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Multidimensionality of morphological awareness and text comprehension among young Chinese readers in a multilingual context

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ABSTRACT

Considering the dual-level representation of meaning in print in Chinese, this study differentiated between morphemic (i.e., morphemic awareness) and sub-morphemic (i.e., graphomorphological awareness) dimensions of morphological awareness and examined their concurrent contributions to text comprehension in fourth grade Chinese readers in a multilingual context where Chinese literacy only has an ancillary function. Structural Equation Modeling analysis revealed that while both dimensions of morphological awareness were significant independent contributors to word reading and vocabulary knowledge, only morphemic awareness significantly predicted text comprehension over and above the two word-level skills. On the other hand, significant indirect effects of both graphomorphological and morphemic awareness were found on text comprehension; in addition, those indirect effects were found to be mediated by vocabulary knowledge or jointly by word reading and vocabulary knowledge. These findings were discussed in light of the centrality of meaning in text comprehension and possible contextual variation in the functioning of different dimensions of morphological awareness in Chinese reading development.

1. Introduction

A universal principle holds that print encodes spoken language (i.e., mapping principle) (Perfetti, 2003). Yet, how specifically different language units are mapped onto print (i.e., mapping details) varies from language to language (Ziegler & Goswami, 2005). In researching how reading acquisition across languages may reflect this mapping principle as well as language/script-specific processes in accordance to each language's mapping details, Chinese has been foregrounded as a unique case (Leong, 2015; Perfetti, 2003; Perfetti, Cao, & Booth, 2013). As a morphosyllabic language, Chinese differs from alphabetic languages like English not only in how sounds are encoded in print (i.e., syllable-to-character/morpheme as opposed to phoneme-to-letter mapping), but also its distinctive dual-level representation of meaning in print (i.e., morphemic and sub-morphemic/character) (Kuo & Anderson, 2006; Leong, 2015; Shu & Anderson, 1997; Tong, Tong, & McBride, 2017).

While morphological awareness emerges from early spoken language experiences, it is further shaped by children's print experiences after formal literacy education commences (Kuo & Anderson, 2006). Thus, developmentally in the context of reading acquisition, it would be limiting to examine morphological awareness primarily as an oral language skill without addressing its interface with orthography. In Chinese, the dual-level meaning representation in print means that morphological awareness is at least comprised of two dimensions, one at the morphemic level (e.g., homophone [书/shū/*book* and 叔/shū/uncle]; homograph [花/huā/means *flower* in花粉/huāfěn/*pollen* and *spend* in 花费/huāfèi/*expense*]; and compounding [月光/yuèguāng/moonlight]) and the other at the sub-morphemic level, the latter of which pertains specifically to meanings represented by semantic radicals (i.e., a graphomorphological unit; e.g., 氵 denoting *water* or *liquid* as in 河/hé/*river* and 酒/jiǔ/*liquor*) (e.g., Leong, 2015; W. Li, Anderson, Nagy, & Zhang, 2002; Shu & Anderson, 1997; Tong et al., 2017). Theoretically, both dimensions should play an important role in reading development in Chinese (Tong et al., 2017).

While studies on native Chinese-speaking children's reading acquisition have generally confirmed the critical import of morphological awareness (e.g., Cheng et al., 2017; Ku & Anderson, 2003; W. Li et al., 2002; McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Shu, McBride-Chang, Wu, & Liu, 2006; Tong et al., 2017; Zhang, 2013; Zhang & Koda, 2014), the focal dimensions examined often varied; and few studies considered the aforementioned dimensions concurrently (see Yeung et al., 2011 and Zhang et al., 2012 for exceptions). In addition, most studies focused on character/word reading rather than text comprehension (Nagy, Carlisle, & Goodwin, 2014; Zhang, Lin, Wei, & Anderson, 2014). An unresolved issue in the literature on morphological contribution to text comprehension, which had a primary focus on English, is whether the contribution is primarily mediated by word reading and/

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or vocabulary knowledge or whether it could be unique over and above these word-level skills (e.g., Cheng et al., 2017; Deacon, Kieffer, & Laroche, 2014; Kieffer & Lesaux, 2012; Zhang, in press). It was therefore an interest of the present study to address this issue further with a focus on Chinese readers.

Another limitation to note about the literature on morphology and Chinese reading, including text comprehension (e.g., Cheng et al., 2017; Li et al., 2002; Yeung et al., 2011; Zhang et al., 2012), is that studies largely focused on native Chinese-speaking readers in a context where Chinese is children's primary literacy and there are strong needs and opportunities for literacy practices on a daily basis (e.g., China). This context, however, is not necessarily characteristics of all contexts where students learn to become literate in Chinese. For example, in Singapore, a multilingual country in Southeast Asia with a bilingual education policy, while Chinese as one of the official languages is learned in school, it only plays an ancillary function in the society. Unlike their peers in China, ethnic Chinese students in Singapore have limited needs for learning and using Chinese, particularly reading and writing. Consequently, it is a question how restricted (oral and) literacy experiences would have an impact on children's morphological insights (especially, graphomorphological insights), and more importantly, the contribution of those insights to reading development. On the one hand, the skills underpinning monolingual Chinese reading may hold for learners in Singapore given the language-to-print mapping properties of Chinese; on the other hand, previous research that compared L1 and L2 readers of alphabetic languages revealed that context could have also an influence on how different sub-skills are specifically orchestrated in the process of becoming literate (Koda, 2005; Lipka & Siegel, 2007; Verhoeven, 2000).

To this end, with a focus on young Chinese readers in Singapore, this study aimed to examine how different dimensions of morphological awareness (i.e., morphemic versus sub-morphemic) might independently contribute to those readers' text comprehension in Chinese, with consideration of possible mediation of word reading and/or vocabulary knowledge.

1.1. Multidimensionality of morphological awareness in Chinese

Chinese is a morphosyllabic language that shows syllable-to-character mapping. Specifically, in printed Chinese, each written symbol or character, which is composed of strokes and stoke patterns, represents a syllable, and is typically a morpheme. A Chinese syllable is comprised of an initial and a final or an onset and a rime. A restricted set of onsets and rimes forms about 400 valid syllables in Chinese, and with the four tones considered, there are about 1300 valid tone syllables (Taylor & Taylor, 2014). Given the large number of characters, homophony is highly pervasive in Chinese. In addition, the meanings of a significant number of Chinese characters vary when those characters appear in different lexical contexts (i.e., homography).

Beyond the difference in how print encodes sound or phonological information, how meaning is encoded in alphabetic languages and Chinese also show notable variations. Chinese is demonstrated to have two levels of meaning representation or morphological structure in print, including morphemic and sub-morphemic levels (Leong, 2015; Shu & Anderson, 1997; Tong et al., 2017). At the sub-morphemic level, sometimes called “subcharacter morphology” (Myers, 2006, p. 170), most Chinese characters (estimated to be about 80% to 90% of all) are compounds composed of two orthographic components named phonetic and (semantic) radical, respectively; these components have varied spatial configurations and canonical positions (e.g., left-right, top-bottom, surrounding, and half-surrounding) (Taylor & Taylor, 2014). While a phonetic provides a clue to the sound of its host character, a radical provides information about the meaning of that character and is added to the phonetic to distinguish the host character from its homophonic neighbors. Phonetics and radicals are often single-unit characters themselves (about 90% for the former and 73% for the latter in elementary school Chinese; see Shu, Chen, Anderson, Wu, & Xuan, 2003). For example, 像 ([person being] *alike*) and 橡 (*oak*) are homophones that share the same right component 象 (/xiàng/ , *elephant*) as the phonetic. What distinguishes the two characters is the different radicals: 亻(人; *indicating person*) for 像and 木 (*wood*) for橡. Previous studies revealed that these orthographic units are functional components in character processing (Feldman & Siok, 1999; Taft & Zhu, 1997), and play an important role in Chinese children's reading acquisition (e.g., Anderson, Li, Ku, Shu, & Wu, 2003; Ho & Bryant, 1997).

While many Chinese characters are free morphemes or words themselves, Chinese words are primarily formed through morphological processes, predominantly compounding. In printed Chinese texts, compound words appear in two or more characters with no space in between (Li & Thompson, 1981). For example, 篮球/lánqiú/(*basketball*) is a nominal compound with a modifier-head relationship; the two component characters篮 and球, which mean *basket* and *ball*, respectively, are both phonetic-semantic compound characters. There is psycholinguistic evidence that in visual processing of two-character compound words, both morphemic (i.e., component characters) and sub-morphemic units (e.g., semantic radicals in component characters) are activated (e.g., Miwa, Libben, & Baayen, 2012).

In accordance to the above properties of dual-level meaning representation or morphological structure in print, morphological awareness in Chinese, in the context of reading acquisition, is logically comprised of two dimensions: one at the morphemic/character level (e.g., concatenation of morphemes through compounding) and the other at the sub-morphemic/character level (i.e., semantic radicals) (Kuo & Anderson, 2006; Tong et al., 2017). In the present study, the former dimension is referred to as morphemic awareness, and the latter as graphomorphological awareness recognizing that this dimension is distinctively about an orthographic unit that is meaningful within a character/morpheme.

1.2. Morphological awareness and Chinese reading

Given the aforementioned properties of Chinese morphology, it is unsurprising that a significant number of studies on Chinese-speaking children revealed that both morphemic and graphomorphological awareness are significant predictors of word reading and vocabulary knowledge. For example, morphemic awareness, such as homophone and homograph discrimination and compound construction, was found to contribute to character as well as multi-character word reading, over and above phonological awareness (e.g., Chen, Hao, Geva, Zhu, & Shu, 2009; Li, Shu, McBride-Chang, Liu, & Peng, 2012; Liu & McBride-Chang, 2010; Liu, McBride-Chang, Wong, Shu, & Wong, 2013; McBride-Chang et al., 2003; Shu et al., 2006; Tong et al., 2017; Yeung, Ho, Wong et al., 2013). Compound awareness was also found to be a significant predictor of vocabulary knowledge (e.g., Chen et al., 2009; Liu et al., 2013; Liu & McBride-Chang, 2010; McBride-Chang, Wagner, Muse, Chow, & Shu, 2005; H. Zhang, 2015). In addition, awareness of semantic radicals was a significant correlate of word reading (e.g., Ho, Wong, & Chan, 1999; Tong et al., 2017; Zhang et al., 2012); and instruction on the orthographic structure of characters, including semantic radicals, led to significant improvements in children's ability to read and write characters (e.g., Packard et al., 2006; Wu et al., 2009). Radical awareness was also found to enable children to infer meanings of unfamiliar characters (e.g., Shu, Anderson, & Zhang, 1995), and consequently, facilitate their vocabulary growth (Tong et al., 2017).

Despite the contribution documented separately for morphemic and graphomorphological awareness, little research, however, examined the effects of both dimensions concurrently. In a study that aimed to fill this research gap, Tong et al. (2017) compared the relative contributions of sublexical-level (i.e., graphomorphological) and lexical-level (i.e., morphemic) morphological awareness in Hong Kong second graders' word reading. The former dimension was measured with a