography-phonology mappings. Meaning instruction, however, is more complex. For words that children have never encountered in spoken

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language, the focus is on word meaning. For words whose meanings L1 children have already acquired via spoken language, meaning instruction sometimes also includes character meaning. Although characters represent meaningful morphemic units, their meanings are often somewhat inexact (as described in the following section, *The Dual Functionality of Chinese Writing*). As a result, the meaning of an individual character is not typically communicated explicitly. Instead, characters are introduced alongside several example words, all of which contain the same character and are commonly encountered in spoken Chinese. For example, since the character “工” cannot function independently as a word, the instructor will typically present words like “工人” (worker), “工作” (work), and “工厂” (factory), all of which are semantically related to the concept of work. Through repeated exposure to the character in various contextually related words, learners gradually develop an implicit understanding of its meaning.

In contrast with Chinese children, whole-word instruction is prevalent in learning Chinese as a second language. Whole-word instruction directs the learner’s attention to the correspondences between the entire word and its pronunciation, as well as its meaning, whereas character-level mappings are not typically explicitly instructed (T. Li, 2005). This aligns with the nature of L2 learning, wherein learners can leverage shared knowledge components between their first and second languages to facilitate second language acquisition, transferring these components from L1 to L2 (MacWhinney, 2005; Odlin, 1989). Whole-word instruction is particularly beneficial for L2 learners who have well-developed word representations in their native language. This prior knowledge allows them to create word-level translation equivalencies between their first and second language.

While whole-word instruction may seem reasonable for L2 Chinese learners, whether whole-word instruction is the most efficient approach in L2 Chinese word learning remains unaddressed. Studies on learning English as an L2 have demonstrated that word constituent-based phonics instruction significantly enhances L2 English word learning more than whole-word instruction (Huo & Wang, 2017; Murphy Odo, 2021). In the reviewed study, we aimed to address this question by testing the effective instructional approach in L2 Chinese learning (Chen et al., in press). Before reviewing the study, we revisited the functions of characters and words in Chinese writing, which led to the development of the Character-Word Dual Function (CWDF) model. This model underpins our proposed character-word dual-focus instructional approach for learning Chinese.

### **The Dual Functionality of Chinese Writing**

In the Chinese writing system, the writing unit, a character, typically corresponds to a syllable as well as a morpheme. Thus, Characters serve two functions, encoding both phonological and morphological information.

#### *Encoding Phonology*

Chinese characters have a high degree of consistency in their pronunciations. Among the 13,000 characters in the Dictionary of Modern Chinese, only 1,000 are polyphonic, and of these, only 100 are frequently used. Of these 100, the majority have a dominant pronunciation, which applies to 95% of the words in which they appear (Zhang & Chu, 2009). Further, words are typically pronounced as a sequential combination of their constituent characters. Thus, the

correct pronunciation of a Chinese word is often accomplished by concatenating the phonology of its characters. For example, the word “石柱” consists of the characters “石” (pronounced /shí/) and “柱” (pronounced /zhù/), and is pronounced predictably as /shí zhù/. From this perspective, Chinese writing is highly phonologically consistent, with straightforward mappings from characters to syllables and a simple concatenation of syllables to form word-level phonology. Indeed, a recent study confirmed the phonological consistency of Chinese writing using an artificial neural network model to evaluate consistency from written forms to pronunciations in 17 orthographies. This study found that the consistency score of Chinese—the character-to-syllable mapping across words—is higher than in alphabetic Dutch and English (Marjou, 2021). They place Chinese closer to “orthographic shallow” languages such as Spanish and Italian in terms of phonological consistency.

### *Encoding Meaning: Morphological and Lexical*

Beyond encoding phonology, it is important to consider how the Chinese writing system represents morphology and meanings. Conventional views hold that the Chinese writing system codes meaning (morphology) directly in its characters. This idea holds some truth, as characters and their (semantic) radicals are associated with meanings in a way that basic writing units in other systems are not. However, the meanings of characters tend to be flexible or imprecise (Taft, 2003), while most characters are bound roots of compounds that cannot stand alone as words (Yuan & Huang, 1998). To understand this claim, it is useful to delve into how modern Chinese evolved. Words in Old Chinese (1200 BC-300 AD) were largely monosyllabic and usually corresponded to writing units (characters) (Arcodia, 2007). To accommodate language change (e.g., merging or eliminating phonemes of Old Chinese) and new meanings, Chinese adopted “compounding” (also called the “disyllabification” in the common case of two-syllable words, which constitute over 70% of Chinese characters) (Arcodia, 2007). Consequently, Chinese writing began to employ multi-character words with clear character boundaries to represent newly developed compounds. In effect, the salient boundaries between characters originally indicated the boundaries of single-character words rather than marking the morpheme as a special unit.

In modern writing, boundaries are retained, now marking syllabic morphemes<sup>2</sup>. Packard (2000) argued that when monosyllabic words were combined into compound disyllabic words, the characters lost their status as free words, resulting in a corresponding loss of specific meaning. This stands in contrast to Indo-European languages, including English, which tend to preserve the constituent morphemes of compounds as free words (Packard, 2000).

The way in which characters convey meaning has two potential consequences. First, the meaning of a character is highly word-dependent, contingent on the meaning of the word and, in effect, on other characters in that word. Thus, a character cannot represent meaning consistently among different words. For example, the translation equivalent of the English compound word “germinate” is “发芽” in Chinese. The first character, “发”, has multiple meanings (such as “generate” or “feel”), and its interpretation is determined by the

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<sup>2</sup>Although most morphemes are expressed by a single character, there are exceptions (e.g., 葡萄 /pú táo/, “grape”, has two syllables and two characters but one morpheme).

compound word in which it appears. For example, in the word “发芽” (germinate), it is combined with the character “芽” (“sprout”) and loosely conveys the meaning “generate”. In contrast, its contribution to the word “发痒” (itching) is more representative of a concept like “feeling” or “sensation” as it scopes the concept of 痒 (“itch”) to imply a physical perception.

This word-dependent phenomenon exists in English as well. For example, the interpretation of “watch” relies on the other morpheme in the same word (That is, “watch” encodes different semantic information in “watchdog” than it does in “watchmaker”). Nevertheless, the word-dependent meaning interpretation of characters is especially common in Chinese because of its high proportion of compound words and the flexible meanings carried by most characters. The second consequence is that the meanings of most Chinese words cannot be directly inferred from the meanings of their constituent characters (J. Li, 2011). Only 29% of compound words in the Modern Chinese Dictionary have completely transparent meanings, where the meaning of the word is a combination of the meanings of the constituent characters/morphemes (e.g., 阳光, or “sunlight”) (J. Li, 2011). These observations lead to what may seem a startling conclusion: Written Chinese is more consistent (and transparent) in its phonology than in its meaning.

The above analyses give rise to our conclusion concerning the dual functionality of characters in Chinese writing. Its characters function as both orthographic and morphemic units. However, the character encodes phonological and morphological meaning information unequally. As primary orthographic units, characters are consistent in coding syllable-level phonology but less inconsistent in coding meaning as morphemic units. Thus, it is words, not characters, that primarily encode meaning.

### **The Character-Word Dual Function (CWDF) Model**

This dual functionality of the Chinese writing system lays the foundation of the Character-Word Dual Function (CWDF) model, which redefines the functionalities of characters and words and predicts their roles and processes in reading Chinese. The complete CWDF model introduced in Chen et al. (2023) rests on three assumptions: 1) the character is the basic unit of orthography, maps to the syllable-level pronunciation consistently, and encodes morpheme meaning variably. 2) The word functions as the primary meaning provider in reading. 3) The functions of the character and word depend on the quality of the reader’s lexical representations, which vary with the Chinese reading experience. We elaborate on these assumptions below.

1) *The character functions as the basic unit of orthography.* Aligned with the facts of consistency in character-syllable, the CWDF model proposes that characters are basic orthographic units and play a critical role in the process of learning to read Chinese. The precise character-level orthographic representations provide a foundation for developing high-quality word-level orthographic representations for skilled reading (Perfetti, 2007; Perfetti & Hart, 2002).

The importance of developing fine-grained representations of character orthography in learning to read Chinese is supported by findings indicating that orthographic knowledge and awareness are critical in early Chinese reading development (H. Li et al., 2012; McBride-

Chang & Ho, 2005). Chinese learners must be able to discriminate among more than six thousand commonly used characters to achieve reading proficiency (the State Language Commission of China, 2013).

The prominent role of character-level orthographic processes continues as novice readers develop into skilled ones (Cao et al., 2010; Tan et al., 2001). In skilled reading, characters act as the orthographic “gateway” to word identification. The activation of characters has been observed even when reading the alphabetic script of Pinyin in both skilled L1 and L2 readers (Chen et al., 2014; Chen, Perfetti, & Leng, 2019; Chen, Perfetti, Fang, et al., 2019).

2) *The word functions as the primary meaning provider.* In contrast to characters, which, as morphemic units, are less consistent in meaning interpretations, a word offers a more precise representation of lexical meaning. Word meaning plays a critical role in linking the subsystems of reading processes connecting word identification and comprehension (Perfetti & Stafura, 2014). Reading comprehension depends on the successful retrieval and integration of word meanings into the reader’s mental representation of the text (Perfetti & Helder, 2021; Yang et al., 2007). An ERP study on reading Chinese supports this, showing that skilled Chinese readers rely on whole-word meanings rather than character meanings, for comprehension (Chen et al., 2017). Eye-tracking studies have produced similar findings (Shen et al., 2018).

3) *The functionalities of characters and words rely on the quality of lexical representations.*

The CWDF model extends the primary functions of characters and words by incorporating their dependency on their representation quality developed through reading exposure. With sufficient reading experience, readers develop well-established orthographic and meaning representations for both constituent characters and words, allowing them to contribute to reading efficiently.

The word superiority effect illustrates the simultaneous orthographic processes at both character and word levels. With very brief exposure, characters within real words are recognized more accurately and quickly than characters within non-words, supporting rapid access to the word-level orthography (Chen et al., 2018). This effect varies with character frequency: high-frequency characters show smaller word superiority effects than low-frequency characters. This suggests that orthography of high-frequency characters can be accessed rapidly, benefiting less from word-level orthography (Chen et al., 2018).

With sufficient reading experience, readers can also develop meaning representations of constituent characters in addition to the word meaning (Tsang & Chen, 2013a, 2013b, 2014; Wu et al., 2017). This development rests on the expansion of the reader’s vocabulary (Rastle, 2019; Reichle & Perfetti, 2003). Knowledge of an increased number of words exposes the learner to the same character in diverse word contexts, resulting in the implicit acquisition of the character’s meaning (Liu et al., 2017). Although character meanings are often imprecise and inexact, their representations can help recognize less familiar, low-frequency words for which the word-level meaning access is less automatic (Chen et al., 2023; Tse & Yap, 2018; Yan et al., 2006).

## **Character-Word Dual Focus: An Implication of the CWDF Model in L2 Chinese Word Instruction**

The conceptual framework of the CWDF model redefines the roles of characters and words in Chinese reading. As a result, its implications merit the formulation of specific hypotheses and experimental investigation (Chen et al., 2023). One of its applications is in L2 Chinese word instruction. According to the CWDF model, Chinese instruction should create a dual focus on the character and the word, aligning with their roles in the structure of written Chinese.

Because characters are the basic orthographic units and map to the syllable-level pronunciation consistently, orthographic instruction should explicitly teach character-level orthography by mapping it to a spoken syllable. Learning these orthography-phonology mappings enables learners to develop character-level orthographic representations, which in turn build the word-level orthographic representations (word orthography being the simple concatenation of constituent characters' orthography), preparing them to become skilled readers. Furthermore, learning the character-level orthography-phonology mappings allows for the acquisition of the systematic structure of the Chinese writing system and supports learning new words. In this process, learners can directly transfer character-level associations between orthography and phonology to new words that include the learned characters, thereby supporting the acquisition of new vocabulary.

Meaning instruction should primarily focus on the word. This allows learners to develop more precise meaning representations, preparing them for rapid meaning retrieval and integration during reading comprehension. In Chinese children's instruction, character meanings are sometimes taught in addition to word meanings. Chinese children can learn the meanings of some characters implicitly through their knowledge of spoken words that share the same character. This approach, however, does not apply to less proficient L2 learners, especially beginners, whose vocabulary may not be sufficient to support such learning.

## **Testing the Character-Word Dual Focus Approach in a Study of Classroom L2 Chinese Learners**

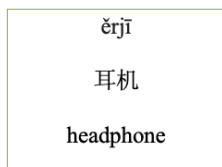
To test the application of the dual-focus approach in L2 word instruction, we conducted a two-session classroom study of learning Chinese as a foreign language (Chen et al., in press). Learners were American college students enrolled in an introductory Chinese course. The control group received conventional word-focus instruction by being presented with a two-character word as a whole, along with its two-syllable pronunciation and meaning in English (Figure 1). The experimental group received dual-focus instruction and was taught the exact words as the word-focus group but with visual space between the syllabic pronunciation of each character (Slide 1 in Figure 2). Both the word-focus and dual-focus groups learned meaning from the whole word presentation; they differed only on whether pronunciations were presented for the whole word or for each character separately.

Two features based on the CWDF model were highlighted in the instruction received by students in the experimental group. First, orthography to phonology mappings were instructed at the character level (Slides 2 and 3 in Figure 2), which benefits the development of both characters' and words' orthographic representations. The character representations can support learning new words that share the same character. Second, the mappings of orthography to

meaning were instructed to learn at the word level for beginning learners, not the character level.

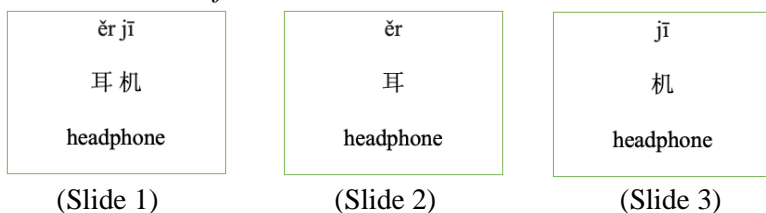
**Figure 1**

*An Illustration of Word-Focus Instruction*



**Figure 2**

*An Illustration of Dual-Focus Instruction*



To evaluate the effectiveness of this dual-focus instruction, we compared the learning performance of students who received dual-focus instruction to that of students who received conventional word-focus instruction at both word and character levels. We hypothesized that dual-focus instruction, relative to word-focus instruction, would have two important outcomes. First, because of the instructional focus on building orthographic-phonological character representations, learners in the experimental group would develop higher-quality orthographic representations of both the word and its characters. The orthographic representations of characters enable learners to make more extensive character-based generalizations (i.e., learners will better recognize these characters when they appear in words they do not know). Second, despite its emphasis on character form, the dual-focus instruction on word meaning should lead to a level of word meaning learning comparable to that of word-focus instruction.

The results showed that the dual-focus instruction led to levels of word pronunciation and meaning learning comparable to the word-focus instruction, regardless of whether the test tasks were retrieval or recognition (as summarized in Table 1. Detailed results and statistical analyses are elaborated in Chen et al. in press). These findings suggest that word-level performance did not suffer due to a focus on character-syllable mapping. More importantly, the dual-focus instruction benefited learning character pronunciation and produced a greater transfer to learning novel words compared to the word-focus approach, with roughly 20% higher accuracy. The advantage of dual-focus instruction in learning pronunciation at both character and word levels aligns with the key assumption of the CWDF model, in which characters are basic orthographic units. Establishing character-level representations is crucial for developing high-quality orthographic representations at both character and word levels, as well as for facilitating the learning of new words.

**Table 1***Instructional Focus and Learning Performance between Two Instructions*

Instruction	Instructional focus		Learning performance			
	Pronunciation	Meaning	Word pronunciation	Character pronunciation	Novel word pronunciation	Word meaning
Dual-focus	Character	Word	Equal	Dual-focus outperforms	Dual-focus outperforms	Equal
Word-focus	Word	Word				

Our results support the application of the dual-focus approach to L2 Chinese instruction. In fact, this approach has clear parallels to current instructional methods for L1, albeit modified to account for differences between native speakers and second-language learners. As we noted previously, Chinese children explicitly learn the character-level orthography-phonology mappings, aligning with the dual-focus approach. Meaning instruction generally occurs at the level of the word. In the case of words that have already been acquired in spoken language, this can result in implicit instruction on the meanings of the constituent characters. However, for unfamiliar or new words, this implicit character-meaning instruction is less accessible (or may not occur at all). Thus, the approach for Chinese native speakers is akin to an updated version of the dual-focus approach tailored to more proficient learners, as meaning instruction still occurs at the word level but may focus on specific characters in some circumstances. Thus, while the reason for character focus differs between L1 and L2 learners, it is still the secondary source of meaning acquisition.

### **Learning Chinese as a Second Language and the Unified Competition Model**

The Unified Competition Model (UCM) of language acquisition proposed by Brian MacWhinney (1987, 1997, 2001, 2005, 2018) provides an excellent theoretical framework for understanding both L1 and L2 acquisition. It has broad implications in L2 learning, including word learning and instruction. Analysis of the products of our own work shows two factors that clearly align with the principles of the UCM model: cue availability and reliability in language learning are critical to acquisition, and factors that support or hinder language acquisition may vary between L1 and L2 learners.

The general applicability of the dual-focus approach in both L1 and L2 Chinese learners is consistent with the importance of reliable and valid cues in language learning highlighted in the UCM model. In learning Chinese, focusing on reliable and available cues, which minimize competition, is crucial for both L1 and L2 readers. Because the character-level mappings between orthography and phonology are reliable, they provide a solid foundation for acquiring whole-word pronunciation and transferring this mapping to new words that include these learned characters. Thus, learning character-level orthography-phonology mapping is important in Chinese word instruction, necessitating explicit instruction, as the UCM model indicates. In contrast, although characters are meaningful, their mappings to meanings are less reliable, with more competition. Thus, character-meaning instruction serves only as a supplementary role.

While using a common approach for Chinese L1 and L2 instruction aligns with the UCM, the UCM also highlights the notion that L1 and L2 learners are supported and hindered by different factors (e.g., variations in prior knowledge). In Chinese word instruction, word

meaning learning can benefit from the different kinds of prior word knowledge that L1 and L2 learners bring to learning written Chinese. L1 learners bring spoken word knowledge to their learning, and L2 learners bring L1 word meaning to their learning. These differences in prior knowledge allow for slight variations in L1 and L2 meaning instruction within the application of the dual-focus model. Native speakers' knowledge of spoken Chinese vocabulary helps them develop morphological awareness of individual characters (McBride-Chang et al., 2004; Shu et al., 2006), preparing them for learning character-level meanings beyond the word meaning. This level of preparation is not typically present for L2 Chinese beginners.

Beyond aligning our work with the tenets of the UCM, the model also presents implications for future exploration. Its assumptions about the features of the target language constrain both first and second language learning. Similarly, the nature of Chinese characters as meaningful yet imprecise units suggests similar character-meaning instructional approaches for both L1 and L2 learning. Consequently, we predict that as L2 learners' vocabulary increases, they will benefit from meaning instructions of individual characters (Gao, 2020; Xu & Zhang, 2020), similar to L1 instruction.

We should note that character meaning instruction must be approached with deliberate design and acknowledge the inconsistent manner in which characters encode meaning (i.e., character meanings are less reliable cues from the UCM model perspective). Two principles derived from the model may guide designs for character meaning instruction. First, instruction should enable the reduction of the meaning competition from a character itself due to the meaning ambiguity of characters. Second, instructions should address the inconsistency between the meanings of a word and its constituent characters in acknowledgment of the reality that most Chinese compound words are not entirely transparent (Gao, 2020).

### **Implications of the Findings from Chinese Instruction for Word Instruction across Different Writing Systems**


The advantages of Character-Word dual-focus instruction, compared to word-focus instruction, during Chinese learning, support the importance of learning the constituents of words to grasp the systematic structure of the writing system. This is similar to the essential practice of learning the phoneme-grapheme mappings of an alphabetic writing system like that of English. While the sub-word mappings have been particularly emphasized in learning to read alphabetic languages such as English, where a small number of written units (letters) and spoken units (phonemes) allow explosive productivity (the ability to read almost any word) (Castles et al., 2018; Rayner et al., 2001), the importance of sub-word units extends to other written languages. This holds true for syllabaries and even for the morpho-syllabic Chinese writing system, where acquiring a large inventory of orthographic characters mapped reliably to syllables and flexibly to morphemes is critical.

This similarity of learning to read languages as different as English and Chinese in the mappings of written-spoken units may reflect two general principles of learning to read identified in the analysis of 17 different orthographies (Verhoeven & Perfetti, 2017, 2022). First, although writing systems differ in how they map orthography to phonology, learning to read involves understanding how a writing system encodes its language, specifically, the mappings between written units and corresponding spoken units in a given writing system. In Chinese, these mappings occur at the character and syllable levels, while in alphabetic

languages like English, they occur at the letter(s) and phoneme levels. Importantly, learning these mappings benefits new word learning, as learning to read relies on acquiring new words, which can be enhanced by transferring shared word components from known words. Second, precise sub-word representations are essential in developing high-quality word representations that support rapid meaning retrieval during comprehension (Perfetti, 2007, 2017; Perfetti & Hart, 2002). In the case of the Chinese writing system, fine-grained representations of character orthography enable readers to identify a given character by distinguishing it from many other visually complex Chinese characters and to identify a given word by distinguishing its character constituents from those of other words. Similarly, in alphabetic writing, the fine-grained sub-word representations enable readers to identify words sharing similar letter strings.

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