



# The developmental transition from holistic to analytic character learning in child readers of Chinese<sup>☆</sup>



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## ARTICLE INFO

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## ABSTRACT

The present study investigated children's capabilities of utilizing analytic strategies in Chinese character learning across different stages of reading development. It employed an associative learning paradigm with pseudocharacters and invented characters as stimuli, which were assigned to *regular* and *irregular* conditions based on print-sound-meaning regularity. Participants were 165 Chinese children (65 kindergarteners, 53 primary second graders and 47 primary fifth graders). Repeated measures ANOVA results showed a significant condition x grade interaction effect in pseudocharacter learning, suggesting that regularity exerted different levels of influences on pseudocharacter learning performance across age groups. Further paired-sample *t*-test results indicated that kindergarteners' learning of pseudocharacters did not benefit from print-sound-meaning regularity as did their older counterparts. The study has lent support to phase/stage models of literacy development which posit that beginning readers rely on a holistic word learning method, which gradually morphs into an analytic approach to word learning as experience in reading develops.

## 1. Introduction

The growing importance of literacy in 21st century society calls for a greater understanding in how the ability to read and write should be learned and taught. To date, progress has been made to foster understanding of the mechanisms by which words are learned, which carries far-reaching theoretical and practical implications with respect to child reading development. A number of word acquisition models posit that the learning of words entails mappings between their phonological, orthographic and semantic forms (Perfetti & Hart, 2002; Plaut, McClelland, Seidenberg, & Patterson, 1996). However, most research in reading development has focused on alphabetic languages, especially English (Share, 2008). The extent to which the learning approaches involved in acquiring alphabetic languages can be applied to the learning of Chinese, a morphosyllabic language with relatively ambiguous orthography-phonology correspondences, remains unclear. As such, this study aims to fill in the research gap by investigating the role of orthographic knowledge in Chinese character learning in children with different levels of reading experience. Extending past research, this study employs an associative learning paradigm with pseudocharacters and invented characters as stimuli to control for children's prior experience with the learning items, in order to provide a better understanding of the character learning processes.

### 1.1. Associative learning and orthographic knowledge in word reading

The ability to form associations between print, sound and meaning is fundamental to word reading, and this process has been well conceptualized in word acquisition models such as the triangle model (Seidenberg & McClelland, 1989) and the lexical quality hypothesis (Perfetti & Hart, 2002). These models view learning to read as a process of developing precise and functional mappings between print, sound and meaning representations. A skill central to carrying out lexical mappings is known as associative learning (Hulme, Goetz, Gooch, Adams, & Snowling, 2007). Measured by matching of spoken nonwords with abstract visual shapes and unfamiliar objects, associative ability has been found to predict word reading (Georgioua, Liu, & Xu, 2017; Hulme et al., 2007; Warmington & Hulme, 2012; Windfuhr & Snowling, 2001).

As learners develop their ability to read, they become increasingly aware of orthographic regularities and are therefore more disposed to employ analytic strategies in word-learning situations (McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Siok & Fletcher, 2001). The analytic approach refers to processing a word analytically with the orthographic structure inside a word, in contrast to the holistic approach which refers to processing a word holistically without paying attention to the orthographic structure inside a word. The transition from a holistic

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approach to an analytic approach in reading acquisition has been discussed by the phase/stage models proposed by Ehri (1999) and Frith (1985). According to these models, the learning of words progresses from focusing on contextual or visual features to utilizing print-sound correspondences and consolidated letter patterns. In other words, when children first begin to learn words, they tend to perceive these semiotic symbols as monolithic visual units and acquire them by rote. Beginning readers gradually develop awareness of print-sound correspondences when they accumulate sufficient understanding of the orthography of a script, underscoring the importance of orthographic knowledge in word reading.

### 1.2. Chinese character reading

To date, some evidence has pointed to a similar developmental trajectory of Chinese reading development as those theorized in the aforementioned models (Siok & Fletcher, 2001). Though print-sound mappings are relatively arbitrary in Chinese compared to alphabetic scripts, it has been suggested that children start to develop awareness of print-sound regularities when they have adequate word reading experience (e.g., Ho, Ng, & Ng, 2003). Analytic approach in Chinese reading has been evidenced in primary school children. A study conducted by Ho, Yau, and Au (2003) showed that children are unable to effectively utilize phonetic radicals in naming novel characters until primary three. Chan and Nunes (1998) found that children are not capable of systematically deducing pronunciation from phonetic radicals until primary three or four. In a longitudinal study in which development-related skill tests were administered to participants across a four-year period beginning at age 3, Ho and Bryant (1997a) administered a pseudocharacter reading test in which children were asked to read aloud 17 Chinese pseudocharacters. A pseudocharacter was deemed to be read correctly if it was pronounced based on its phonetic radical. They showed that the ability to use phonetic cues provided in the radicals to read pseudocharacters was evident when the participants were in primary one and proposed that learning to read Chinese progressed from a visual phase to a more analytical phonological phase. These findings suggest that children progress from relying on holistic approach to employing more analytic strategies in the course of Chinese reading acquisition. Approximately 80% of Chinese characters are ideophonetic characters, of which around 72% are left-right structured (Hoosain, 1991; Hsiao & Shillcock, 2006). In left-right structured Chinese characters, the left part (i.e., the semantic radical) provides information about the meaning, and the right part (i.e., the phonetic radical) signals the sound. For example, 枝, which means branch(es) and is pronounced as /zi1/[Jyut Ping<sup>1</sup>], has the phonetic radical 支/zi1/ on its right and the semantic radical 木 (meaning wood) on its left. Studies found that advanced learners of Chinese are able to utilize knowledge of print-sound regularities to aid identification of left-right structured pseudocharacters (Cheung, Chan, & Chong, 2007).

Studies that investigated developmental trajectories of Chinese character reading have mostly focused on character reading outcomes rather than the learning processes involved. A limited number of studies have looked into children's Chinese character learning approaches. Specifically, they attempted to find out whether children would be able to analyze sub-character features and apply their knowledge of print-sound regularities to learning new characters with a self-teaching mechanism (Share, 1995). The learning of the Chinese language is more efficient if learners are able to make use of orthographic knowledge rather than relying on rote memorization. Some studies have provided evidence for children's utilization of orthographic knowledge to aid Chinese character learning. Ho, Chan, Tsang, Lee, and Chung (2006) showed that children learned regular Chinese characters better than

irregular Chinese characters because regular characters have radicals providing reliable sound cues while irregular characters do not, evidencing children's reliance on print-sound-meaning regularities in Chinese character learning. However, their results might have been confounded by the participants' prior experience with the language because the character stimuli used in their study were real Chinese characters. In another study using visual shapes as testing items, Li, Shu, McBride-Chang, Liu, and Xue (2009) showed that older children were able to apply symbol-sound regularities to recognizing unfamiliar items. Interestingly, they also found that children with reading disorders showed difficulties applying symbol-sound regularity rules to learning new symbols. In a recent study, Yin and McBride (2015) taught Chinese kindergartners to pronounce novel characters which were divided into the orthographic groups of random strokes, noncharacters (Chinese radicals placed in illegal position in character structure), and pseudocharacters (Chinese radicals placed in legal position in character structure). Among these noncharacters and pseudocharacters, half of them contained phonetic cues (i.e., the characters were pronounced the same as their phonetic radicals), and the other half did not (i.e., the characters were pronounced differently from their phonetic radicals). They found that Chinese kindergartners showed sensitivity to orthographic and phonetic regularities in Chinese. Specifically, the children showed better performances in novel character learning when phonetic cues were available than when they were not available, and their performances were the best in learning pseudocharacters and the worst when learning random strokes.

Taken together, past studies have shown some evidence that child readers of Chinese are able to employ an analytic approach in Chinese character learning. However, there were contradictory hypotheses regarding the threshold period in which an analytic approach to word learning becomes developmentally feasible and is used as the normative approach: some found that Chinese kindergartners predominantly adopted the holistic visual approach (e.g., Ho & Bryant, 1997a) whereas others indicated that preschoolers were able to employ an analytic approach (e.g., Yin & McBride, 2015). One potential contribution of this study would be to provide more empirical grounding that may shed light on the incongruence.

### 1.3. The present study

This study investigated the capabilities of utilizing analytic strategies in Chinese character learning, taking into account the influences of experience in reading. It adopted a novel perspective to the study of reading development in children by focusing on learning processes rather than reading outcomes. Using an associative learning paradigm and a cross-sectional design, this study aimed to answer two research questions:

1. Do child readers of Chinese learn characters holistically (i.e., by recognizing characters as monolithic visual units) or analytically (i.e., by identifying print-sound-meaning regularities in characters and apply those rules to learning them)?
2. Do children learning Chinese with different levels of reading experience differ in their character learning approaches?

The research questions were motivated by the phase/stage models and findings of research on reading in Chinese children. The phase/stage models proposed by Ehri (1999) and Frith (1985) suggest that the learning of words progresses from focusing on contextual or visual features to utilizing print-sound correspondences and consolidated letter patterns. However, these models were developed based on alphabetic scripts (scripts with higher orthography-phonology correspondences than Chinese). Could they be extended to reading in Chinese, a script which has more ambiguous orthography-phonology correspondences compared to alphabetic scripts? Past studies have shown some evidence that child readers of Chinese are able to employ

<sup>1</sup> The romanization system used is JyutPing, which was devised by the Linguistic Society of Hong Kong.

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