Literacy Studies: Perspectives from Cognitive Neurosciences, Linguistics, Psychology and Education

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Reading Development and Difficulties in Monolingual and Bilingual Chinese Children

Springer

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LITERACY STUDIES

VOLUME 8

While language defines humanity, literacy defines civilization. Understandably, illiteracy or difficulties in acquiring literacy skills have become a major concern of our technological society. A conservative estimate of the prevalence of literacy problems would put the figure at more than a billion people in the world. Because of the seriousness of the problem, research in literacy acquisition and its breakdown is pursued with enormous vigor and persistence by experts from diverse backgrounds such as cognitive psychology, neuroscience, linguistics and education. This, of course, has resulted in a plethora of data, and consequently it has become difficult to integrate this abundance of information into a coherent body because of the artificial barriers that exist among different professional specialties.The purpose of the proposed series is to bring together the available research studies into a coherent body of knowledge. Publications in this series are intended for use by educators, clinicians and research scientists in the above-mentioned specialties. Some of the titles suitable for the Series are: fMRI, brain imaging techniques and reading skills, orthography and literacy; and research based techniques for improving decoding, vocabulary, spelling, and comprehension skills.

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ISSN 2214-000X
ISBN 978-94-007-7379-0
DOI 10.1007/978-94-007-7380-6
Springer Dordrecht Heidelberg New York London

ISSN 2214-0018 (electronic)
ISBN 978-94-007-7380-6 (eBook)

Library of Congress Control Number: 2013953225

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Foreword

A book devoted to research on learning to read Chinese is an appropriate recognition of Richard C. Anderson's leading-edge work on Chinese literacy and education. Dick has been a pioneer in bringing issues of Chinese language and reading to the attention of the international reading community. His work with colleagues in China has taken place in a rich context of collaboration and exchange in Illinois and China. His professorial appointments at Beijing Normal University and National Taiwan University are apt symbols of his deep engagement with Chinese education.

A much broader recognition is required, however, because Richard C. Anderson's contributions span the broad fields of reading, learning, and education. His leadership in educational research is reflected in his presidency of the American Educational Research Association. The contributions of his research are acknowledged in awards too numerous to list, including, to name just one, the APA's 1997 Edward L. Thorndike Award for distinguished career-long contributions to the psychological study of education.

Well before he turned to comparative reading studies of Chinese, Dick directed the University of Illinois' Center for the Study of Reading, bringing together research on reading and on reading instruction. Dick's research on reading in English with colleagues at the Center was groundbreaking in its perspective and highly influential in its reach, in particular its emphasis on the idea that higher-level knowledge exerts top-down influences on comprehension. For example, he demonstrated that a reader's interpretation and recall of a story can depend dramatically on the background knowledge the reader has and also on the perspective taken during reading. Also influential was Dick's work (with his colleague William Nagy) on vocabulary growth and learning word meanings from the context. The articles Anderson wrote during the 1970s and 1980s are among the most highly cited in the research on literacy and education.

Substantively, this book is an accounting of some of the important discoveries that have been made concerning Chinese reading, both how it is similar to and different from alphabetic reading, and the broader aspects of Chinese literature that are part of the story of literacy development. The editors, two of Dick Anderson's highly accomplished former students and a student of a former student—Xi (Becky)

Chen, Qiuying Wang, and Yang Cathy Luo—have put together an important volume on Chinese literacy. Its chapters are a major contribution to the comparative study of reading, in which factors of language, writing system, and culture are critical. I was very pleased to be part of the 2010 University of Toronto conference that honored Dick's research on Chinese literacy and led to this book. It is a privilege to be able to acknowledge Dick's many contributions to literacy education and to anticipate this excellent set of chapters that reflect his leadership in bringing the study of Chinese reading to the attention of the English-speaking world.

Pittsburgh Charles Perfetti
June 2013

Preface

This book celebrates the profound leadership and influence of Dick on Chinese reading research. It is based on the "Research in Reading Chinese and Related Asian Languages" conference Lydia Qiuying Wang, Yang Cathy Luo, and I organized at the University of Toronto in 2010 to honor Dick's pioneering role in this field and his enduring contribution. Lydia and I were Dick's students at the University of Illinois, while Cathy was my student at the University of Toronto. More than 150 reading researchers from the Mainland China, Hong Kong, Taiwan, Korea, Japan, Australia, the USA, and Canada gathered at Ontario Institute for Studies in Education (OISE) for the event. Among the chapter authors are several generations of Dick's students: Hua Shu (1991), Lydia Qiuying Wang (2005), Li-Jen Kuo (2006), Jie Zhang (2009), Tzu-Jung Lin (2012), Junli Wei (Ph.D. candidate), and myself (2004), and his academic "grandchildren" Hong Li and Jinger Pan. Other authors include Che Kan Leong, Catherine McBride-Chang, Connie Suk-Han Ho, Keiko Koda, Min Wang, and their colleagues and students. Some of these prominent researchers have received Dick's guidance in the early stages of their careers; all of them have been deeply influenced by his work over the years.

About 15 years ago, shortly after I arrived in Urbana-Champaign as a new doctoral student from China, I took the bus to the reading center to meet with my advisor Richard C. Anderson for the first time. Probably noticing that I was new, the bus driver started a friendly conversation with me. He asked me what I'd study at the University of Illinois. I was not sure. "Educational Psychology," I said. That was the name of my department. "Oh," the bus driver said enthusiastically, "so you will be working with children!" Children, I thought to myself, nobody ever told me about this! That was how much I knew about child development back then. Now, when I sit in my office at the University of Toronto, as an associate professor of children's language and literacy development, and reflect on this experience, I realize how much Dick has changed my life, and the lives of many others like me.

As I am writing this introduction, Dick's words come into my mind. "I invest in my students," I remember him saying, "They are not slave labour. They are tomorrow's colleagues." Not until I became a professor myself, did I begin to fully understand the meaning of these words. An extremely accomplished reading researcher,

psychologist, and educator, Dick has been the director of the Center for the Study of Reading at the University of Illinois at Urbana-Champaign since 1976. In his office in the reading center hangs a "family tree" that he is proud of. The chart delineates his academic heritage, the giants that came before him, B. F. Skinner, Wilhelm Wundt, and his academic children (students) and grandchildren (students' students). A lot of "children," such as John Guthrie and Ian Wilkinson have long been leaders in the field of reading themselves. Remarkably, as his research in reading Chinese expands, Dick has more and more Chinese academic "children" and "grandchildren."

Dick is a pioneer in research in reading Chinese, having been conducting research in this area for more than 30 years. He first visited China in the early 1980s as the leader of a Chinese Ministry of Education—US Department of Education delegation. At that time, China had just opened up to the outside world after decades of isolation. Higher education restarted in the late 1970s after the Cultural Revolution, but most Chinese professors were out of touch with modern developments in education and psychology. Many questions came into Dick's mind as he set foot on this mysterious country. Is child growth and development the same in China and the West? What are the differences, and could there be any similarities, in reading Chinese and English, considering the very large differences in languages, writing systems, cultures, and traditions of schooling? Soon after, Dick began to pursue this exciting new direction of research.

Dick's first Chinese student was Hua Shu, whom he co-supervised with Professor Houcan Zhang at Beijing Normal University. The plan was for Hua to come to the USA to study with Dick and then return to China to become the first person to get a Ph.D. in psychology at a Chinese university. Hua completed her studies as planned. She would later become one of the most influential psychologists in China and worldwide, leading the State Key Lab of Cognitive Neuroscience and Learning at Beijing Normal University. However, as it happened, Hua was not the first person to receive a Ph.D. in psychology from a Chinese university. That honor went to Wenling Li. Subsequently, Wenling came to work with Dick as a research scientist at the University of Illinois and stayed on for 12 years. Since Hua, Dick has had a large number of Chinese students from China and Taiwan. Now many of Dick's students are professors themselves and the academic family is rapidly growing all over the world. Amazingly, Dick mentors his students' students just as if they were his own students. The same generosity extends to colleagues, visiting scholars, or even people who just email to ask a question.

Together with his students and colleagues, Dick has established a comprehensive framework of research in reading Chinese. His early work in this area demonstrated that Chinese children learned new characters "incidentally" simply from reading. The rate of learning was similar to that of American children. Next came the studies showing that Chinese children making the best progress in reading utilized the information in semantic and phonetic radicals in compound characters. The major theme of his Chinese research in the 2000s was morphological awareness. Dick pioneered the study of compound words, showing that Chinese students had greater compound awareness than American students, and that morphological productivity was an important factor in insight into the structure of compounds. Another line of research focused on visual orthographic analysis of Chinese. This innovative work

was featured in a recent special issue of Scientific Studies of Reading on Chinese reading that Dick and I co-edited. Dick also studied bilingual Chinese children, contributing important empirical findings and theoretical ideas to the comparison of reading between monolinguals and bilinguals and cross-language transfer of cognitive and linguistics skills, notably the structural sensitivity theory. In sum, Dick's research has examined the development of metalinguistic, language, and print-based skills in both monolingual and bilingual Chinese children, providing a full understanding of the cognitive processes involved in Chinese reading.

With more than 200 publications, Dick is undoubtedly one of the most productive researchers of our time. However, Dick is not just interested in producing theories and publications. He has a deep concern for the education and well-being of Chinese children, especially those who are poor and who belong to minority groups. This concern is reflected in the large-scale intervention studies he carried out in China promoting Shared Book reading and systematic morphology-based instruction. These studies fulfilled an important need because of the absence in China of a tradition of parents reading books with their children and the "intensive" reading emphasis in the primary school Chinese curriculum. In fact, Dick's impact on the Chinese world goes far beyond his research. He helped found the Sunglory Education publishing company in China that produces evidenced-based, content rich, and age-appropriate reading and math materials for young Chinese children. Dick and his wife, Jana Mason, created some of the books themselves. Today, through the efforts of Dick and the company, hundreds of thousands of Chinese kindergarteners are using the Shared Book reading program Dick initiated. The program is used by kindergartens in every province in China, including remote provinces such as Xinjiang and Mongolia. Despite his busy schedule, Dick visits China every year, traveling all over the country to talk to teachers about reading theories and practice.

For a brief moment, I thought I was still at the reading center with Dick. Dick was always the first one to show up at work in the morning, and that was after a lengthy session in the gym. I remember the numerous parties he threw in his house, where he served delicious Japanese food he cooked and Jana played piano and showed off her paintings. I remember the fun trips to AERA, with us students following him from reception to reception pretending to be professors. I remember he was proud of me when I was offered the position at the University of Toronto, but was also slightly disappointed that I wasn't going back immediately to improve education in China. I went back to Champaign to attend Dick's retirement party in 2012. Our conversation was not about retirement, it was about his new projects, new students, and new horizons. Dick is an inspiration in every aspect of life.

Overview of the Book

This book consists of four sections, Psycholinguistic Study of Reading Chinese, Reading Disability in Chinese Children, Bilingual and Biliteracy Development in Chinese and English, and Children's Literature in Chinese. We have chosen to

structure the book this way because each section represents an important aspect of Dick's research framework. Among the authors of the book are leading experts on research in reading Chinese. We are pleased that the "Research in Reading Chinese and Related Asian Languages" conference and this book provide opportunities for them to review and synthesize extant research and explore important and exciting new directions.

The first section, Psycholinguistic Study of Reading Chinese, consists of five chapters which address Chinese reading at the levels of character, word, and text comprehension, as well as the role of motivation in reading achievement. The section opens with Chap. 1 by Jie Zhang, Tzu-Jung Lin, Junli Wei, and Richard C. Anderson. This chapter presents the idea that morphological awareness enhances reading development by increasing the efficiency of the working memory, which in turn facilitates vocabulary learning and reading comprehension. Theoretical and empirical supports for the relationships between morphological awareness, working memory, vocabulary, and reading growth are reviewed. The chapter is the first to link morphological awareness to verbal working memory, which opens new areas for future research endeavors.

Chapter 2 is based on Xi Chen's dissertation. In this chapter, Xi Chen, Richard C. Anderson, Hong Li, and Hua Shu examined the development of strategies in learning to read Chinese through three experiments. Experiment 1 showed that preschoolers relied on a few distinctive visual features to read their first words. Experiment 2 found that kindergarteners already developed some understanding of the phonetic strategy and the analogy strategy. The former refers to reading a phonetic compound character by using the information in the phonetic, while the latter refers to reading a compound by making an analogy to another compound that shares the same phonetic. Experiment 3 revealed that children in the fourth and sixth grade used consistency information to learn families of characters sharing the same phonetic. A model of Chinese reading development is proposed that addresses similarities and differences in reading Chinese and English.

In Chap. 3, Tong Li and Catherine McBride-Chang discuss the similarities and differences in reading Chinese characters and words. The chapter begins by distinguishing the concept of a character from that of a word in Chinese. Next, it reviews research on the acquisition of each, with particular attention to the role of orthographic structure in reading characters and the role of morphological awareness in reading words. The chapter concludes by addressing how character and word reading skills interact and bidirectionally influence one another.

Che Kan Leong, Shek Kam Tse, Ka Yee Loh, and Man Koon Ho, in Chap. 4, emphasize the principles and learning strategies underpinning children's text comprehension and written composition in Chinese. The topic-comment nature of Chinese sentences and text and their comprehension are discussed. Verbal working memory is shown to play an important role in reading. The knowledge telling and knowledge transforming approaches of Bereiter and Scardamalia (1987) provide a viable framework in studying written composition in Chinese. The authors discuss different ways to enhance children's writing with examples in learning and teaching

and address issues in composing, including the quantity and quality of writing and the continuing quest to understand the reading-writing reciprocal relationship.

In the last chapter of this section, Qiuying Wang and Cassandra Coddington described a study examining Chinese beginning readers' motivation for reading and reading achievement in relation to parental and home influences. Children completed a questionnaire that assessed their perceptions of reading competence and reading difficulty, and their attitudes toward reading. Parents completed a survey of their values on reading, encouragement for challenging reading, support with printed materials and attitudes toward their child's reading. Results indicated that Chinese children's competence for reading was positively associated with reading achievement, while their perceptions of difficulty for reading were negatively associated with reading achievement. Parental and home influences were significantly associated with Chinese children's motivation for reading and reading achievement.

The second section of the book, Reading Disability in Chinese Children, consists of two chapters. In Chap. 6, Connie Suk-Han Ho, Yau-Kai Wong, Chor-Ming Lo, David W. Chan, Kevin Kien-hoa Chung, and Sau-Ching Lo review research findings regarding the cognitive profile of Chinese children with reading disability and discuss the relevance of the profile for intervention. In particular, the authors describe a successful Chinese tiered intervention model with core reading instruction curriculum, which they have developed and implemented in 37 primary schools in Hong Kong. Comparing the core reading components in Chinese and English suggests that different cognitive demands are needed for reading diverse orthographies—phonological training is essential for learning to read English, whereas orthographic and morphological training is significant for reading success in Chinese.

In Chap. 7, Jinger Pan and Hua Shu explored how Rapid Automatized Naming (RAN) is related to reading in Chinese children with and without dyslexia. The children were administrated processing speed tasks, auditory temporal processing, RAN, phonological awareness, Chinese character recognition, and timed word list reading. Results showed that Chinese dyslexic children performed poorer than typical developing children in all tasks. Furthermore, principal component analyses revealed that RAN loaded on both phonological processing and processing speed components. RAN uniquely predicted Chinese timed and untimed word reading, while phonological awareness predicted only untimed Chinese word reading. The authors conclude the chapter with a discussion of the underlying mechanism and the role of RAN in Chinese reading.

The third section, Bilingual and Biliteracy Development in Chinese and English, comprises three chapters. In Chap. 8, Keiko Koda, Chan Lü, and Dongbo Zhang address two overarching questions: How are previously acquired sub-skills assimilated in learning to read in later acquired, or additional, literacy? How do assimilated skills enhance reading sub-skills development in later acquired literacy? Two empirical studies are reported. The first study focused on the intra- and interlingual relationships in oral vocabulary knowledge, phonological awareness, and decoding skills in Chinese heritage language learners in the USA. The second study examined cross-linguistic relationships in morphological awareness and lexical inference in

Chinese children learning English as a Foreign Language in China. Findings of the studies are discussed in light of systematic variations in L1-induced facilitation that are attributable to task demands, linguistic distance between two languages, and L2 grapheme-language mapping experience.

In Chap. 9, Li-Jen Kuo and Tae-Jin Kim report two studies with Chinese-English bilingual children to determine whether bilingual advantage in structural sensitivity identified in phonological processing (Kuo & Anderson, 2010) extends to morphology and syntax. Experiment 1 compared Chinese-English bilingual children to English-speaking monolingual children on the way they constructed novel adjectival compounds with a verb and an object. Experiment 2 focused on how the two groups differed in the way they acquired novel syntax. The findings of both experiments are consistent with the prediction made by structural sensitivity theory, which postulates that having access to two linguistic systems allows bilingual children to compare and contrast structural properties of language, thereby attending to more abstract level of linguist structures.

Min Wang, Candise Y. Lin, Chen Yang, in Chap. 10, present a longitudinal study that followed Chinese-English bilingual children from Grade 1 to Grade 2 to investigate the contribution of phonology, orthography, and morphology to biliteracy acquisition across time and across languages. Chinese onset awareness at Grade 1 predicted English real word reading at Grade 2, providing evidence for cross-language cross-time transfer. Within language across time, Chinese rime awareness at Grade 1 predicted Chinese character reading at Grade 2, while English phonemic awareness at Grade 1 accounted for unique variance in English real and pseudoword reading at Grade 2. These results highlight the importance of phonological awareness in reading development in bilingual children. The authors also discuss why transfer was not observed for orthographic or morphological awareness.

The final section of the book, Children's Literature in Chinese, contains two chapters. In Chap. 11, Belinda Yun-Ying Louie describes a systematic analysis of Chinese juvenile literature available in North America. In total, 1,034 titles of Chinese children's literature books available to the North American community were considered. These books were published in China, Taiwan, Singapore, Hong Kong, and the USA. Five aspects of the books were analyzed including genres, readability, aural accessibility, cultural content, and appeal to Chinese language learners. The analysis revealed that the books were written for Chinese-speaking children who have the oral language capacity to understand when the stories are read to them. In addition, some of the contemporary realistic fiction titles were laden with strong Chinese sentimentalism that may be foreign to students who grew up overseas.

In Chap. 12, the final chapter of the book, Minjie Chen and Qiuying Wang examined 46 titles of award-winning picture books published from 1993 through 2009, tracing changes, progresses, and persistent flaws in how the culture and experience of ethnic Chinese had been portrayed in publications for American young readers. The authors analyzed the diversity of genres and subject matter in these books, and evaluated the accuracy of cultural representation in textual and visual contents, with attention paid to the relationship between cultural authenticity and authors' cultural

backgrounds. They highlight high-quality titles considered satisfactory sources for learning about Chinese culture, and make suggestions to publishers on ways to raise the standards of multicultural youth literature.

June 13, 2013

Xi Chen
Qiuying Wang
Yang Cathy Luo

Acknowledgments

A project of this scope would not have been possible without the contribution of many people. First, we wish to thank the staff and students involved in organizing the conference. I am truly grateful for my large team of graduate and undergraduate students, especially my conference coordinator Eileen Zhao. They devoted their time and energy to organizing the conference and enjoyed every moment of it. We also wish to thank the contributors who presented at the conference, wrote for the book, or both. In particular, I am indebted to Chuck Perfetti, who wrote the foreword for this book under a nearly impossible deadline despite his busy schedule. We asked the authors to review each other's work to improve the quality of the chapters and increase the coherence of the book. In this process, we also brought in additional reviewers who were not authors of the book chapters. These reviewers include Mingshui Cai, Vedran Dronjic, Janet Gaffney, Yu-Min Ku, Wenling Li, and Xiaoying Wu. Their comments were very helpful and appreciated. We also wish to thank the journal *Language Learning* for awarding us a conference grant. My senior colleague Alister Cumming provided encouragement and support when we put the grant application together. Finally, we express our gratitude to our series editor Malt Joshi, our Springer editor Jolanda Voogd, and her senior assistant Helen van der Stelt. We could not have completed this project without their support, guidance, and patience.

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Part I
Psycholinguistic Study of Reading Chinese

Chapter 1
Morphological Awareness and Learning to Read Chinese and English

Jie Zhang, Tzu-Jung Lin, Junli Wei, and Richard C. Anderson

Abstract This paper presents a model of the process by which morphological awareness facilitates reading development, and evaluates the role of morphological awareness in learning to read Chinese and English. The central idea is that morphological awareness enhances reading development by increasing the efficiency of the working memory, which in turn facilitates vocabulary learning and reading comprehension. Theoretical and empirical supports for the relationships between morphological awareness, working memory, vocabulary and reading growth are reviewed. Whether morphological awareness is more important for learning to read Chinese than learning to read English and to what extent morphological information may be more important for Chinese children's working memory capacity are discussed. The paper is the first to link morphological awareness to verbal working memory, which opens new areas for future research endeavors that have the potential of enriching understanding of morphological awareness in learning to read.

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_1,

Keywords Morphological awareness • Working memory • Vocabulary • Reading development

This paper compares and contrasts the role of morphological awareness in reading Chinese and English, and proposes a model of the process by which morphological awareness facilitates reading development. Morphological awareness refers to the ability to reflect on and manipulate morphemes, the smallest meaningful units of a language, and to use word formation rules to understand morphologically complex words (Kuo & Anderson, 2006). For example, the word *unhappiness* is composed of three morphemes, the prefix, *un-*, the stem *happy,* and the suffix *–ness*. It is well established that morphological awareness is associated with children's vocabulary knowledge and reading comprehension in both Chinese (e.g., Ku & Anderson, 2003; Li, Anderson, Nagy, & Zhang, 2002; McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003) and English (e.g., Anglin, 1993; Carlisle, 2000; Deacon & Kirby, 2004; Mahony, Singson, & Mann, 2000; Nagy, Berninger, & Abbott, 2006).

Vocabulary learning is one of the most important aspects of language acquisition and is frequently used as a proxy for general reading development (e.g., August, Carlo, Dressler, & Snow, 2005; Snow & Kim, 2006). Knowledge of morphology has long been thought to play an essential role in vocabulary growth (Anglin, 1993; Nagy & Anderson, 1984); however, how the process might work has never been specified in detail. We adopt the view that morphological awareness facilitates reading development primarily by speeding children's vocabulary growth and propose a model of the process.

Our foundational premise is the ability to break an unfamiliar complex word into familiar meaningful units—prefixes, roots, and suffixes, and then recombine the units into a meaningful whole, enables children to figure out the meanings of newly encountered words and probably enhances memory for these words and efficiency of word learning. This is particularly true when the meaning of a morphologically complex word can be directly inferred from the meanings of its components.

Support for the role of morphology in word learning was obtained in a pioneering study by Freyd and Baron (1982), who found that, as compared to average eighth graders, gifted American fifth graders were significantly better at defining derived words (e.g., *oceanic*), but not at defining single morpheme words (e.g., *bachelor*). In a pair-associate learning task, the gifted fifth graders more readily learned the meanings of pseudowords when these words were morphologically related (e.g., *flur*=*play,* and *flurment*=*playground*) than when they were not (e.g., *jeve*=*study* and *kruttist*=*student*). The study suggested that children, especially those with superior language-learning ability, use morphological relationships to encode morphologically complex words, thus rendering them better vocabulary learners.

An additional premise is that vocabulary acquisition in a first language predominantly occurs while people are listening or reading, thus as 'incidental' learning (Jenkins, Stein, & Wysocki, 1984; Nagy, Herman, & Anderson, 1985; Shu, Anderson, & Zhang, 1995). On average, American children acquire approximately

3,000 new English words annually between third and twelfth grades (Nagy & Herman, 1987), but best available estimates are that only about 7–10 % of these new words are acquired via formal instruction and deliberate study (Jenkins & Dixon, 1983). After third grade, 60–80 % of words encountered in texts written in English are morphologically complex derived words (Anglin, 1993). The meanings of the 60 % of unknown derived words in texts can be determined from analysis of constituent morphemes and context (Nagy & Anderson, 1984). It stands to reason that morphological awareness explains a fair amount of individual differences in the ability to infer new word meanings from natural contexts, especially when the contextual support is low.

A third premise is that morphological awareness increases the capacity of verbal working memory. Morphological awareness allows children to efficiently segment and chunk the speech stream, to hold morphemes and contextual information in mind until the meaning of an unfamiliar word can be formulated. Morphological knowledge may also direct attention to the meaningful units of unknown words, increase the size of chunks and enhance working memory capacity. In an early study, the relationship between phonological memory and the structure of words was investigated by Daneman and Case (1981). Children aged 2–6 were taught novel labels for novel actions, either with a suffix (e.g., *pumabo*), a prefix (e.g., *akipum*), or both a suffix and a prefix (e.g., *apumtay*). Later children were asked to either supply an appropriate label for an action or an appropriate action for a label. The results showed that morphological complexity affected the difficulty of producing labels. Generating *pumabo* is easier than producing *apumtay* because *pumabo,* which consists of two contiguous parts *(pum-abo),* could be treated as a single chunk and thus impose less working memory load than *a-pum-tay,* encoded and stored as three separate chunks. Another important finding was that children with greater working memory were better able to sequence more complex morphological constructions in the short-term memory, suggesting a link between verbal working memory and morphological structure. This link will be elaborated in detail in a later section.

In the next sections, we will first compare and contrast the role of morphological awareness in reading Chinese and English, and then review research on working memory and reading development, and research on morphological awareness and working memory. Finally, we will propose a model explaining the contribution of morphological awareness to reading development via working memory.

Development of Morphological Awareness in Chinese and English

Much attention has been paid to inflectional and derivational morphology in research on morphological awareness with native English speakers. Several conclusions can be drawn from this body of research. First, mastery of inflectional morphology of English is essentially complete by the early primary grades (Kuo & Anderson,

2006) whereas knowledge of derivational morphology continues to develop through the elementary school years into the high school years (Carlisle, 2000; Nagy, Berninger, & Abbott, 2006; Tyler & Nagy, 1989) and even through adulthood (Kaye, Sternberg, & Fonseca, 1987).

Second, morphological awareness makes a unique contribution to reading and literacy outcomes (e.g., word decoding, spelling, vocabulary and reading comprehension) beyond phonological awareness (e.g., Deacon & Kirby, 2004; McCutchen, Green, & Abbott, 2008; Nagy et al., 2006). Third, the relative importance of morphological awareness in reading development increases with age (Deacon & Kirby, 2004; Nagy et al., 2003). In a 4-year longitudinal study (grades 2–5), Deacon and Kirby found that morphological awareness uniquely predicted pseudoword reading and reading comprehension for fourth and fifth graders but not for third graders.

Chinese contains some inflectional and derivational affixes (Packard, 2000). For example, 们, men, is a plural affix (e.g., 学生们, xue2 sheng1 men, student + plural → students); 了, le, means a perfective aspect (e.g., 来了, lai2 le, come + perfective → came); and 者, zhe3, is a derivational suffix, -er (e.g., 作者, zuo4 zhe3, write + er → writer). However, inflected and derived words are much less common in Chinese than in English.

Compound words are the most frequent type of complex word in Chinese (Packard, 2000). Chinese compounds can be right-headed, left-headed, or two-headed, each of which creates new instances productively (Ceccagno & Basciano, 2007). The position of the 'head' is determined by the compound structure (e.g., [N N], [V N]) and the relationship between its constituents (i.e., subordinate, attributive, coordinate). The meaning of a compound depends on which constituent(s) is/are the 'head'. For example, 待业, dai4 ye4, *wait for-job* [V N], is a left-headed subordinate verb which means unemployed. 蜜蜂, mi4 feng1, *honey-bee*, [N N] is a right-headed attributive noun which means bee, as compared to 蜂蜜, feng1 mi4, *bee-honey*, [N N], a right-headed attributive noun which means honey. 呼吸, hu1 xi1, *exhale-inhale,* [V V], is a two-headed coordinate verb that means to breathe. Based on the analysis of a set of 1,077 neologisms, Ceccagno and Basciano (2007) demonstrated that among subordinate compounds there is a statistical tendency for nouns to be right-headed and verbs to be left-headed. Most attributive compounds are nouns and are right-headed, and most coordinate compounds are two-headed.

Research on the development of morphological awareness among native speakers of Chinese is less plentiful than comparable research with native speakers of English. However, available research leaves no doubt that development continues over the elementary school years (Ku & Anderson, 2003; Zhang et al., 2012). There are several reasons for believing that morphological awareness is more important for learning to read Chinese than learning to read English. First, with rare exceptions, virtually all Chinese morphemes are in one-to-one correspondence with syllables and characters. Thus, identifying individual morphemes in Chinese is straightforward. In contrast, morphemes in English may consist of more than one syllable. Morpheme boundaries are not reliably marked by any phonological feature, and morphemes do not have a simple one-to-one correspondence with syllables (e.g., *sign and signature*).

A second reason is that, morphology is more transparent in Chinese than in English in which morphemes come in different sizes and shapes and undergo phonological and orthographic shifts in different contexts. Unlike English, there are no orthographic shifts in Chinese and few pronunciation shifts when complex words are formed. Such shifts in English may involve phonemic change (e.g., *elect – election*), stress change (e.g. *tutor – tutorial*), or both phonemic and stress change (e.g., *electric – electricity*). These shifts obscure the relationships between basic and complex words and make the access to the meanings of English complex words more difficult (Carlisle, 2000; Clin, Wade-Wooley, & Heggie, 2009; McCutchen et al., 2008).

Third, Chinese words are not marked by stress cues in speech or separated by spaces in writing, which as Lin, Anderson, Ku, Christianson, and Packard (2011) note, may make parsing difficult and increase reliance on morphology for making parsing decisions. In contrast, in English, stress and space cues are useful for word identification. Ordinarily, the first constituent of English disyllable compound words is stressed and compounds are ordinarily written without internal spaces (e.g. *gréenhouse*) whereas the second word in phrases is stressed and phrases are written with spaces between words (e. g. *green hóuse*). Research also shows that in on-line processing, artificially added interword spacing facilitates lexical decomposition, but hinders lexical access of words (Juhasz, Inhoff, & Rayner, 2005). Note, however, there are exceptions from the standard stress or spacing patterns in English compounds. For example, some English disyllable compounds are stressed on the second constituent, such as *mankind*; some compounds are written with internal spaces, such as *side effect* and *stage fright*.

Fourth, another feature of Chinese that may increase reliance on morphology is the fact that most Chinese characters do not have fixed positions within words, because most Chinese morphemes are roots and not affixes. This means less information is available about word boundaries in comparison to English (Lin et al., 2011), within which certain forms such as *un-* and *con-* usually appear at the beginning of words, while other forms such as *–tion* and *–ness* almost always appear at the end of words. Lin et al. (2011) found that sensitivity to morphological productivity—the extent to which new words can be formed with certain morphemes in certain positions—can serve as a word boundary cue in reading Chinese. For example, readers who know that 车, che1, *'car'*, occurs more often in the second position of a word than in the first position (e.g., 火车, huo3 che1, *'train'*; 公车, gong1 che1, '*bus*') are more likely to treat 车 as the ending character of a word.

Research has confirmed that morphological awareness is important in learning to read Chinese. Li et al. (2002) found that morphological awareness accounted for substantial unique variance in measures of reading of Chinese first graders and fourth graders, after controlling for IQ and phonological awareness. Ku and Anderson (2003) reported that morphological awareness was highly correlated with vocabulary knowledge and reading comprehension in second, fourth, and sixth graders in Taiwan and the United States. Shu, McBride-Chang, Wu, and Liu (2006) found that among several linguistic and cognitive factors, morphological awareness best distinguished fifth- and sixth-grade Chinese dyslexia children from

age-matched controls and was the strongest consistent predictor of a variety of literacy skills for both groups.

There is considerable evidence that morphological awareness is important for Chinese children's early vocabulary acquisition. In a cross-language comparative study, McBride-Chang et al. (2005) found that morphological awareness was similarly associated with vocabulary among second graders in Beijing, Hong Kong, Korea and the United States. In a longitudinal study, McBride-Chang et al. (2008) reported that preschoolers' awareness of the morphology of compounds explained unique variance in vocabulary knowledge a year later and showed stronger relationships with vocabulary than other measures such as phonological awareness. The results held across three different languages, Mandarin, Cantonese, and Korean, in which compounds are the most productive word formation rather than derivational and inflectional word formation as in English. The larger contribution of compound awareness to vocabulary acquisition, as compared to phonological awareness, has also been found with Chinese first and second graders (Chen, Hao, Geva, Zhu, & Shu, 2009).

Because compounding is a more productive word formation process in Chinese than in English, Zhang and her associates (2007, 2012) reasoned that Chinese speakers would have greater insight into the structure of compound words than English speakers. This hypothesis was confirmed with several types of compounds common to Chinese and English among second graders, fourth graders, six graders, and college students from China and the United States. An interesting additional finding was that, as predicted, speakers of both languages evidenced greater awareness of the structure of Noun + Noun (篮球, lan2 qiu2, *basketball*) and Verb + Particle (捡起, jian3 qi3, *pick up*) compounds, which are productive in both Chinese and English, than Noun + Verb (日落, ri4 luo4, *sunset*) or Verb + Noun (跳绳, tiao4 sheng2, *jump rope*) compounds, which are less productive in the two languages.

As elaborated earlier, morphological awareness is important for children's vocabulary growth and reading development in both Chinese and English, however, the underlying mechanism by which morphological awareness facilitates reading development is less understood. In two previous attempts to test the direct and indirect effects of morphological awareness on reading comprehension using Structural Equation Modeling techniques (Kieffer & Lesaux, 2012; Nagy et al., 2006), the consistent finding is that much of the contribution of morphological awareness to reading comprehension is via its impact on vocabulary. Moderating roles of phonological decoding and nonword repetition on the path from morphological awareness to literacy outcomes (spelling, vocabulary, reading comprehension) were weakly supported in Nagy et al.'s (2006) study with fourth- through ninth-grade native English-speaking students.

Kieffer and Lesaux (2012) further speculated that word decoding efficiency may moderate the effects of morphological awareness on reading comprehension. Such a hypothesis, however, was not supported in their multi-group SEM study involving sixth grade native English speaking students and three groups of English language learners. The finding that nonword repetition, but not word decoding accuracy and fluency, mediates the effect of morphological awareness on literacy outcomes is

interesting and relevant to our model that takes the verbal working memory into account because nonword repetition is a sensitive test of children's capacity to maintain phonological material in the phonological loop component of working memory (cf. Baddeley, 1997).

Second, morphological awareness may enable readers to use syntactic cues embedded in morphological suffixes to comprehend complex sentence structures (Nagy, 2007). For instance, consider the following two examples from Nagy (2007, p. 64):

Observant investigators proceed carefully.

Observe investigators' procedures carefully.

Comprehending these two sentences entirely depends on the recognition of morphosyntactic cues provided by the derivational suffixes (observant vs. observe, procedure vs. proceed). Children who are less sensitive to these cues may have difficulty understanding the sentences. Nagy (2007) argued that morphological awareness plays a role in constructing sentence-level meaning during the reading process that is independent of its roles in vocabulary learning and efficient word recognition. The role of morphological awareness in syntactic parsing is a potential explanation of the association between morphological awareness and reading comprehension. Since morphological awareness involves both relational and syntactic aspects of morphology (Tyler & Nagy, 1989), it stands to reason that morphological awareness would facilitate syntactic parsing of the speech stream and free working memory resources for comprehension.

Working Memory and Reading Development

Working memory capacity is believed to play a crucial role in language comprehension in a first language (cf. Just & Carpenter, 1980; Kintsch & van Dijk, 1978; for a review, see Daneman & Merikle, 1996) or a second language (Andersson, 2010; Swanson et al., 2006, 2011). While most studies have involved alphabetic languages, working memory tasks are significant predictors of reading comprehension in Chinese (Ding, Richman, Yang, & Guo, 2010; He, 2007; Hu & Catts, 1998; Liao, Georgiou, & Parrila, 2008). In a study involving from second-, fourth-, and sixth-grade Chinese children, He (2007) found that sentence reading span and speeded naming were strong predictors of textbase level and situation model representation of text.

According to Baddeley's (2000) latest working memory model, four components: the phonological loop, the visuospatial sketchpad, the central executive, and the episodic buffer work together as a mental workspace for maintenance and manipulation of information that is necessary for performing cognitively complex tasks. Complete and accurate phonological representations in working memory are one of the key enablers of vocabulary growth and integral to language comprehension (See reviews, in Baddeley, 2003; Daneman & Merikle, 1996). The

phonological loop is the component of working memory specialized for the temporary maintenance and processing of verbal material (Baddeley & Hitch, 1974). It consists of two subcomponents, a temporary phonological store that holds information in phonological form and a rehearsal process serving to maintain decaying representation in the phonological store. Phonological loop capacity is limited by number of chunks rather than number of items, with different types of material being more or less chunkable (Miller, 1956).

There is considerable experimental evidence that phonological loop is a central mechanism in language learning. The phonological loop appears to mediate the acquisition of new vocabulary items in both native and foreign languages. For example, the ability to repeat nonwords strongly predicts overall vocabulary acquisition in children's native language (see Baddeley, Gathercole, & Papagno, 1998, for a review). Research also shows that children with greater phonological loop capacity produce longer and more semantically and syntactically complex utterances (Adams & Gathercole, 1995, 2000; Blake, Austin, Cannon, Lisus, & Vaughan, 1994) and are better at learning novel words and definition of new words (Gathercole, Hitch, Service, & Martin, 1997). Phonological loop capacity is a good predictor of the ability of children (e.g., Cheung, 1996; Service, 1992) and adults (e.g., Atkins & Baddeley, 1998) to learn a second language. Its relationship with actual second language learning gains in the classroom is clearly shown, even after controlling for the effects of general intelligence, school motivation, and prior second language skills (French, 2006).

Despite the importance of phonological loop or verbal short-term memory in reading development, Daneman and Merikle (1996) argued that general working memory tasks that tap both storage and processing components, such as the sentence reading span test (Daneman & Carpenter, 1980), are better predictors of language comprehension than are measures that only tap storage (e.g., digit span, word span) because the reading span test requires attentional control and is also a measure of central executive (Whitney, Arnett, Driver, & Budd, 2001). The central executive is a domain-general system whose main functions are to focus and switch attention, to activate and update representations, and to inhibit automatic processes and discard irrelevant information (Alloway, Gathercole, & Pickering, 2006; Baddeley, 2007; Henry, Messer, & Nash, 2012; Swanson, 2011; Wiebe, Espy, & Charak, 2008). These executive functions reflect controlled cognitive processes and are highly relevant to higher-order reasoning and thinking skills (Kane, Conway, Hambrick, & Engle, 2007; Swanson, 2011) and largely determine individual differences in working memory capacity (Daneman & Carpenter, 1980).

Central executive processes are important in reading comprehension because comprehension depends essentially on the readers' active use of knowledge that guides their strategies toward the construction of meaning from textual information (Kintsch, 1998). This active process of meaning construction and the metacognitive monitoring during reading, underscores the importance of attentional control in higher-order thinking and reading comprehension. The central executive controls attention by maintaining relevant information and suppressing irrelevant information that is not needed for comprehension (Baddeley, 1986). It coordinates and

facilitates new information integration with the representation of the updated constructed text meaning.

Alloway, Gathercole, Kirkwood, and Elliott (2009) investigated the behavior and cognitive profiles of children with poor academic performance, and found that limited working memory skills, which were assessed in three dimensions—central executive function, phonological loop, visuospatial sketchpad, significantly predicted their low reading abilities. It is still under debate whether the executive function or the phonological loop component of working memory is more important in children's reading development. Some studies show that the executive function (attentional control), but not the phonological loop, significantly contributes to reading development in Chinese and English (e.g., Chung & McBride-Chang, 2011; Swanson & Ashbaker, 2000). However, other recent studies suggest that both the executive control and phonological loop components of working memory make a significant contribution to children's reading comprehension in L2 (Swanson et al., 2011). The causal relation between central executive and reading comprehension is supported in a recent intervention study. Training of working memory's executive processes: focusing, switching, the activation of long-term representations and updating, and the inhibition of irrelevant information, significantly improved third-grade children's reading comprehension (Garcia-Madruga et al., 2013).

The episodic buffer is a pathway to long-term memory and the other components of the working memory (Pickering, 2006). It is a multidimensional storage system that allows verbal and visual information from the subsystems (phonological loop and visual sketchpad) to be combined with that from long-term memory into integrated chunks (Baddeley, 2000). The episodic buffer is assumed to form a basis for conscious awareness. Baddeley, Allen, and Hitch (2011) suggested that the episodic buffer processes and stores multimodal information into unitary episodic representations that are accessible by conscious awareness (Baddeley, 2000, 2007), as one of the principal functions of consciousness is binding (Barrs, 2002). Multimodal information may also be chunked into bigger episodic units to reduce the load of the episodic buffer so that more information can be stored for executive processing.

Recent research has supported the existence of the episodic buffer. Sentence repetition is a promising measure to assess the capacity of episodic buffer in that repeating sentences requires blending information from the short-term components (i.e., phonological loop, visuo-spatial sketchpad) with the products of semantic and syntactic analysis. Using a "recall of spoken sentence task", Alloway and his colleagues (2004) successfully tapped 4–6 year-old children's episodic buffer capacity. The result of a confirmatory factor analysis suggests that episodic buffer is distinct from the central executive, phonological loop, phonological awareness, and nonverbal ability.

People can overcome the capacity limits of short-term memory and make possible all higher cognitive functions by relying on long-term memory through retrieval structures (Kintsch, 1998). Research shows that good readers and poor readers do not differ much in their short-term memory capacity, but in the efficiency of long-term storage and retrieval (e.g., Ericsson & Kintsch, 1995). The efficiency of long-term

storage and retrieval information from the long-term storage cannot be completed without the involvement of the central executive and the episodic buffer. The episodic buffer acts as a "bridge" to retrieve information from the long-term memory coordinated by the central executive.

Morphological Awareness and Working Memory

The central idea of this article is that morphological awareness would enhance the working memory capacity, which in turn could facilitate vocabulary learning and reading comprehension. We hypothesize that morphological awareness is directly associated with the central executive and the episodic buffer, and is indirectly associated with other short-term storage components (i.e., phonological loop, visuo-spatial sketchpad) via the episodic buffer. The phonological loop plays a pivotal role in linking the central executive and the episodic buffer to vocabulary learning.

The motivation for this hypothesized model is threefold. First, metalinguistic awareness and working memory are associated but distinguishable, and make contributions to different aspects of literacy development (Alloway, Gathercole, Willis, & Adams, 2004). Most previous research on the relationship between metalinguistic awareness and working memory has focused on phonological awareness and phonological loop. Individual differences in working memory capacity (especially phonological loop capacity) have been largely attributed to phonological sensitivity or phonological processing ability (e.g., Metsala, 1999; Snowling, Chiat, & Hulme, 1991). Despite the established association between phonological awareness and morphological awareness, little is understood about whether and how morphological awareness links to working memory.

Morphological awareness comes into play when the reader encounters a new word in the text, a situation where the coordination of several controlled processes that draw on the executive functions of working memory is needed. For instance, a new word, *dyscalculia,* is encountered in the sentence "*Grocery shopping was difficult, due to her dyscalculia. She filled her cart with more than she could afford*." The sentence does not provide much contextual support for the new word meaning. To construe the meaning and function of the new word, the reader must be able to attend to and interpret the morphological structure of the word (two meaningful units: *dys-, -calculia*), retrieve and maintain relevant phonological, semantic, syntactic, and orthographic information of the two morphemes (*dys-* means having problem doing something, *-calculia* has something to do with calculator or math), integrate information and decipher the word meaning while reading (so *dyscalculia* means having trouble doing math. That would make shopping a challenge.)

These effortful processes carried out by the central executive functions must coordinate with morphological awareness (breaking down words into meaningful

units) and coordinate with the episodic butter to store relevant information from the long-term memory, phonological loop, or visuo-spatial sketchpad as well as the blended multimodal information. Readers who are more sensitive to the morphological structure of a new word might process word encoding and meaning retrieval more efficiently, and might be better at manipulating or organizing the morphological structure in minds. In other words, morphological awareness enhances the efficiency of the central executive by allocating cognitive resources for 'on-the-spot' morphological problem solving.

Second, working memory capacity varies systematically as a function of children's ability to make use of linguistic information in long-term memory. Children's existing knowledge about language can positively influence the working memory capacity, as the available linguistic information in long-term memory can help reconstruct incomplete lexical-phonological information in short-term memory (Gathercole, 1995; Hulme et al., 1991). The episodic buffer serves as a 'bridge' to retrieve the linguistic knowledge from the long-term memory.

Aspects of linguistic knowledge found to be important for the working memory capacity are phoneme discrimination (Metsala, 1999), knowledge of phonotactics—allowable positions and sequences of phonemes (Munson, Edwards, & Beckman, 2005), sensitivity to phonological neighborhood density (Metsala & Chisholm, 2010), attention to supersegmental phonological features such as stress or tone (Dollaghan, Biber, & Campbell, 1995), ability and disposition to use morphology and stock of known words (Daneman & Case, 1981), and knowledge of syntax (Ellis & Sinclair, 1996; French & O'Brien, 2008). To date, the role of word form and semantic levels of existing language knowledge (i.e., knowledge of morphology) in the working memory capacity has been largely overlooked.

Gathercole (1995) observed that for any given length of nonword, items rated as more 'wordlike' (e.g., *stirple; defermication*) were consistently easier to repeat than less wordlike items (e.g., *kipser; perplisteronk*), which shows the influence of existing language on nonword repetition performance. Interestingly, among preschoolers, repetition of the *less* wordlike items—which depend mainly on phonological encoding and memory—significantly predicted vocabulary knowledge, while repetition of *more* wordlike items did not. After a year of school, the relationship had reversed and repetition of *more* wordlike items predicted vocabulary, suggesting an increasing role for linguistic information or episodic buffer.

Third, knowledge of morphology provides one basis for chunking and organizing the speech stream into segmented lexical representations (e.g., the nonword *dimhowfigblue* can be chunked into *dim/how/fig/blue*). Brown and Hulme (1996) hypothesized that segmentalised lexical representations lead to improved nonword repetition performance, which in turn leads to vocabulary growth. Presumably, it is easier to use known morphemes to learn and remember an unknown word. For instance, if the readers know the meaning of *race*, they might learn other words such as *racecourse, racehorse, racegoer,* more easily than others who do not possess the

knowledge. With these more efficient processes, children could effectively have more capacity for storing and maintaining information while processing continues. With the morphological computation of, say, morphologically complex words, fewer steps might be involved in decoding, lexical accessing, parsing, inferencing, and integrating if the words are represented and accessed with the constituents they are composed of rather than as whole forms. On the contrary, children who have to store morphologically complex words as whole forms without decompositions may face a bottleneck in the flow of information to higher levels of processing such as comprehension.

Morphological awareness may enhance working memory capacity because sensitivity to morphological cues could increase the size of chunks, decrease the number and complexity of chunks held in verbal working memory. The more the units of language come as packaged wholes, the greater the possibility of attentional focus, accurate recall, and longer retention. Consider two children who hear the nonword "*thermoluminescence*", the child who is sensitive to morphological cues and knows the word part(s) *thermo-*, *lumines,* and *-cense* will attend to the sequence of three chunks, a prefix *thermo-*, a root *lumines*, and a suffix *-cence*. Another child who has not heard neither the words nor the syllables before, has to attend to a much longer sequence of chunks: *th/er/mo/lu/m/in/e/s/cen/ce*, and there is a greater chance of error in sequencing. van der Ley and Gallon (2006) pointed out a possible role of morphological awareness in nonword repetition performance. For example, repeating stressed three-syllable words, rare in English, like *feimoychee "fei-moy-chee",* would be analogous to repeating a morphological compound such as, *"nap"kin-"ring," "wal"nut-"tree," or "pho"to-"frame*". Children with poor morphological awareness may recognize inflectional or derivational words like "*walked, electricity, laughing*" as whole syllables, and fail to extract morphological components (Gathercole, 2006). Even an adult reader may have no clue about the exact meaning of the longest English word appearing in the sentence "The coal miners, coughing and wheezing, suffered from *pneumonoultramicroscopicsilicovolcanoconiosis*". If the reader can break down the word into seven morphemes, *pneumono-ultramicroscopic-silico-volcano-coni-osis*, and knows that *pneumono* means a type of lung disease and *volcano* means burning heat, he or she may guess the word meaning: lung inflammation.

Morphological awareness might have a greater impact on working memory in reading Chinese than in reading English because of the lack of space and stress cues to signal word boundaries in Chinese. Morphological boundaries serve as important cues for readers to identify new words from a string of characters. For example, suppose that readers have not seen the word 購物 *(buying thing) shopping*. To identify this word from the sentence 他上網搜尋購物頻道(*He searched for shopping channels on the internet),* the readers need to recognize that 物 (*thing)* is a productive right constituent of a compound noun in Chinese and that 購物 (V N, *buying thing*) is a sensible compound structure and lexicalized word whereas 物頻 (*thing channels*) is not. Morphological awareness therefore facilitates the readers to activate compound knowledge, treating 物 as a right compound constituent while

suppressing information about 物 as a productive left constituent of compounds in Chinese (e.g., 物品, goods, 物价, price). Morphological awareness may therefore enhance working memory efficiency by inhibiting insensible morphological combinations.

A second reason why the association between morphological awareness and working memory may be stronger in Chinese than in English is that, more than 70 % of words in Chinese are compound words (Institute of Language Teaching and Research [of China], 1986), whereas in English inflectional and derivational words are more productive than compounds. While inflectional or derivational structures can usually be identified by affixes, there are no salient cues to identify compound structures. Therefore, whether Chinese readers are able to manipulate compound structures becomes crucial during reading.

Third, morphological information may be particularly important for Chinese children's working memory capacity because of the abundance of homophones in Chinese. In an immediate recall experiment (Zhang & Simon, 1985), Chinese adults were visually presented with sequences of homophone characters (e.g., 工弓公共功供恭龚, all pronounced *gong1*) and sequences of nonhomophonic characters, and then asked to write down the sequence. Recall performance was much worse on the homophone characters than on the nonhomophonic characters. Encoding homophone characters, however, has to rely on the visual and semantic memory which is only capable of retaining two or three chunks. In contrast, phonological encoding of nonhomophonic characters enables children to retain up to seven chunks.

Proposed Model: Morphological Awareness, Working Memory, and Reading Development

In this section, we propose a process model by which morphological awareness facilitates reading development via verbal working memory. Building on the existing research, we propose a functional framework of the relationship of morphological awareness and reading development that explicitly takes working memory into account, a real-time factor that is less explored in empirical studies tapping the relationship between morphological awareness, vocabulary acquisition, and reading development.

We attempt to integrate the insights from research on knowledge of morphology, working memory, vocabulary, syntax and reading into a common framework. Confining ourselves to constructs closely related to morphological awareness, we have outlined a dynamic mechanism depicted in Fig. 1.1 by which morphological awareness may facilitate reading. Undoubtedly, this framework could be modified and expanded in various ways as to include additional factors, such as knowledge of syntax. Here we focus on paths from morphological awareness to working memory, to vocabulary, and then to reading development.

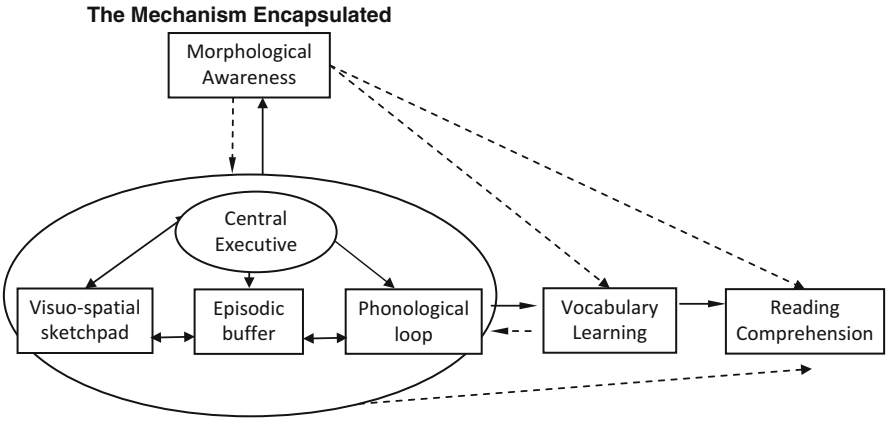

Fig. 1.1 A functional mechanism for how morphological awareness influences reading development

The Mechanism Encapsulated

In this model, a plausible mechanism by which morphological awareness may enhance reading development is presented, namely by increasing the efficiency of the working memory, which in turn facilitates vocabulary learning and reading development. Four components of the Baddeley (2000) working memory model are included: phonological loop, visuospatial sketchpad, central executive, and episodic buffer. As elaborated earlier, morphological awareness directly influences the central executive by directing attention to morphological cues (e.g., word boundaries, roots, affixes etc.) and facilitating word decoding efficiency and syntactic parsing, and thus free working memory resources for higher level processes. The central executive coordinates the episodic buffer, which combines the temporary phonological and visual-semantic information (from the phonological loop and the visuo-sketch pad, respectively) with that from long-term memory into integrated chunks (morphologically meaningful units). The central executive acts as a coordinator, so in our proposed model, the phonological loop and the visual-spatial sketchpad indirectly interacts with morphological awareness through the central executive.

The relationship between working memory and knowledge of words (vocabulary) and word parts (morphological awareness) is most likely reciprocal. Research suggests that the mental lexicon of adult readers is morphologically organized, whether they speak and read an alphabetical language or a morphosyllabic language such as Chinese (e.g., Burani & Caramazza, 1987; Niswander, Pollatsek, & Rayner, 2000; Zhou & Marslen-Wilson, 1995). Thus, morphological knowledge serves as the framework to efficiently store words. As suggested by Sandra (1994), "morphology could be a powerful device for facilitating the acquisition of polymorphemic vocabulary items and improving the retention of such items" (p. 261).

The implication is that as children acquire increasing insight into morphology, their functional working memory increases, and they have greater capacity for learning and remembering new words. The capacity to temporarily store an unfamiliar word increases the ability to form a corresponding entry in long-term lexical memory (Gathercole, Willis, Emslie, & Baddeley, 1991). Going in the other direction, existing vocabulary knowledge affects the ability to retain an input string until processing can be completed because known chunks reduce the memory load (Snowling et al., 1991; Metsala & Chisholm, 2010; Munson, Kurtz, & Windsor, 2005). This may explain why the association between nonword repetition and native vocabulary knowledge declines with increasing age (Gathercole, 2006). In a recent longitudinal study, Nation and Hulme (2011) revealed a reverse relationship between phonological loop and reading skills. Reading skills at Year 1 significantly predicted nonword repetition at Year 2, after language skills (vocabulary, recalling sentences, sentence structure), Year 1 reading, and Year 1 phonological awareness were controlled. However, nonword repetition at Year 1 did not predict reading skills at Year 2. This study suggests that learning to read influences children's language processing system.

Other possible paths are considered (marked by dash lines) based on existing research findings. As elaborated earlier, the relationship between working memory and vocabulary learning could be reciprocal. It is likely that the working memory influences reading via its effect on vocabulary but also possible that working memory capacity influences comprehension directly (Cooke, Halleran, & O'Brien, 1998; Daneman & Merikle, 1996). Repeating nonwords, especially nonwords that overlap strongly with existing words (e.g., *cathedruke* derived from *cathedral)*, may activate corresponding phonological lexical entries and drive the restructuring of lexical items from more holistic to segmentalized representations (Gaskell & Dumay, 2003).

An implication of the model is that degraded or incomplete lexical representations in working memory are a risk when morphological awareness is limited. Sentences may fly by before new words can be grabbed from the speech stream. Any hiatus and elements may drop from memory before an interpretation can be confirmed. Children with superior morphological awareness are expected to have greater working memory capacity, leading to accelerated vocabulary growth and better comprehension. Although presumably not as important as in listening, working memory capacity is important in reading, too, because working memory for written material is also primarily phonological in nature (cf. Andersson, 2010).

A strong test of the model would be to ascertain whether the capacity of working memory can be enhanced through explicit training in morphology. This may be a promising avenue to explore with poor readers or second language learners. Correlational data in cross-sectional and longitudinal designs can also be used to explore whether working memory plays a moderating role between morphological awareness and vocabulary learning/reading comprehension. It would be also interesting to see whether morphological awareness is more closely related to the executive functions, episodic buffer, or to the phonological loop. A cross-language study examining the possible moderating or mediating role of working memory on the

path from morphological awareness to vocabulary and to reading comprehension in Chinese and English needs to be run to empirically test the hypothesis that morphological information may be more important for Chinese children's working memory capacity.

Concluding Remarks

Recent research with primary-age children learning English or Chinese (e.g., Nunes & Bryant, 2006; Wu, et al., 2009; for a review, see Carlisle, 2010) suggest that instruction in morphology can have strong effects on reading and language development. One long-term promise of morphological instruction is to help students meet the challenge of the difficult, morphologically complex vocabulary that is inevitably part of 'academic language' (Snow, 2010). If the process model proposed in this article can be empirically supported, there are important implications for vocabulary and reading instruction in both Chinese and English. First, explicit instruction of morphological cues in complex words increases the efficiency of working memory, which in turn facilitates vocabulary and reading comprehension. Second, teachers should promote children's sensitivity to word structures, or word consciousness, and cultivate strategic language learners who can use morphological analysis to learn new word meanings.

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Chapter 2
Visual, Phonological and Orthographic Strategies in Learning to Read Chinese

Xi Chen, Richard C. Anderson, Hong Li, and Hua Shu

Abstract The research reported in this chapter examined the development of strategies in learning to read Chinese through three experiments that involved more than 300 children from preschool to grade six. Experiment 1 showed that preschoolers relied on a few distinctive visual features to read their first words. Experiment 2 showed that kindergarteners already developed some understanding of the phonetic strategy and the analogy strategy, although second graders used both strategies more effectively than kindergartners. The phonetic strategy refers to reading a phonetic compound character by using the information in the phonetic. The analogy strategy refers to reading a compound by making an analogy to another compound that shares the same phonetic. Another finding of Study Two was that the phonetic strategy and analogy strategy developed simultaneously. Experiment 3 revealed that children in the fourth and sixth grade used consistency information to learn families of characters sharing the same phonetic. They learned characters in consistent families better than semi-consistent families, followed by inconsistent families. Moreover, children took family consistency information into consideration when

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_2,

they pronounced novel characters. A model of Chinese reading development is proposed based on the results of the three experiments.

Keywords Learning to read Chinese • Distinctive visual feature • Phonetic strategy • Analogy strategy • Family consistency

Several decades ago, it was a popular belief that Chinese readers process characters as visual wholes or Gestalts and perform little phonological analysis (Baron & Strawson, 1976). As will be described in detail below, a large number of studies have since provided evidence against this belief. In fact, 72 % of the characters children learn to read in primary school are phonetic compounds, e.g., 清 /qing1/, 倩 /qian4/ (Shu, Chen, Anderson, Wu, & Xuan, 2003). Previous research has shown that children can use information, even partial information, in the phonetic component (e.g., 青 /qing1/) to learn and remember pronunciations of phonetic compound characters (Anderson, Li, Ku, Shu, & Wu, 2003; He, Wang, & Anderson, 2005; Ho & Bryant, 1997a). Furthermore, they can read an unfamiliar character by making analogies to characters that share the same phonetic (Ho, Wong, & Chan, 1999).

Despite the recent progress, our understanding of Chinese children's strategies for character reading is still quite limited. The purpose of the experiments reported in this paper was to examine the use of visual, phonological, and orthographic strategies in learning to read Chinese characters. In the following sections, we will review research on models in learning to read alphabetic languages and research on learning to read Chinese. The findings of these studies shed light on how a model that focuses on visual and phonological strategies may operate in Chinese. We will analyze the characteristics of the Chinese writing system, and describe in detail the experiments we carried out to investigate children's use of strategies in Chinese reading development.

Reading Acquisition in Alphabetic Languages

A dozen models have been proposed to capture the development of word reading skills in alphabetic languages (e.g. Chall, 1983; Ehri, 1985, 1987, 1991; Frith, 1985; Gough & Hillinger, 1980; Mason, 1980). These models typically describe the development of word reading as a succession of different stages, with each stage represented by one reading strategy. For example, Frith (1985) describes three stages in her model: logographic, alphabetic, and orthographic. Ehri (1991) adopted Frith (1985)'s three stages, and added a transitional stage between the logographic and alphabetic stage.

The so-called "logographic" stage is the first stage of reading development. Children have little or no reading experience at this time. They read a word by

remembering one or several visual features associated with it. The features are visually distinctive but not intrinsic to word recognition. For example, they might remember how to read the word *yellow* by looking at the two "sticks" in the middle. Evidence of logographic reading has been reported in several languages including English (Gough, Juel, & Griffith, 1992), Swedish (Hoien & Lundberg, 1988), and French (Bastien-Toniazzo & Jullien, 2001).

Sometime after they have started to read, children begin to use letter-sound relations. Letter knowledge plays a critical role in this transition (De Abreu & Cardoso-Martins, 1998; Ehri & Wilce, 1985; Scott & Ehri, 1990). Ehri and Wilce (1985) taught children to read two kinds of word spellings. A phonetic spelling was a simplified spelling whose letters mapped to some sounds of a real word, e.g. *NE* for knee. A visual spelling was visually more distinctive but did not contain any phonological information, e.g. *Fo* for knee. While prereaders learned to read the visual spellings more easily, novice readers learned to read the phonetic spellings more easily. Prereaders and novices differed in letter knowledge and the number of words known. The former knew some letter names but couldn't read any words. The latter knew almost all of the letter names and could read about four words. Thus, children can use phonetic cues when they know the names or sounds of letters and their attention is drawn to the letters (Ehri & Wilce, 1985; Scott & Ehri, 1990).

The alphabetic stage begins when children are able to "phonologically recode spellings into pronunciations according to grapheme-phoneme correspondence rules" (Ehri, 1991, p. 396). Because an alphabetic orthography is based on a system of grapheme-phoneme rules, acquiring the alphabetic principle enables children to read unfamiliar words systematically and with greatly increased accuracy. Children who have mastered decoding skills have a big advantage over those who have not (Carnine, 1977; Fox & Routh, 1984; Juel, Griffith, & Gough, 1985). They also read words more reliably than transitional readers who only use partial letter sound cues.

Using spelling-pattern knowledge is the characteristic of the orthographic stage. As children encounter words sharing the same spelling patterns such as *-ing*, *-ment*, *-tion*, over and over again, they can read these spelling patterns as wholes without having to decode each constituent letter. Using orthographic knowledge greatly increases the efficiency of reading by allowing children to read multisyllabic words that would be hard to decode letter by letter. Frith (1985) describes the orthographic stage as being different from the alphabetic stage by operating in bigger units.

Reading Words by Analogy

When children can make analogies has been the focus of much debate. In many models, analogy-making happens only during the orthographic stage (Ehri, 1985, 1991; Marsh, Desberg, & Cooper, 1977; Marsh, Friedman, Desberg, & Saterdahl, 1981). In contrast, Goswami (1993) believes that making analogies based on onset-rime units is the first strategy in learning to read. Goswami's studies typically employed a clue word paradigm. In this paradigm, children are first presented with

clue words and told their pronunciations. They are then shown test words with the clue words remaining in view. Goswami (1986, 1988) reported that even beginning readers read more words (*bean, peak*) that were analogous to clue words (*beak*) than words that shared some letters with the clue words (*bask*), or control words (*rain*). On the other hand, Ehri and Robbins (1992) found that only children who had some decoding skills read more words by making analogies than by letter-sound decoding; nonreaders were equally poor at the two strategies. They argued that nonreaders could not make analogies because these children did not have the decoding skills to analyze clue words into onset and rime units and blend new onsets with old rimes.

Researchers also disagree on whether the analogies children make in the clue-test word paradigm are based on orthographic knowledge, or are simply the result of phonological priming (e.g., Bowey, Vaughan, & Hansen, 1998; Nation, Allen, & Hulme, 2001). Since the sound of the clue word alone induces the pronunciation of the target word, children may make "analogies" without attending to the orthographic overlap between the clue and target word. Bowey et al. (1998) observed that clue words with different rime spellings helped children read primed words just as much as clue words that shared rime spellings. Nation, Allen, and Hulme (2001) also failed to find any difference between the two types of clue words. Moreover, they reported that children made the same number of "analogy" responses when the clue words were kept in view or just heard but never seen. These findings seem to indicate that there is no genuine use of orthographic rime knowledge among beginning readers.

Use of Orthographic Knowledge

Glushko (1979) was the first to introduce the concept of orthographic 'neighborhood.' Words with the same spelling pattern are in the same neighborhood, for instance, *made*, *wade,* and *fade*. Glushko compared sets of words that were regular according to grapheme-phoneme correspondence rules but came from neighborhoods that differed in consistency. Consistent words such as *wade* contain letter patterns (*-ade*) that are pronounced the same way in every word in the neighborhood. Inconsistent words such as *wave* contain letter patterns (*-ave*) that have variable pronunciations (e.g. *have)*. He found that consistent words were named more quickly than inconsistent words. This finding indicates that the pronunciation of a word is influenced by the consistency of its neighborhood.

Although children as young as kindergarteners have been observed to make analogies in the clue-test word paradigm (Goswami, 1986, 1988), their orthographic knowledge is quite limited at this age. They don't have well-developed neighborhoods in their lexicon because in most cases each spelling pattern is represented by only one word. In Goswami's experiments, the clue words she provided were the only words children knew that contained the spelling patterns on which the analogies were based. Moreover, they could only make analogies when the clue words were kept in sight. Therefore, the spelling patterns they used to make analogies were not yet consolidated units.

Children's orthographic knowledge grows with their reading experience. As children encounter the same spellings patterns over and over again in different words, these spelling patterns become consolidated units that they can read as wholes. However, none of the existing stage models addresses how children read a spelling pattern that is based on an inconsistent neighborhood containing patterns such as *-ave*. Studies with adult readers have shown that the size of the consistency effect depends on the relative frequencies of "friends" and "enemies" in the neighborhood (e.g. Jared, 1997). It is likely that children in the orthographic stage would also be influenced by the proportion of friends and enemies.

Characteristics of the Chinese Writing System

Chinese characters represent morphemes rather than phonemes. Each character corresponds to a single syllable in the spoken language. By the end of the sixth grade, Chinese children have to learn about 2,500 characters (Shu et al., 2003). Many characters are simple characters that are made up of a small number of strokes and do not contain components, e.g., 火 /huo3/. These characters serve as building blocks for semantic phonetic compound characters.

As previously mentioned, about 72 % of the characters are semantic phonetic compounds (Shu et al., 2003). Only 23 % of these compound characters are fully regular in the sense that the phonetic provides information about all three of the phonological elements, onset, rime, and tone, e.g. 油 /you2/-由 /you2/ (Shu et al., 2003). About 42 % of the compound characters are semi-regular. The phonetic in these characters provides partial information about pronunciation. It could be the syllable, e.g. 请 /qing3/-青 /qing1/, rime, e.g. 精 /jing1/-青 /qing1/, or onset, e.g. 结 /jie2/-吉 /ji2/. About 15 % of compound characters are irregular, e.g. 排 /pai2/-非 /fei1/. A small percentage, 8 %, of semantic phonetic compounds have bound phonetics, e.g., 畺, which have neither pronunciation nor meaning in modern Chinese (Shu et al., 2003). Nevertheless, bound phonetics can be useful because characters with the same bound phonetic are often related in pronunciation. For instance, all the characters with the bound phonetic 畺, including 僵, 疆, 薑, 疅, 橿, 缰 and 礓, are pronounced /jiang1/.

Following Glushko (1979)'s concept of neighborhood, Tzeng, Lin, Hung, and Lee (1995) describe characters with the same phonetic as neighbors. We have used the term "phonetic family" (Shu et al., 2003). A phonetic family also includes the phonetic when it is an independent character. An example of a phonetic family is 半 /ban4/, 伴 /ban4/, 绊 /ban4/, 拌 /ban4/, and 判 /pan4/. The simple character 半 /ban4/ is the shared phonetic. As the example indicates, characters in a phonetic family are often related in pronunciation. There are 563 phonetic families in school Chinese, with family size ranging from 2 to 12 (Shu et al., 2003). Most families contain 2–4 characters. Both number of families and mean family size increase as grade level increases, but mean family consistency decreases.

Use of Visual, Phonological, and Orthographic Strategies in Chinese Children

Several studies have investigated the relationship between visual skills, phonological awareness, and learning to read Chinese. Ho and Bryant (1997b) conducted a 4-year longitudinal study that started when children were 3 years old. They found that visual skills predicted children's character reading at early ages, whereas phonological awareness predicted reading as the children grew older. Siok and Fletcher (2001) reported similar findings. In their study, visual skills predicted character reading in the first and second grade, but ceased to do so from the third grade. Phonological awareness predicted character reading in the fifth grade, but not earlier. These findings suggest that the developmental trajectory of Chinese children is similar to children who learn to read alphabetic writing systems. As Chinese children become more experienced readers, the importance of visual skills decreases and the importance of phonological skills increases.

Research has shown that Chinese children can use information in the phonetic to read phonetic compound characters. They read more regular characters than irregular characters (Ho & Bryant, 1997a; Shu, Anderson, & Wu, 2000). There are large individual differences in children's ability to use phonetic information, especially in early grades. Good readers read more unfamiliar regular characters than poor readers (Shu, Anderson, et al., 2000). The former also produce more phonetic errors (Chan & Siegel, 2001; Shu, Anderson, et al., 2000). Moreover, there is a high correlation between pseudocharacter naming (i.e., naming a pseudocharacter by its phonetic) and character and word reading (Ho & Bryant, 1997a). These findings suggest that children who use phonetic information are better readers.

The phonetic can be useful even when it only provides partial information, such as in tone-different characters. The ability to use partial information represents a more sophisticated understanding of the relationship between a character and its phonetic. Anderson et al. (2003) found that in character learning experiments, second and fourth grade children learned more tone-different characters than characters whose phonetics were unknown to them. However, the researchers also found that children's ability to use partial information was limited, as their performance on tone-different characters was substantially worse than on regular characters.

Chinese children are aware that characters that share the same phonetic are often related in pronunciation (Wu & Anderson, 2007). They can read a character, e.g. 绊 /ban4/, by making an analogy to another character with the same phonetic, e.g. 伴 /ban4/. Ho et al. (1999) found that first and third grade children read more test characters that had the same phonetics as the clue characters than control characters that did not. Third graders read more test characters even when positions of phonetics were different in the test characters and the clue characters.

Although Chinese children have been observed to read words by using phonetic information and by making analogies, no studies have investigated the developmental sequence of the two strategies. At present, we can infer the developmental sequence only by synthesizing the results of different studies. The limited number

of studies described above provides some evidence that Chinese children develop both strategies as early as the first grade (Ho & Bryant, 1997a; Ho et al., 1999). That they can do so at an early age is not surprising because the processes underlying these strategies are relatively simple. There are no grapheme-to-phoneme decoding, segmenting, or blending skills involved in reading Chinese, unlike in reading an alphabetic language such as English.

Very few studies have investigated whether Chinese children can use family consistency information to read characters. Tzeng et al. (1995) asked third and sixth grade children to read pseudocharacters whose phonetics came from families with only regular characters, both regular and irregular characters, and irregular characters that are all pronounced differently. The first type of family had the highest consistency, whereas the third type had the lowest. Children made more regular responses in the regular-only condition, followed by the mixed and irregular-only conditions. Compared to poor readers, good readers made more regular responses in the regular-only condition but fewer in the irregular-only condition.

Shu, Zhou, and Wu (2000) asked fourth, sixth, eighth graders and college students to make homophone judgments of pairs of characters with the same phonetic. One character in each pair was a regular character familiar to children. Another character was unfamiliar. The characters either came from consistent families, in which all the characters have the same pronunciation, or inconsistent families, in which some characters are pronounced differently. Children were more likely to judge a pair as homophones in the consistent condition. Both Tzeng et al. (1995) and Shu, Zhou, et al. (2000) suggest that children's pronunciation of an unfamiliar character is affected by family consistency. Further, the ability to use family consistency information develops with age and is related to reading level.

To summarize, research has shown that Chinese children use visual, phonological, and orthographic information in learning to read. There is some evidence that they progress from focusing primarily on visual features to using phonological and orthographic strategies to read phonetic compound characters. It is not clear, however, how and when Chinese children make the transition from one strategy to another.

Purposes of the Present Study

In the present study, we examined the use of visual, phonological, and orthographic information in reading Chinese in three experiments. Experiment 1 compared the strategy of Chinese and English-speaking preschoolers. The goal was to investigate whether beginning Chinese readers, like beginning English readers, rely on distinctive visual features in reading. Experiment 2 investigated the use of the phonetic strategy and analogy strategy in Chinese kindergarteners and second graders. Experiment 3 examined whether Chinese children in grade four and six use consistency information in phonetic families to read characters.

We propose that beginning readers of Chinese are not able to perceive the internal structure of Chinese characters. Instead they depend on self-selected stroke features such as a dot at the upper left corner or a square in the middle to learn and remember characters. As they gain more reading experience, children can use the phonological information contained in phonetic compound characters. Two strategies are available: reading a character by using the information contained in the phonetic or by making an analogy to another character that shares the same phonetic. Even more advanced readers may be able to use the phonological information contained in families of characters sharing the same phonetic. In this stage, children no longer focus on just one character. They take the whole phonetic family into consideration. They read a novel character after the most frequent pronunciation in the family.

According to our theory, the overall developmental trajectory of learning to read Chinese is similar to that of English. However, the roles that different strategies play in reading Chinese and English are different. Visual skills are likely to have a larger and more lasting impact on learning to read Chinese. Although Chinese children use phonological information in reading compound characters, Chinese character reading is not based on the alphabetic principle. Chinese readers do not assemble pronunciations through letter-by-letter decoding.

Experiment 1

This experiment compared the strategies used by Chinese and English beginning readers. Chinese and English-speaking children learned to read three sets of Chinese characters or English words, respectively. The *distinctive set* contained characters/words with exaggerated visual features. The *normal set* contained real characters/words. Another set, the *similar* set, was added that contained characters/words that were visually similar. The two characters/words in each pair were visually similar. We hypothesized that both Chinese-speaking and English-speaking children would rely on distinctive visual features despite the fundamental difference between the two writing systems. It was expected that children would read characters/words in the distinctive set better than in the normal set. Performance on the similar set would be the worst among the three sets due to the interference caused by visual similarity.

Method

Subjects

Forty Chinese children in a preschool in Guilin, China, and 28 English-speaking children in a preschool in Champaign, Illinois participated in the present study. Children in each group were native speakers of their respective language. The

average age of the English-speaking children was 4 years and 1 month, and the average age of the Chinese children was 4 years and a 1/2 month. The average parent education level was high school for Chinese children and college for English-speaking children. Because literacy is highly valued in the Chinese culture, we believe that the lower parents' education level did not necessarily put Chinese children at disadvantage in comparison with English-speaking children.

Materials and Procedures

Chinese-speaking children received a character reading task and a character learning task. English-speaking children received a word reading task, a word learning task, and a letter task. All the tasks were administered individually. Parents of participating children were asked to fill out a questionnaire.

Character/word reading task. English-speaking children received a word reading task (Clay, 2002). Due to the lack of a standardized Chinese character reading test, Chinese-speaking children received a character reading task created by the researchers. This task sampled characters from textbooks used in primary school in China. Chinese children varied from non-readers to readers of more than 20 characters. They read 8.21 characters on average. All of the English-speaking children were non-readers.

Character/word learning task. Only children who didn't know any target characters/words were given the learning task. Chinese children learned three sets of characters or pseudocharacters. There were four characters or pseudocharacters in each set and each character or pseudocharacter had four or five strokes. The distinctive set contained pseudocharacters with exaggerated strokes, which represent distinctive but irrelevant visual features, e.g.  . The normal set had four real characters with "normal" strokes, e.g. 龙. The similar set contained two pairs of pseudocharacters. The pseudocharacters in each pair were constructed so that they looked like real characters and were visually similar to each other  . The original plan was to use real characters in the similar set. But it was difficult to find pairs of real characters that are visually similar, matched in stroke numbers, and still unknown to most of the children. None of the Chinese characters in the three sets contained any phonological information.

English-speaking children learned three sets of English words or pseudowords. There were four items in each set and each item had three letters. The visual spellings in the distinctive set were pseudowords with distinctive but irrelevant visual features. These pseudowords did not contain any useful phonological information, e.g. g**e**m for fish. In the normal set, children learned regular English words, e.g. pig. The distinctive and normal sets were modeled after the phonetic and visual spellings in Ehri and Wilce's (1985) study. The similar set contained two pairs of regular English words. Words in each pair were visually similar to each other, such as big-bag. All the English words and Chinese characters were part of children's oral language.

Table 2.1 Means (standard deviations) of the correct responses in the character/word learning task

Language	Distinctive	Normal	Similar
Chinese-speaking	7.95 (3.53)	6.73 (3.97)	3.51 (2.67)
English-speaking	8.04 (4.86)	6.07 (5.21)	4.27 (4.03)

In the word learning task, children learned the characters or words in a study trial followed immediately by five test trials with feedback. All the study and test trials were administered individually by the same experimenter, who was a native speaker of Chinese and was highly fluent in English. Characters/words and their pictures were printed on cards. The experimenter taught each character/word in two steps. First, she displayed a card on which the character or word was printed and pronounced it for the child. Then she displayed the picture card and explained the meaning. Children learned each set on a separate day and three sets on three consecutive days. The order of presentation within each set and the order of sets were counterbalanced.

Letter knowledge task. English-speaking children received a letter knowledge task. They were asked to identify the 26 letters in upper and lower case. They could give either letter names or letter sounds. Children read 8.82 lower case letters and 12.89 upper case letters on average.

Results

The results of the character/word learning task for Chinese and English-speaking children are displayed in Table 2.1. The dependent variable is the total number of correct responses in the five test trials. Since there were four words/characters in each set, the maximum score was 20. The overall performance was low for both groups of children, which was expected since all of them were beginning readers.

Data were analyzed in a two-way repeated-measure ANOVA (Language x Type of Character/Word). Type of character/word was a within-subject factor, and language was a between-subject factor. The main effect of language was not significant, $F(1, 62) = .09$, ns. The interaction between character/word type and language was not significant, $F(1, 62) = .51$, ns. The results indicate that Chinese and English-speaking children performed similarly on the character/word learning task.

The main effect of character/word type was highly significant, $F(2, 124) = 39.87$, $p < .01$. Two planned contrasts were carried out: distinctive vs. normal, and normal vs. similar. Data for Chinese and English-speaking children were analyzed together because no interaction was found between character/word type and language. Children learned the distinctive set better than the normal set, $F(1, 62) = 13.42$, $p < .01$, and the normal set better than the similar set, $F(1, 62) = 56.58$, $p < .01$.

Table 2.2 Means (standard deviations) of more and less experienced Chinese readers

Experience	Distinctive	Normal	Similar
Less experienced	6.68 (3.23)	5.53 (3.26)	2.26 (1.94)
More experienced	9.47 (3.39)	8.21 (4.35)	4.89 (2.71)

Based on the performance on the character reading task, Chinese children were divided into two subgroups: less experienced readers and more experienced readers. Two children were excluded from further analysis because they didn't take the character reading task. There were 19 children in each group. The less experienced readers read only 1.37 characters on average. About half of them didn't read any characters at all. The more experienced readers read 15.05 characters on average. The majority of them read more than 10 characters. Information of the two groups is displayed in Table 2.2.

More experienced Chinese readers outperformed less experienced Chinese readers in the character learning task, $F(1, 36) = 11.12$, $p < .01$. The interaction between experience and character type was not significant, $F(2, 72) = .01$, ns. Both groups learned the distinctive set better than the normal set, $F(1, 36) = 6.59$, $p < .05$, and the normal set better than the similar set, $F(1, 36) = 46.07$, $p < .01$. Although more experienced readers outperformed less experienced readers on all three sets of characters, the patterns of results for the two groups were very similar. The distinctive stroke features helped the more experienced readers just as much as the less experienced readers; and visual similarity was equally interfering for both groups.

Discussion

Results of this experiment showed that for both Chinese and English-speaking children, performance on the distinctive set was better than performance on the normal set, which in turn was better than performance on the similar set. These results suggest that Chinese and English-speaking children use similar strategies when they begin learning to read in spite of the fundamental differences between the two writing systems. Therefore, relying on distinctive features may be universal in the earliest stage of learning to read. Visually similar characters/words greatly interfered with reading for both groups of children, which provides converging evidence that beginning readers do not process characters/words comprehensively.

The developmental trajectories of Chinese and English-speaking children diverge, however, as they become more experienced readers. Previous research on English-speaking children found that only prereaders, who knew many letters but couldn't read any words, read more visual spellings than phonetic spellings (e.g. Ehri & Wilce, 1985). Novice readers, who read about four words on average, learned more phonetic spellings than visual spellings. In contrast, in the present study, the more experienced Chinese children who knew 15 characters on average still read the distinctive set better than the normal set. In fact, these children relied on the distinctive stroke features just as much as the less experienced readers. It seems that,

since the simple Chinese characters used in this experiment did not contain any phonological information, children regardless of their reading experience took advantage of the visual information in the distinctive set.

The findings of Experiment 1 contribute to the existing research examining children learning to read different writing systems. Taken together, these studies show that the strategies children use are affected by the "depth" of the writing system. The deeper the orthography, the longer children tend to rely on distinctive visual features. German- and Portuguese-speaking children, who learn to read orthographies that have quite regular grapheme-phoneme correspondences, are able to use letter-sound relations earlier than English-speaking children (Cardoso-Martins, Resende, & Rodrigues, 2002; Wimmer & Hummer, 1990). The present study indicates that Chinese children, on the other hand, rely on distinctive visual features to read longer than English-speaking children, suggesting that identifying visual features may be necessary and even important for learning to read Chinese.

Experiment 2

Experiment 2 investigated the use of the phonetic strategy and analogy strategy in learning to read Chinese. The experiment was exploratory in nature. There were two alternative hypotheses. The first hypothesis was that the phonetic strategy and the analogy strategy develop simultaneously. The key process underlying both strategies is the function of the phonetic. Knowing very few characters, kindergartners wouldn't understand the function of the phonetic and therefore they wouldn't be able to use either strategy. Second graders know a large number of simple and semantic-phonetic compound characters. They would use the two strategies reasonably and equally well.

The alternative hypothesis was that the phonetic strategy develops earlier than the analogy strategy. The first characters beginning readers learn are simple characters. Many of these characters are phonetics in phonetic compound characters. When children encounter a character that has a familiar simple character as the phonetic, it is somewhat intuitive to read the character after the phonetic. However, because beginning readers' knowledge of phonetic compound characters is quite limited, they may not understand that two characters with the same phonetic are often related in pronunciation.

Method

Subjects

Thirty-six kindergarteners and 33 second graders from a working class primary school in Guilin, China participated in the study in fall, 2003. The kindergarteners

had not received any formal literacy instruction. The average age of the kindergarteners and second graders was 5 years and 8 months and 7 years and 8 months, respectively.

Materials and Procedure

Children in kindergarten and second grade received a character reading task, a character naming task, and a character matching task. All the tasks were administered individually.

Character reading task. Kindergarteners and second graders received a character reading task created by the researchers. The task contained 120 characters selected from the vocabulary lists in the textbooks used in primary schools. Children started with the easiest characters and moved on to more difficult ones. The task was discontinued if the child failed to read 10 characters consecutively. The character reading task also included the clue characters in the character naming task. Results indicated that all the clue characters were unknown to the children.

Character naming task. On each of 2 days, children received four clue characters and eight test characters. Half of the clue characters were simple characters, e.g., 胥, and the other half were phonetic compound characters, e.g., 楷. The experimenter displayed each clue character on a card and read the character for the child. The child read after the experimenter. On subsequent trials, the child was asked to read clue characters independently. Correct responses were praised and mistakes were corrected. The process was repeated until the child read all the clue characters correctly on two consecutive trials. All of the second graders learned the clue characters quickly. For kindergarteners, the task was discontinued if the child failed to reach criterion after 10 trials.

Immediately after the child learned the clue characters to criterion, s/he was asked to read test characters without the clue characters in sight. Eight test characters were printed on a test sheet together with eight filler characters in a randomized order. The filler characters were included to reduce the phonological priming effect. Since most of the filler characters were familiar to children, they also reduced children's sense of failure. The experimenter pointed to the characters on the sheet one by one and asked the child to read them.

The test characters were phonetic compound characters that either had the simple clue characters as phonetic components, e.g., 湑, or shared the same phonetic components as the compound clue characters, e.g., 缙. There were two test characters for each clue character. The test characters corresponding to the simple clue characters could be read by the phonetic strategy. The ones corresponding to the compound clue characters could be read by the analogy strategy. All the phonetic compound characters were fully regular. They had left-right structures with phonetic components on the right. The test characters had very low frequency and were unlikely to be familiar to children. The clue and test characters are presented in Appendix 1.

Table 2.3 Mean (standard deviations) number of characters correct in the naming, matching, and reading tasks as a function of grade and strategy

Grade	Character naming		Character matching		Reading
	Phonetic	Analogy	Phonetic	Analogy	
Kindergarten	1.75 (2.10)	1.67 (2.06)	5.29 (2.78)	5.03 (3.31)	32.26 (23.74)
Second Grade	4.36 (2.71)	4.64 (2.76)	7.85 (.44)	7.97 (.17)	64.21 (15.02)

Children at each grade level were randomly assigned to two groups. As Appendix 1 indicates, the simple clue characters received by Group 1 were phonetic components of the phonetic compound clue characters received by Group 2, and vice visa. The test and filler characters received by the two groups were identical. Clue and test characters were presented in counterbalanced orders.

Character matching task. Because the character naming task was difficult for kindergarteners, a follow-up character matching task was given. All the clue and test characters were displayed in front of the child. The experimenter pointed to a clue character, pronounced it, and asked the child to find among test characters the ones that they thought had the same pronunciation as the clue character. The task was given in two steps. The child was first shown the clue and test characters s/he received on the first day, then the ones on the second day.

Results

Descriptive data from the character naming task, the character matching task, and the character reading task are presented in Table 2.3. The dependent variable for the naming task and the matching task was the number of test characters read by a specific strategy. Half of the 16 test characters could be read by the phonetic strategy, and the other half could be read by the analogy strategy. Therefore, the maximum score for each strategy was eight. Because there was no significant difference between Group 1 and Group 2 on any task in either kindergarten or second grade, data from the two groups were collapsed.

The character naming task was very difficult for kindergarteners. They read fewer than two out of eight characters. The second graders averaged more than four characters. Children in both grades read many more characters in the character matching task. Although kindergarteners hadn't received any formal literacy instruction at school, they read more than 30 characters on average in the character reading task. The variance was very high among kindergarteners. The lowest children read fewer than ten characters whereas the highest ones read more than a hundred. Second graders read more than 60 characters on average.

A repeated-measure ANOVA was used to analyze the data from the naming and matching tasks. The dependent variable was number of test characters read. Task and strategy were within-subject variables and grade was a between-subject variable. The main effect of strategy was not significant, which indicates that children

did not use one strategy more effectively than the other. The main effect of task was significant, $F(1, 66) = 103.41$, $p < .01$. Children read fewer test characters on the naming task than the matching task. The main effect of grade was significant, $F(1, 66) = 42.30$, $p < .01$. Second graders read more test characters than kindergarteners. None of the two- or three-way interactions was significant. Notably, the interaction between grade and strategy was not significant. Therefore, although second graders outperformed kindergarteners, their patterns of strategy use were similar.

Analyses were also carried out with strategy as a between-subject variable, as the design of the experiment allows the children in Group 1 and Group 2 to read the same test characters with different strategies. The effect of strategy was not significant in either case, which further confirms that there was no difference in children's mastery of the two strategies.

In the character naming task, the correlation between successful use of the phonetic strategy and successful use of the analogy strategy was high within each grade, $r = .77$ among kindergarteners, $r = .80$ among second graders. This indicates that there is a strong association between the two strategies. But neither strategy correlated significantly with the character reading task. In the character matching task, the correlation between the two strategies was very high among kindergarteners, $r = .93$. Both strategies also had relatively high correlations with the character reading task, $r = .57$ for the phonetic strategy, and $r = .54$ for the analogy strategy. But none of the correlations were significant among second graders due to a performance ceiling.

An informal interview was carried out immediately after the character matching task, with the clue and test characters in view. Children were asked to explain how they made decisions about the pronunciations of test characters. All the second graders demonstrated perfect understanding of the phonetic and analogy strategies. Kindergarteners, however, gave a variety of responses to interview questions. The majority of kindergarteners looked for visual similarity between the clue and test characters. Some children believed that two characters could have the same pronunciation because they had a particular stroke in common. For example, 潭and 谰 were treated as homophones because they both had a dot at the upper left corner. These children were at the very beginning stage of learning to read. They focused on distinctive but irrelevant stroke features in character recognition. They were clearly not ready to use either the phonetic or the analogy strategy. Many kindergartners were confused about the function of the phonetic and the radical. They believed that a test character had the same pronunciation as a clue character when the two shared the same radical, such as 潭 and 渭. But a small number of kindergartners showed the same level of understanding as the second graders.

Discussion

Experiment 2 found that the phonetic strategy and the analogy strategy developed early and simultaneously among children learning to read Chinese. Even some

kindergartners were able to use both strategies. Second graders used the strategies more effectively than kindergartners. But no difference was found within either age group in the use of the two strategies. The results supported the first hypothesis. It seems that the key insight underlying both the phonetic and analogy strategy is to understand the function of the phonetic.

It was somewhat unexpected that even some kindergartners were able to use phonological information to read Chinese characters. Although kindergartners did poorly on the naming task, their performance improved significantly on the matching task, which indicates that their low performance on the naming task was partly caused by memory demands. This suggests that the principles underlying the phonetic strategy and analogy strategy are available to many children at an early age. Given enough support, they can read a character by naming its phonetic or another character with the same phonetic through making an analogy.

Children's early understanding of the phonetic strategy and analogy strategy was further supported by two sources of evidence. First, character reading was correlated with use of phonological information on the matching task among kindergartners. However, this correlation was not significant among second graders due to performance ceiling on the matching task. In other words, by the second grade, almost all the children were able to use both strategies. Second, although some kindergartners demonstrated that they understood the function of the phonetic in the interview, the majority of kindergarteners believed that visual similarity between two characters indicated a connection in pronunciation. Children who did not understand the function of the phonetic would look for visual similarity anywhere. For them, two characters could have the same pronunciation because they had the same radical, or even one particular stroke in common. Children who understood the function of the phonetic looked for the phonetic and could use both strategies.

The findings of this experiment are consistent with the findings of Goswami's studies with English-speaking children (1986, 1988, 1990a, 1993). It seems that the analogy strategy is available to beginning readers across different languages. The cross-linguistic comparison, however, is modulated by the differences between the Chinese and English writing system. The analogy strategy ought to be easier for children learning to read Chinese because no segmenting or blending skills are required.

Although this experiment demonstrates that both strategies are available to children at an early age, it doesn't necessarily mean that children can spontaneously use the strategies while reading. The clue-test word paradigm used in this experiment is different from natural reading in at least two ways. First, presentation of the clue characters immediately before the test characters prompts children to use the information in the clue words. Second, the role of character knowledge is bypassed, since the clue characters are explicitly taught to children. In order to use the strategies in natural reading, children have to know the phonetic or the analogous character and retrieve it from long term memory without prompting. Therefore, spontaneous use of the strategies is likely to develop more slowly.

Experiment 3

In Experiment 3, we examined whether children can use family consistency information in learning to read Chinese characters. Children were taught phonetic families with three levels of consistency: consistent, semi-consistent, and inconsistent. Each family contained a simple character and two compound characters with the simple character as the phonetic. Characters in a consistent family had the same pronunciation. In a semi-consistent family, the compound characters had the same pronunciation, but their pronunciation was different from the phonetic. All three characters in an inconsistent family had different pronunciations. Immediately after the learning task, children were asked to read characters with the same phonetics in a transfer task.

We hypothesized that children would use consistency information to learn phonetic families, with characters in the consistent families learned faster than the semi-consistent families, followed by the inconsistent families. Moreover, we expected that children's prediction of the pronunciation of novel characters in the transfer task would be affected by the consistency of phonetic families. Finally, it was expected that children's ability to use consistency information would be related to their grade level and character knowledge.

Method

Subjects

Sixty-one fourth graders and 73 sixth graders in a working class primary school in Beijing participated in the study. There were two classes in each grade. The average age of the fourth graders was 9 years and 9 months, and the average age of the sixth graders was 11 years and 10 months.

Materials and Procedure

Children received two tasks, a character knowledge task and a character learning and transfer task. Both tasks were administered to the whole class simultaneously.

Character knowledge task. Children's character knowledge was evaluated with a standardized test developed by Wang and Tao (1993). The test asked children to form compound words with each character in a list. For example, 蛋/egg could appear in 鸡蛋/chicken egg or 蛋黄/yolk. If children had difficulty forming words with a character, they could write a short sentence instead, e.g. 母鸡刚下了一个蛋./ The hen just laid an egg. Children could use pinyin if they didn't know how to write a character. The lists for grade four and grade six contained 196 and 210 characters, respectively. One point was given for an acceptable word or sentence. The final

score for each child was calculated according to the norm provided by Wang and Tao (1993) and reflected the total number of characters the child could read. This was a paper and pencil task. All the characters were printed on an answer sheet.

Character learning and transfer task. In the learning task, children were taught three types of character families: consistent, semi-consistent, and inconsistent. Each character family included three characters: a simple character and two phonetic compound characters with the simple character as the phonetic. The characters in a consistent family had the same pronunciation, e.g., 冥 /ming2/, 榠 /ming2/, 熐, /ming2/. In a semi-consistent family, the two compound characters had the same pronunciation, but their pronunciation was different from the simple character, e.g., 肴 /yao2/, 崤 /xiao2/, 淆 /xiao2/. The characters in an inconsistent family had different pronunciations, e.g., 妥 /tuo3/, 馁 /nei3/, 绥 /sui2/. There were two families of each type and 18 characters in total. All the characters were presumably unfamiliar to the children because they had very low frequency and had never been taught in school. The compound characters had a left-right structure with the phonetic on the right.

Children had three study-test trials to learn the pronunciations of the 18 characters. The characters were presented in two different ways. Half of the children learned the characters blocked by family, half learned the characters with families intermixed. The purpose of blocking was to examine if learning characters by family would enhance children's use of consistency information.

An experimenter standing in the front of the classroom displayed the characters one by one at about a 2-second rate. Each character was pronounced twice. After each study trial, children indicated pronunciations by writing pinyin on an answer sheet on which the 18 characters appeared in a random order. If children remembered the pronunciation of a character but didn't know how to write the pinyin, they could write a homophonous character or ask an experimenter for help. The method of presenting and testing the characters was the same during each trial except that the characters were in different orders.

After the three study-test trials, children were asked to read transfer characters that had the same phonetics as the characters in the learning task. The transfer characters were of very low frequency and had never been taught in school. They were printed on an answer sheet in a random order. Children indicated the pronunciations by writing pinyin. There were three transfer characters for each family. To investigate whether children's strategy use was affected by the position of the phonetic, two transfer characters had the phonetic on the right, and one had the phonetic either on the left or on the bottom. The stimuli in the character learning and transfer task were presented in Appendix 2.

Results

The descriptive data from the learning task as a function of trial, family type, and grade are displayed in Table 2.4. Blocking by family [versus intermixing characters from different families] was not included as a factor because the main effect was not

Table 2.4 Mean proportion correct (standard deviation) on the learning task as a function of family type, trial, and grade

	Trial one		Trial two		Trial three	
Grade	Four	Six	Four	Six	Four	Six
Consistent	.52 (.37)	.87 (.23)	.74 (.31)	.96 (.11)	.83 (.29)	.96 (.12)
Semi-consistent	.27 (.24)	.53 (.31)	.46 (.31)	.80 (.25)	.62 (.32)	.89 (.18)
Inconsistent	.27 (.17)	.47 (.21)	.37 (.25)	.69 (.25)	.46 (.29)	.79 (.23)

Table 2.5 Mean proportion correct (standard deviation) on the learning task as a function of family type and character knowledge

Family type	Low	Medium	High
Consistent	.77 (.25)	.83 (.24)	.86 (.21)
Semi-consistent	.46 (.26)	.60 (.26)	.76 (.23)
Inconsistent	.39 (.24)	.55 (.22)	.63 (.21)

significant, perhaps because of the relatively short time children had to learn the characters. There were some significant interactions involving blocking, but they were difficult to interpret. For this reason, blocking will not be discussed further.

A 3 (trial) × 3 (family type) × 2 (grade) × 3 (character knowledge) repeated measure ANOVA was used for data analysis. Trial and family type were within-subject variables; grade and character knowledge were between-subject variables. Children in each grade were divided into three groups according to their performance on the character knowledge task, with approximately equal number of children in each group.

The main effect of trial was significant, $F(2, 256) = 262.33$, $p < .01$. Children made steady progress over the three trials. The main effect of family type was significant, $F(2, 256) = 156.18$, $p < .01$. Scores on consistent families were higher than semi-consistent families, $F(1, 128) = 127.29$, $p < .01$, which were in turn higher than inconsistent families, $F(1, 128) = 28.03$, $p < .01$. The main effect of grade was significant, $F(1, 128) = 102.55$, $p < .01$. Sixth graders learned the characters better than fourth graders.

The two-way interaction between trial and family type was significant, $F(4, 512) = 7.29$, $p < .01$, as was the three-way interaction between trial, family type, and grade, $F(4, 512) = 10.90$, $p < .01$. Children didn't read more characters in the semi-consistent families than the inconsistent families on the first trial, but they improved faster on the semi-consistent families than the inconsistent families on the second and third trials and the difference between the two types of family became significant, $F(1, 128) = 17.58$, $p < .01$, $F(1, 128) = 37.40$, $p < .01$ respectively. Despite the improvement, the performance on the semi-consistent families never reached the same level as the performance on the consistent families.

The descriptive data from the learning task as a function of family type and character knowledge are displayed in Table 2.5. The main effect of character knowledge was significant, $F(2, 128) = 21.50$, $p < .01$, and so was the two-way interaction between family type and character knowledge, $F(4, 256) = 5.97$, $p < .01$.

Table 2.6 Mean proportions (standard deviation) of phonetic and analogy responses on the transfer task as a function of family type and grade

	Grade Four		Grade Six	
Family type	Phonetic	Analogy	Phonetic	Analogy
Semi-consistent	.20 (.25)	.30 (.31)	.24 (.19)	.43 (.30)
Inconsistent	.28 (.25)	.11 (.19)	.25 (.20)	.26 (.23)

Table 2.7 Mean proportions (standard deviation) of correct responses on the transfer task as a function of phonetic position

	Phonetic position	
Family type	Same	Different
Consistent	.75 (.33)	.62 (.39)
Semi-consistent	.66 (.35)	.45 (.43)
Inconsistent	.51 (.33)	.36 (.34)

Children with different levels of character knowledge performed similarly on consistent families. But the high character knowledge group was significantly better than the medium group on semi- consistent and inconsistent families, MD (mean difference) = .16, $p < .01$, MD = .08, $p < .05$ respectively, which in turn was better than the low group on these two types of families, MD = .14, $p < .01$, MD = .16, $p < .01$ respectively.

Table 2.6 displays the proportions of phonetic and analogy responses by family type and grade in semi-consistent and inconsistent families on the transfer task. A phonetic response was made when children pronounced a transfer character after the phonetic. An analogy response was made when children pronounced a compound character the same as another compound character with the same phonetic. A family type (semi-consistent, inconsistent) × grade (four, six) × type of response (phonetic, analogy) × character knowledge (low, medium, high) ANOVA was performed. The interaction between grade and type of response was significant, $F(1, 128) = 7.45$, $p < .01$. Children in the two grades made similar numbers of phonetic responses. But sixth graders made more analogy responses than fourth graders, $F(1, 128) = 14.77$, $p < .01$. The interaction between family type and response was also significant, $F(1, 128) = 26.98$, $p < .01$. Children made more analogy responses under the semi-consistent condition than the inconsistent condition, $F(1, 131) = 16.78$, $p < .01$, and more phonetic responses under the inconsistent condition than the semi-consistent condition, $F(1, 131) = 5.51$, $p < .05$. The findings indicate that children in both grades were sensitive to family consistency, but sixth graders were better at using consistency information than fourth graders.

Table 2.7 displays the proportions of correct responses to transfer characters as a function of phonetic position and type of family. Both phonetic and analogy responses were counted as correct. In all three types of families, performance was better when the phonetic in the transfer character was in the same position as it had been in the related clue character, $F(1, 133) = 29.90$, $p < .01$ in consistent families, $F(1, 133) = 59.74$, $p < .01$ in semi-consistent families, and $F(1, 133) = 25.07$, $p < .01$ in inconsistent families.

Discussion

This experiment demonstrates that children can use consistency information in a family of characters that share the same phonetic. Results from the learning task indicate that the level of consistency in a family is related to character learning. More characters were read in the consistent families than in the semi-consistent or inconsistent families. Importantly, consistency information was useful even when a family was semi-consistent—Children performed better on characters from the semi-consistent families than on those from the inconsistent families.

On the other hand, information in semi-consistent families was more difficult to use than in consistent families. Performance on semi-consistent families never reached the same level as consistent families. Awareness of information in a semi-consistent family also developed more slowly. While children read more characters in the consistent families than in the semi-consistent or inconsistent families from the first trial, no difference was found between the semi-consistent and inconsistent families immediately. The difference only became significant in the second and third trials. Notably, children's ability to use consistency information in semi-consistent families increased with character knowledge. In consistent families, children with a low level of character knowledge learned characters almost as well as those with higher levels of knowledge. By contrast, in semi-consistent families, children with a high level of character knowledge learned more characters than children with an average level of character knowledge, who in turn learned more than those with a low level of knowledge.

An analogy response in the transfer task reflects children's ability to use family consistency when they encounter a novel character. When a phonetic family was semi-consistent, children did not simply name a transfer character after the phonetic. Rather, they produced more analogy responses, meaning that they were more likely to name a transfer character after the most frequent pronunciation in the family. Even when a phonetic family was entirely inconsistent, children still made some analogy responses, although they were more inclined to make phonetic responses under this condition. Taken together, these findings suggest that children in Grades Four and Six have developed a more sophisticated strategy than "name the phonetic" when they encounter new compound characters. They are quite capable of taking family consistency information into consideration in their decision making. The ability to use consistency information increases with grade level. Sixth graders made more analogy responses than fourth graders to transfer characters.

Locating the phonetic is a basic step in using information about character pronunciation. We found that the position of the phonetic had a significant effect on all three types of families. Children showed markedly greater transfer when the phonetic was in the same position in a transfer character as it was in the related character in the learning task. The implication of this finding may be that teachers should help children locate the phonetic when teaching a new compound character, especially when this phonetic tends to appear in different positions in different characters.

General Discussion

The three experiments reported in this paper provide a comprehensive, albeit sketchy, picture of the strategies in Chinese children's reading development. Experiment 1 indicates that preschoolers rely on a few distinctive visual features to read their first characters. Because these features do not provide a reliable basis for discriminating among characters, children have significant difficulty reading visually similar characters. The experiment also suggests that compared with beginning English readers, Chinese beginning readers tend to stay longer in the visual stage.

Previous research indicates that many Chinese children can use the phonetic strategy and the analogy strategy in the first grade (Ho & Bryant, 1997a; Ho et al., 1999). Experiment 2 suggests that kindergarteners have already developed some understanding of these strategies. This is probably due to the fact that the basic principle of phonological representation is relatively straightforward in Chinese. Unlike English, there is no assembling of pronunciations through letter-by-letter decoding. On the other hand, kindergarteners' use of phonological strategies is quite limited. It happened only when the clue characters were taught immediately before and kept in sight, and the experimenter prompted children to pay attention to the clue characters. Children's performance was considerably worse when they had to remember the clue characters. The second graders in Experiment 2 used both the phonetic and analogy strategy more effectively than kindergartners. It seems that by the second grade, children have become proficient in using both phonological strategies in learning to read Chinese.

With continuing experience, children's character reading becomes more sophisticated. They no longer make analogies based on just a single character, but on a whole phonetic family of characters. Experiment 3 suggests that children in the fourth and sixth grade can use consistency information to learn the pronunciations of families of characters sharing the same phonetic. They learn characters in consistent families better than semi-consistent families, followed by inconsistent families. Moreover, children can use family consistency information to pronounce novel characters. Since children younger than fourth grade were not included in Experiment 3, it is possible that this stage begins earlier than grade four.

Based on the results of the three experiments, we propose a model of learning to read Chinese. This model shares some similarities with the models in English. Beginning readers in both Chinese and English rely on a few distinctive visual features, which might be the universal first step of learning to read despite differences in the writing systems. In both writing systems, children progress from using idiosyncratic visual information to systematic phonological information. In Chinese, this phonological information is encoded by the phonetic radical, whereas in English, it is encoded by letters. The final, orthographic stage is also similar across the two writing systems. In this stage, children use consistency information in words/characters sharing the same orthographic patterns.

On the other hand, the stages in Chinese are qualitatively different from the stages in English. Chinese children rely on distinctive visual features for a longer period of time. This visual stage may be more important for Chinese children because they need to develop sophisticated visual skills and a large knowledge base to read

visually complex characters. Moreover, the nature of phonological information in the two writing systems is different. English-speaking children in the alphabetic stage are able to phonologically decode spellings into pronunciations according to grapheme-phoneme correspondence rules. For Chinese children, the key is to understand the function of the phonetic. No assembling of pronunciations through letter-by-letter decoding skills is involved. Finally, Chinese children can make analogies in kindergarten, which is a lot earlier than English-speaking children according to traditional models, but consistent with Goswami's findings (1986, 1988, 1990b, 1993).

The research reported in this study had several limitations. First, each experiment was designed to evaluate whether children use certain strategies at a certain period. These experiments did not establish that a strategy under investigation was predominant during this period of time. Part of the difficulty is due to the cross-sectional nature of the experiments. A longitudinal study that starts to follow children when they are in preschool will provide a more precise picture of strategy use and transitions between strategies. Second, the strategies that we examined in this study are not exhaustive. There are other important strategies, such as morphological strategies, that are not included in the present study. Future research should attempt to produce a more comprehensive model of Chinese reading development.

Appendix 1: Stimuli in the Character Naming Task in Experiment Two

Group	Clue character	Test character
Group One	胥, 阑, 鬲, 旬	湑, 揣, 谰, 镧, 隔, 滆, 徇, 恂
	楷, 唳, 煠, 潭	缙, 潘, 悯, 拨, 猥, 恫, 撢, 谭
Group Two	晋, 戾, 冥, 覃	缙, 潘, 悯, 拨, 猥, 恫, 撢, 谭
	谄, 澜, 镉, 洵	湑, 揣, 谰, 镧, 隔, 滆, 徇, 恂

Appendix 2: Stimuli in the Character Learning and Transfer Task in Experiment Three

	Type of family		
Task	Consistent	Semi-consistent	Inconsistent
Learning task	冥, 榠, 煠	肴, 峭, 淆	妥, 铗, 绥
	ming2, ming2, ming2	yao2, xiao2, xiao2	tuo3, nei3, sui2
	邑, 悒, 浥	弇, 娭, 唵	翏, 憀, 缪
	yi4, yi4, yi4	yan3, an1, an1	liu2, liao2, mou2
Transfer task	恫, 猥, 郯	諵, 俑, 殽	挼, 浟, 荽
	偲, 挹, 邕	揜, 淹, 荠	镣, 漻, 戮

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Chapter 3
How Character Reading Can Be Different from Word Reading in Chinese and Why It Matters for Chinese Reading Development

Tong Li and Catherine McBride-Chang

Abstract Both characters and words in Chinese are related to meaning, and it is interesting to consider the ways in which children process the two. Both phonetic and semantic radicals are essential for character identification. At the same time, within multi-character words, the association(s) of each character to the other(s) are additionally important for children to master. Lexical compounding is a particularly salient aspect of this process. In this chapter, we will elaborate on how characters and words might be considered to be somewhat different Chinese acquisition processes for young children and the developmental association between the two. We will begin by distinguishing these two concepts and explaining why the concepts of "character" and "word" warrant unique focuses in Chinese. We will also highlight what is meant by "reading," i.e., the inclusion of both oral recognition (i.e., just saying the character or word aloud) and understanding of meaning of the character or word and metalinguistic skills which are important for children's character and word learning. Next, we will highlight research on the acquisition of each, with particular attention to orthographic structure in characters and the role of morphological awareness in words. We will conclude by addressing the relations among context, words, characters, and radicals in learning and development.

Keywords Radicals • Morphology • Compounds • Basic units of processing • Eye movement • Code-related skills • Phonological awareness • Orthographic skills • Morphological awareness

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_3,

The basic graphic unit in Chinese is the character, which is written using a square pattern of strokes that is very different from the linear structure of alphabetical words. Each Chinese character is monosyllabic and, in most cases, represents one morpheme, or the smallest unit of meaning within a word. About 80–90 % characters are semantic-phonetic compounds, which consist of two types of subcharacters – a semantic and a phonetic component (Kang, 1993). According to statistics from Shu et al. (2003), semantic–phonetic compounds make up 72 % of approximately 2,570 characters that mainland Chinese children are expected to learn during the 6 years of primary school. Among the subcharacters there are about 200 semantic radicals and 800 phonetic radicals (Hoosain, 1991). For example, in the compound character 枫/feng1/(maple), 木/mu4/(wood or tree) is the semantic radical which gives a cue to the meaning of the whole character, and 风/feng1/(wind) is the phonetic radical which gives a cue to the pronunciation of the whole compound character. Typically, the semantic radical occupies the left or top position in a compound character, and the phonetic radical occupies the right or bottom position. Many radicals are independent radicals and they are also characters themselves. Others are bound radicals which can only appear as a part of a compound character but do not have independent pronunciations by themselves.

Apart from regular ones, there are also semiregular and irregular characters. He, Wang, and Anderson (2005) differentiated two types of semiregular characters. In one type, the onsets and rhymes of the phonetic radical are the same as those of the whole character, but the tone is different. In another type, the tones and rhymes of the phonetic radicals are the same as those of the whole character, but the onset is different. On the other hand, the phonetic radical of an irregular character is unrelated to the pronunciation of the whole character. The majority of characters are semiregular and irregular characters but not the regular ones. It is estimated that regular phonetic compounds only make up less than 30 % of all characters (Fan, Gao, & Ao, 1984). In the investigation of Shu et al. (2003), only 23 % of semantic–phonetic compound characters taught in school were regular in pronunciation, and 35 % were irregular in that they contained obscure or ambiguous information (Shu et al., 2003). Consistency is another dimension by which to categorize characters in terms of phonetic radical information in addition to regularity. The degree of consistency involves whether the character shares the same pronunciation with its orthographic neighbors that contain the same phonetic radical. For example, characters that share 肖 as a phonetic radical are consistent, for they are all pronounced in the same way, i.e., as/yao2/. By contrast, the characters sharing 翟 as the phonetic radical are not consistent characters because there are five different sounds among them.

Characters can also be categorized according to their semantic radicals. In most situations, the semantic radical gives a cue to the meaning of the whole character (Feldman & Siok, 1999). Shu et al. (2003) found that 58 % of compound characters taught in primary schools could be characterized as transparent characters in which the semantic radical reliably indicates the meaning of the whole character. For example, in 妹/mei4/(younger sister), the semantic radical 女/nü3/(meaning

female) is fully consistent with the whole character. In addition, 30 % of compound characters are semitransparent characters. For example, in 嘲/chao2/(mock, laugh at), the meaning of the semantic radical 口/kou3/(mouth) is indirectly related to the whole character's meaning because we laugh with our mouths. Finally, in 9 % of the cases, the characters are characterized as opaque. For example, in 物/wu4/(object), the semantic radical 牛/niu2/(ox) is unrelated to the meaning of the whole character.

A further noteworthy aspect of Chinese characters centers on homophones and homographs. In English, a homophone is a word that sounds the same as another word but is spelled differently, such as *tide* as contrasted with *tied*. A homograph is a word that is spelled the same but its meaning differs across instances. *Bank* as in *riverbank* vs. withdraw *money from a bank* would be an example of a homograph. About 1,277 syllables (Chao, 1976) exist among 7,000 characters which are frequently used in modern Mandarin (Li, Anderson, Nagy, & Zhang, 2002), whereas there are more than 8,000 syllables in English (DeFrancis, 1984). This characteristic of so many characters sounding the same but having different meanings makes Chinese script relatively complex in literacy demands. Thus, children must fairly often and skillfully keep track of characters that indicate homophones or homographs.

Although, in some writings about Chinese literacy, the terms word and character are used interchangeably, they are not the same thing. Identification of the boundaries of Chinese words is not very straightforward because there are no spaces between adjacent words. Word is defined by Bloomfield (1926) as "a minimum free form" in language. Similarly, Wang (1953) defined the Chinese word as the smallest independently usable part of language. Another important feature of a word in English is applicable in Chinese as well; that is, that there should be no insertion within it (Hoosain, 1992). For example, 花瓶 (vase) is a word, and it is acceptable to insert a morpheme at its boundary to form 大花瓶 (big vase), but an insertion within the boundary which forms 花大瓶 changes the word's original meaning. Statistics shows that multi-character words are more frequently used in modern Chinese than are single-character words. In the Chinese word corpus of the Academia Sinica Taiwan (1998), which contains 54,393 words, the proportion of two-character words is 65.6 %, and Tan and Perfetti (1999) made a very similar estimation based on the Modern Chinese Frequency Dictionary (1986) published in mainland China, noting that two-character words make up 64 % of all words. Thus Chinese readers encounter two-character words more often than single- or multi-character words in their daily speaking and reading.

Both characters and words convey meaning. When a character is merely a part of a word, its pronunciation is usually the same as it is as a word of itself, but its original meaning could be either closely related or totally unrelated to the meaning of this compound word (Li & Thompson, 1981). About the connection between the component character and the whole compound word, Li and Thompson pointed out that "As time moves on, this semantic connection begins to recede from the realm of the knowledge of the native speakers until, finally, it is totally lost" (p. 46). They

also differentiated three levels of this connection: (i) the connection does not exist or it is very weak; (ii) the connection is metaphorical, figurative, or inferential; (iii) the connection is strong and direct, such that the meaning of component character may be identical to the compound word.

Morphology is about the structure within a word. In a multi-character word, the structure is reflected by the relationship among its component morphemes, each of which usually corresponds to one character. Chinese words have three main morphological processes: reduplication, affixation, and compound.

Reduplication means that a word is formed by a morpheme and the repetition of itself. The meaning of the new word is always a little bit different from the original morpheme (Li & Thompson, 1981). Reduplication of volitional verbs, adjectives, measure words and kinship terms are most common types. Reduplication of verbs usually means to do something "a little bit". For example, 说说 (say-say) means "say a little", and 走走 (walk-walk) means "walk a little". Reduplication of adjectives is usually used to describe something more vividly, e.g., 红的花 means "flowers that are red" and 红红的花 means "flowers that are really red" (Li & Thompson, 1981). Reduplication of measure words means "every", e.g., 条条路 means "every road". Reduplication of kinship terms is an exception; these usually share the same meaning with the reduplicated morpheme itself, as in 爸 and 爸爸 (father) or 姐 and 姐姐 (sister).

Mandarin has fewer affixes compared to Indo- European languages. Most affixes in Chinese are suffixes (Li & Thompson, 1981). Most frequently used suffixes are aspect markers, e.g., 着 (durative), 过 (experiential), and 了 (perfective). In addition to these three suffixes, there are also several others indicating different meanings, such as 们 (plural form of human nouns and pronouns), 家 (–ist), 学 (–ology), etc.

Compounds are very important in Chinese. Statistics by the Institute of Language Teaching and Research (1986) showed that over 70 % of Chinese words are compound words which are formed by two or more morphemes. According to the different relationship between these component characters, compound words normally have several kinds of structures, such as subject + predicate, verb + object, verb + resultative complement, modifier + head, and coordinate constructions. Yuan and Huang (1998) analyzed the Chinese morpheme database founded by Tsinghua University which not only covers 10,442 Chinese morphemes, but also exhaustively describes the words that those morphemes could form. In this database there are 78,230 two-character words, which is about four times of the amount of three- and four-character words together. Among nouns, verbs, and adjectives, which comprise 95 % of two-character compound words, modifier and coordinate words are much more prominent than are the other types.

Above, we have summarized the basic types and features of Chinese characters and words, which directly affect a reader's processing as well as how children learn to read. Since both characters and words are related to meaning, it is interesting to ask which one is selected by readers as their target of attention in natural reading. In the next section we will discuss these as the basic processing units in Chinese reading based on results of previous research.

Exploration of the Basic Unit of Processing in Chinese Reading

Although there is consensus that in alphabetic languages the saccade target of reading is the word (cf. Radach & Kennedy, 2004), since both Chinese characters and words convey meaning and there is no space between semantic units in written Chinese, it is not easy to tell whether Chinese readers adopt character- or word-based processing when they are reading. Thus far, many studies on this issue seem to suggest that the word is always processed as a whole unit when reading sentences or texts (e.g., Bai, Yan, Liversedge, Zang, & Rayner, 2008; Chen & Ko, 2011; Hsu & Huang, 2000a, 2000b; Shen, Bai, Zang, Yan, Feng, & Fan, 2010; Yan, Kliegl, Richter, Nuthmann, & Shu, 2010; Yan, Tian, Bai, & Rayner, 2006). At the same time, information such as complexity and frequency of single characters, which are the components of the words, can also affect processing speed of the whole multi-character word. Many of these studies have adopted an eye-tracking technique (e.g., Bai et al., 2008; Hsu & Huang, 2000a, 2000b; Yan et al., 2010). For example, Bai et al. (2008) presented to adult participants sentences in four conditions. In the control condition, the text was of a normal unspaced format in which characters were normally arranged one by one without spaces. In the single character spaced condition a space was inserted between adjacent characters. In the word spaced condition, a space was inserted between adjacent words. Finally, in the nonword spaced condition a space was inserted between some characters in order to form nonword groups. The researchers found that in the normal reading condition, participants' total reading times were the shortest and were very similar to those in the word spaced condition. Furthermore, the total number of fixations in the normal reading condition was similar to those in the word spaced condition, whereas the total number of fixations in the character spaced condition was similar to that in the nonword spaced condition. Because total number of fixations could be used as an indicator of the difficulty of the text, these results suggest that reading the text in a normal format is of the same difficulty as reading the text with words spaced.

On the other hand, some studies have indicated the importance of individual characters in reading and have showed that character frequency affects reading as well. For example, Zhang and Peng (1992) reported that for adult readers, when two-character word frequency was controlled, the response times of words containing two high frequency component characters were shorter than the response times of words containing one low and one high frequency character. A study by Yang and McConkie (1999) also confirmed that, for adult readers, both character complexity and word frequency influence fixation time on a word, suggesting an influence of character characteristics on words. Furthermore, Chen, Song, Lau, Wong, and Tang (2003) found that character frequency and complexity were more important than whole word frequency in both adult readers and children for total fixation times. However, this idea is not without its critics, because the repeated appearance of a word in a passage will confuse its ordinary frequency, and the relatively strong relationship between character frequency and word frequency may cause

multicollinearity, potentially obscuring the predictor's effect (e.g., Rayner, Raney, & Pollatsek, 1995; Yan et al., 2006).

Another type of evidence also supports the word as the basic unit of Chinese reading. Rayner (1979) originated the term Preferred Viewing Location (PVL) to describe the position where the first glance lands that facilitates the reader in obtaining information about the word to a maximal extent. PVL is usually found to be slightly left to the word center. Although Yang and McConkie (1999) found an even distribution of PVL on each character in words, Yan et al. (2010) argued for a two-stage process which showed that there may be no conflict between the finding of Yang and McConkie (1999) and a word-based processing. If the word segmentation occurs in the first fixation then the PVL tends to be located near the center of the word. Otherwise, it shifts to the beginning of the word for separating the word from the prior one. The second situation is what causes the general distribution of the PVL to change in Chinese reading.

With a word-based eye movement assumption, Rayner, Li, and Pollatsek (2007) applied the E-Z Reader model to simulate eye movement behavior in Chinese sentence reading. The E-Z Reader model (Pollatsek, Reichle, & Rayner, 2006; Reichle, Pollatsek, & Rayner, 2006; Reichle, Rayner, & Pollatsek, 2003) is a computational model used to account for eye movement behavior in typical alphabetic languages (like English). Rayner et al. found that eye movement control in Chinese is similar to that in English, and when character frequency was added in the model, the overall fits of the data were not improved. This simulation with the E-Z Reader model suggests a psychological reality of words in Chinese reading, although there is no space between adjacent Chinese words.

Few studies have examined eye movements of Chinese children. Two recent research studies using eye tracking to examine children's reading have shown results that are similar to those found for adults. Shen et al. (2010) used a similar method as Bai et al. (2008) to investigate eye movements on children when reading Chinese sentences. They found that for children in grade 3, the fixation time of reading normal unspaced sentences was not different from reading sentences with space inserted between words, but the fixation time of reading sentences with space inserted within words was significantly longer. This is consistent with the results for adult readers. Chen and Ko (2011) also reported that when reading texts, like adults, children fixated longer on low frequency words, and on content words as well. These results indicate that, like adults, children adopt a word-based processing strategy when engaged in natural reading.

As summarized above, results of the related studies seem to be more likely to converge at the conclusion that the basic processing unit in Chinese reading is the word rather than the character. However controversy still exists and component characters also affect reading, e.g., via character frequency. Although research on children seems to support the findings on adults, more evidence is still needed and comparisons among different ages might further reveal a more consistent developmental pattern.

Important Skills for Character and Word Acquisition

Above, we have introduced some major characteristics of Chinese characters and words and reviewed studies on the relation between character and word processing. In the next several parts of the chapter, we will highlight what skills are important in predicting children's character and word reading ability, and talk about how children map their oral vocabulary onto print. Then we will introduce a mini-experiment of our own that explored the relationship between children's character reading and word reading. Based on this study and other evidence, we will then propose one way in which we think that Chinese children's character and word learning develop.

Particularly in a first language, children typically acquire reading related abilities roughly within a given sequence. They usually develop oral vocabulary knowledge much earlier than they do print recognition for characters and words. To connect oral language and written language, children need code-related skills to map oral vocabulary to print. Code-related skills enable children to encode printed input in order to facilitate access to the mental lexicon and retrieve semantic information. Across orthographies, code-related skills include abilities such as print concepts (e.g., knowing that writing goes from left to right and top to bottom across a page in many orthographies), alphabet knowledge, phonological processing, etc.

To explore a character-word interaction in Chinese, one must also understand the metalinguistic skills required for learning to read. Here, we highlight three that might be particularly strong in Chinese: phonological awareness, orthographic skills and morphological awareness. According to the orthographic depth hypothesis proposed by Katz and Frost (1992), orthographies can be differentiated as shallow or deep by the degree of their grapheme–phoneme consistency. In languages with a relatively shallow orthography, such as Finnish and German, literacy acquisition may be based primarily on phonology, whereas in a language with a deep orthography like English, a logographic process based on the visual-orthographic structure is also required. Children who acquire reading in shallow languages have been found to be close to ceiling by first grade in primary school, in both word reading and nonword reading, whereas English speaking children were found to perform much more poorly on such word recognition tasks (Ziegler & Goswami, 2006). In English, pronunciation of rimes and syllables which are larger reading units than phonemes is less inconsistent (Treiman, Mullennix, Bijeljac-Babic, & Richmond-Welty, 1995). Therefore English-speaking children may be more likely to develop other recoding strategies with letter pattern and whole word recognition, to supplement grapheme-phoneme mapping. Since Chinese is often considered to be a deep orthography (e.g., Hu & Catts, 1998), both phonological awareness and orthographic skills should be important for children's literacy acquisition (e.g., Ho & Bryant, 1997; Ho, Yau, & Au, 2003; McBride-Chang & Ho, 2000; Siok & Fletcher, 2001). For example, Siok and Fletcher (2001) found that the

performance on both visual-orthographic and phonological processing among students of Grades 2, 3, and 5 consistently predicted their character reading. Li, Shu, McBride-Chang, Liu, and Peng (2012) carried out a battery of reading related tests on children in kindergarten and primary school, and found that for children in kindergarten, phonological but not orthographic knowledge was correlated with character recognition, and for children in primary school, both phonological task and orthographic knowledge were independently correlated with character recognition.

Phonological processing usually involves syllable, rhyme, and phoneme awareness or manipulation. Whereas in most alphabetic languages, phonemic awareness is particularly important for literacy acquisition, syllable awareness may be particularly salient for Chinese. In Chinese, one character corresponds to one syllable, and phonemes are not represented in written form. For young Chinese children, several studies have demonstrated that syllable awareness is important for very early character learning. For example, McBride-Chang, Bialystok, Chong, and Li (2004) found that syllable awareness, but not phoneme onset awareness, was reliably associated with children's Chinese character recognition across Chinese cultures. McBride-Chang and Ho (2005) also reported that 4-year-old children's phonological awareness measured using a syllable deletion task could modestly predict their character recognition 2 years later. Another study by Shu, Peng, and McBride-Chang (2008) confirmed again that the task of syllable awareness significantly contributed to performance on character recognition in young children.

In most cases, if one reading related ability associates with Chinese character recognition, it is also related to Chinese word reading. This is because characters are the building blocks for words and sometimes are words themselves; this relation is similar for both characters and words. Therefore both orthographic skills and phonological awareness could as well predict children's Chinese word reading; evidence suggests this is so. Both visual-orthographic and phonological processing have uniquely explained children's word reading in some studies (e.g., Siok & Fletcher, 2001). Chow, McBride-Chang, and Burgess (2005) also found in a longitudinal study that Chinese syllable deletion predicted 5-year-old children's Chinese word reading 9 months later. Chan, Ho, Tsang, Lee, and Chung (2006) also found that both orthographic and phonological tasks explained Chinese word reading performance among children aged 6–10.5 years.

Apart from phonological awareness and orthographic skills, morphological awareness, in the form of understanding of word structure, has also been found to be particularly important for Chinese word reading (McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003). Carlisle (1995) defined morphological awareness as follows: "…morphological awareness focuses on children's conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (p. 194). Since Chinese words are made up of characters, and the majority of Chinese words are compounds, at least two important prerequisites might affect young children's efficiency in learning new words: whether they know a sufficient number of characters (morphemes) and whether they know how these characters

can be used to build up words using a linguistically "legal" structure that is correct in Chinese. The development of the latter relies on the emergence of morphological awareness.

In Chinese, morphological awareness mainly refers to the ability to compound words at a structural level. Chinese is an analytic language, which means that multi-morphemic words and concepts are built from simple morphemes. For example, *flood* (洪水) in Chinese could be literally defined as "large (amount of) water", and *university* (大学) as "big study." Chinese morphemes are quite productive in relation to word formation. For example, a Chinese morpheme might appear in nearly 17 compound words on average (Yin, 1984). Many Chinese compound words (especially nouns) are at least somewhat semantically transparent as well, which means that the meaning of a compound word might be discerned somewhat directly by combining the meanings of each constituent morpheme. Therefore lexical compounding is an important skill for Chinese children. Also, because there are many homophones (and homographs) in Chinese, speakers have to keep track of the meanings of each syllable; otherwise they may miss the various possible meanings across homophones. Therefore, morphological awareness affects both character and word reading of children. Consistent with this result, Shu, McBride-Chang, Wu, and Liu (2006) showed that in both typically developing and dyslexic Chinese children, the ability to identify homographs and homophones via lexical compounding strongly and consistently explained their performances in character reading and character dictation. Longitudinally, lexical compounding in Chinese also predicts subsequent reading skills in Chinese children (e.g., Lei et al., 2011; McBride-Chang et al., 2011). Moreover, training kindergartners in lexical compounding facilitates their subsequent word reading (Chow, McBride-Chang, Cheuk, & Cheung, 2008; Zhou, McBride-Chang, Fong, Wong, & Cheung, 2012). Collectively, these findings suggest that, in Chinese, morphological awareness plays a particularly important role when children are learning to map their oral (spoken) language onto printed characters because the unit of the morpheme and the unit of the Chinese character are typically one and the same.

Above we emphasized three reading related abilities that are important in Chinese. Phonological awareness and orthographic skills are particularly important in character recognition, and their contribution to word reading could be ascribed to their facilitation effect on character recognition. On the other hand, morphological awareness mainly includes both homophone knowledge and lexical compounding in Chinese. Homophone knowledge reflects children's ability to keep track of the meanings of each morpheme, usually corresponding to one character. Thus it is related to the semantic aspect of single characters. Lexical compounding is more likely to reflect the extent to which children understand the rule by which multi-morpheme words are created. These aspects of morphological awareness, though overlapping, thus, have different functions. Overall, then, morphological awareness in Chinese concerns both word reading and character reading in different ways, different from phonological awareness and orthographic skills.

Chinese Children's Acquisition of Character and Word Recognition

Young children who are beginning Chinese readers are affected by some features of characters. Children are found to have some orthographic knowledge when they are still young. Cheng and Huang (1995) asked children of grades 2–6 to judge whether an item was a character or whether it looked like a character. They used four kinds of material: frequently used characters, rarely used characters, pseudocharacters in which all the radicals are in their legal positions, and noncharacter in which the radicals are not in the legal positions. They found that children of grades 2 and 3 could judge frequently used characters and noncharacters correctly in most cases, which indicated that they had acquired some knowledge of radical position. Children get more familiar with character structure and radical position when they grow older, as is evidenced by the fact that, in the same study, from fourth grade onward children judged rarely used characters and pseudocharacters as looking like characters above the chance level. This result was somewhat repeated in another study of Shu and Anderson (1999). Children of different grade levels in primary school were asked to decide which items that they saw could be Chinese characters and which could not. Mixed with real characters, there were three kinds of pseudocharacters: the ones with well-formed structures in which the radicals were in the right position and of the correct form, the ones with an ill-formed structure in which the radicals were of the correct form but in the wrong position, and the ones with ill-formed components in which the radicals were in the correct position and of similar but different forms as compared to the correct ones. The results showed that even the first and second graders could correctly judge the pseudocharacters of ill-formed structure in most cases, with an error rate of around 10 %. Li, Peng, and Shu (2006) in a similar study also found that second graders rejected the pseudocharacters with radicals in illegal positions significantly above the chance level.

Studies have shown that children can use analogies in learning to read new words (Goswami, 1986, 1988, 1990; Walton, 1995). As most Chinese characters are compound characters and the majority of them are regular/transparent and semi-regular/transparent, children will benefit from mastery of radicals within compound characters. Ho, Wong, and Chan (1999) found that even the first graders could be trained to make phonological analogies to name unfamiliar characters, as well as to make semantic analogies in getting the meaning of new characters. He et al. (2005) further tested whether children could use phonetic radicals as cues to read newly learned characters. They found that children performed better on regular, tone different and onset different characters than on characters with unrelated phonetics; whether such characters included an independent or bound radical did not seem to affect children's utilization of characters' phonetic information. This means that when the phonetic radical does not have a pronunciation, children adopt an analogy strategy to infer the pronunciation of the whole character by referring to the other character containing the same phonetic part.

Although children have the ability to use radicals as cues when reading characters, it seems that children's processing of character is not on a radical by radical basis. Su and Samuels (2010) measured reaction times of children of different ages on high frequency characters with different complexities and found that for 2nd grade children, the complexity of the character significantly affected their reaction times in judging whether the character was real or not, implying that they used more time when the character comprised more strokes. Children of 4th and 6th grade did not display this tendency, indicating that they processed characters in a more holistic way. However, when the number of stroke patterns (components) rather than strokes was used to define complexity of characters, no complexity effect was found for children of any grade. This result suggests that the number of radicals is not related to complexity of the character, which affects the processing of the whole character. However, it is still not clear whether this result is generalizable to the processing of all characters or only to characters of high frequency, because some experiments involving adults have found that the frequency also matters (e.g., Taft & Zhu, 1997).

Whether a compound is processed decompositionally or not is a controversial topic in alphabetic languages (e.g., Fiorentino & Poeppel, 2007). Research on eye movements has shown that in English reading, frequencies of both first and second constituents in a compound affect gaze duration, although frequency of the whole word affects total looking time as well (Andrews, Miller, & Rayner, 2004). Results of priming tasks have indicated that priming of words that are semantically related to morphological constituents facilitate processing of the whole word (e.g., Shoolman & Andrews, 2003; Zwitserlood, 1994). These results suggest a decompositional processing of compounds. In Chinese, both characters and words have structures, and it is natural to ask whether the processing of characters and words are decompositional or not, i.e. analytic or holistic, as well as whether readers process characters and words in a same way. Given the importance of lexical compounding in Chinese, Liu, Chung, McBride-Chang, and Tong (2010) explored whether Chinese children tend to use different strategies when processing single characters and words. They asked third and fourth grade children to judge whether or not two-character words and compound characters, made up of both a left and a right radical, respectively, were real. In this experiment, there were three conditions, i.e., the real condition in which the words and characters were real, the reversed condition in which pseudo-words and characters were created by reversing their left and right components, and the random condition in which two random characters in the word or two random radicals in the character were randomly combined. A longer reaction time in the reversed condition indicated a more holistic processing of the item (character or word). Results showed that there were indeed differences between children's processing of the two-character words as compared to the characters. For the word stimuli, children's reaction times were longest in the reversed condition, whereas for characters, the reaction times were the longest in the random condition. These results suggest that children tend to use a holistic strategy to process words and an analytic strategy to process characters.

Goswami, Ziegler, Dalton, and Schneider (2003) point out that in orthographically inconsistent orthographies, apart from grapheme–phoneme correspondences, readers also have to rely on whole word phonology and orthographic units corresponding to rhymes. Since Chinese is considered to have an inconsistent orthography, Chinese children should be more likely to read based on larger units compared to children using a language with a consistent orthography. In daily life, children usually encounter multiple character words more than they do single characters. For instance, they should be more familiar with the word 皮肤 (skin) than the character肤 by itself. Therefore when reading sentences or text, children as beginning readers also seem to adopt the word as the processing unit. Evidence from several studies could be used to support this perspective.

However this assertion remains controversial across studies. Chen et al. (2003) reported that among 2nd, 4th and 6th grade children there was a developmental tendency for processing to move from the word to the character unit over time. In a later study, Chu and Leung (2005) found a word frequency effect in primary school children's reading. The performance of Grade 1, 3, and 5 children suggested that generally all of them could use whole word-level processing. Furthermore, a character frequency effect was found only in low frequency words, showing that when the word does not frequently appear as a whole, the effect of the character as a component of the word would be larger. However, only first grade children showed the effect of character frequency in high frequency words, indicating that younger children may rely more on such characters than do older children; this seems to conflict with the results of Chen et al. (2003). One possible reason for these results in Chu and Leung (2005) is that the sight vocabulary of first graders may be too small for adequate measurement. Clearly, more research is needed to confirm this pattern and explore the possible related factors.

Following the results of Chen et al. (2003) we carried out a short experiment to explore children's strategies of processing multi-character words. In this experiment, we compared young children's performance on character reading, when the character appeared as a component within a word, to when the character appeared alone. We conducted the study among young children because if word reading is easier than character reading for beginning readers, such effects would be clearest in younger children. Participants of the experiment were 69 Hong Kong Chinese children from three kindergartens. Thirty-five of them were girls. Their ages ranged from 61 months to 73 months, with an average age of 67 months. All children were asked to complete two tasks: reading 60 single characters, and reading 41 two-character words. All of the 60 single characters were used to make up the 41 two-character words, and these were also the "target characters" from which we judged the children's performances on the word reading. For example, children read "花 (flower)" as a single character in the character reading task, and read "花瓣 (petal)" as a word in the word reading task; for both tasks, the target character was "花 (flower)". The sequence of the two tasks was balanced among these children. Thus, we compared recognition of 60 individual characters with 60 characters embedded within two-character words.

Paired sample t-tests showed that children's reading accuracy on the target characters was significantly higher when these were embedded within whole words ($M = 31.68$, $SE = 2.23$) than when the same characters were presented alone as single characters ($M = 27.68$, $SE = 2.12$), $t(68) = 7.77$, $p < .001$. This primary result confirms that young children's word reading facilitated their character recognition. Results are also consistent with the way in which characters are taught in primary school: In most situations, Chinese children learn characters from words or larger contexts; they rarely learn single characters in isolation.

Overall, we can conceptualize of recognition of individual words as occurring at three levels: sublexical, character and word level. Radicals serve as parts of characters, whereas character serves as part of word. Children seem to process words in a more holistic way. Our experiment on young children also supported this view. The fact that children usually encounter words rather than characters in instructional contexts (especially at school but also in various books) may be one of the explanations for this type of processing. On the other hand, the other components as well as their positions in a word may provide a "context" in which children can remember particular characters. Apart from the information of the character itself (e.g., radicals), children who encounter more external cues thus may guess the character more accurately.

Conclusion

This concept that words and characters are different units and, though interacting, may not be equivalent units in understanding children's literacy development, is not new (e.g., Chen et al., 2003). Nevertheless, the fact that characters and words can be distinguished, at least to a certain extent, among Chinese developing readers is important for future research and practice. At least some current models of reading acquisition in Chinese (e.g., Yang et al., 2009) assume that characters are the basic unit of reading in Chinese. In many studies of reading in Chinese children, character recognition lists are administered (e.g., Shu, McBride-Chang, Wu, & Liu, 2006). In other studies, particularly in Hong Kong, reading is generally measured with a word recognition task (e.g., McBride-Chang et al., 2003). A central point of this chapter is to highlight the fact that character and word reading, though overlapping, are not necessarily the same process, particularly for young children or (perhaps) for those learning Chinese as a foreign language. Morphological skills may be particularly helpful in facilitating word reading in Chinese, for example (e.g., McBride-Chang et al., 2003), whereas visual-orthographic processes may be more central for character acquisition skills. More research on this issue is needed.

Along with development, Chinese character and word recognition skills should continuously reinforce one another. Knowledge of radicals is also helpful for character recognition, with greater character knowledge facilitating clearer sensitivity to radicals as well. Thus, sublexical components of characters, characters, and words should be mutually reinforcing in literacy development in Chinese.

Word recognition is continuously reinforced via oral language and in textbooks that teach word reading. Character recognition is reinforced as children break down signs into individual characters and memorize these characters individually. Knowing individual characters helps facilitate "educated guessing" of unknown words with such characters embedded within them. Skills in character and word reading are mutually reinforcing. This idea is potentially crucial in understanding literacy development in Chinese. This concept has no clear analogy to alphabetic orthographies, but it may be developmentally fundamental for understanding how Chinese literacy learners acquire reading skills in Chinese.

Acknowledgments We are grateful to the Research Grants Council of the Hong Kong Special Administrative Region (project reference# 451210) for support of this research. Please address correspondences regarding this manuscript to Catherine McBride-Chang, Psychology Department, The Chinese University of Hong Kong, Shatin, Hong Kong; Tel 852–26096576; Email: cmcbride@psy.cuhk.edu.hk.

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Chapter 4
Fostering Reading Comprehension and Writing Composition in Chinese Children

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Abstract This chapter emphasizes the principles and learning strategies underpinning children's text comprehension and written composition in Chinese. The topic-comment nature of Chinese sentences and text, and their comprehension are discussed. Verbal working memory is shown to play an important role in reading. The knowledge telling and knowledge transforming approaches of Bereiter and Scardamalia (1987. *The psychology of written composition*. Hillsdale, NJ: Erlbaum) provide a viable framework in studying written composition in Chinese. Different ways to enhance children's writing are discussed with examples in learning and teaching. Issues in composing include the quantity and quality of writing and the continuing quest to understand the reading-writing reciprocal relationship.

Keywords Chinese reading comprehension • Written composition • Integrative pedagogic principles • Strategies • Reading-writing relationship

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_4,

In this chapter we focus on research into reading comprehension and writing composition in Chinese children. These two inter-related areas are under-developed in reading literacy acquisition in Chinese as compared with learning Chinese characters and words, especially in the domain of morphological processing. We first review relevant research literature on reading comprehension at the syntactic and semantic levels and highlight the contribution of verbal working memory. Pedagogical principles and learning strategies of text comprehension are outlined. We then discuss Chinese written composition within the "knowledge telling" and "knowledge transforming" framework of Bereiter and Scardamalia (1987). We provide examples to show the promotion of linguistic concepts and procedures to enhance essay writing. The chapter concludes with discourse into reading-writing reciprocal relationship and the factors impacting on Chinese reading literacy acquisition.

Reading Comprehension

Reading comprehension "… requires the delicate interaction of several component processes that integrate information from the page that the student is reading with his or her background knowledge and experience, subject to a multitude of contextual constraints… Reading comprehension involves transforming the meaning on the page into meaning in the mind" (Kintsch & Kintsch, 2005, p. 71). Reading comprehension is an active and complex process involving the interaction of the reader, text in some purposeful activities appropriate for particular goals and situations (RAND Reading Study Group, 2002).

Children's reading comprehension has been shown to be influenced by their verbal working memory (Cain, Oakhill, & Bryant, 2000, 2004); their rapid, automatic decoding of words (Perfetti, 1985); their phonological skills (Shankweiler, 1989); their lexical quality with well specified and abundant representations of orthography, phonology and flexible representation of meaning (Perfetti, 2007); and their oral language skills and sensitivity to story structure (Kendeou, van den Broek, White, & Lynch, 2009). There is also a confluence of cognitive and metacognitive strategies such as monitoring comprehension, activating background information, integrating multiple strategies of questioning, clarifying and searching for information, identifying story themes, summarizing main points and predicting outcomes (e.g., Oakhill, Cain, & Bryant, 2003; Perfetti, Landi, & Oakhill, 2005).

There have also been recent studies of the effectiveness of comprehension training of expository text in English embedded in a science program taught to American second graders (Williams, Hall, Lauer, Stafford, Desisto, & de Cani, 2005; Williams et al., 2002; Williams, Stafford, Lauer, Hall, & Pollini, 2009). Teachers in the Williams et al. (2009) study taught the 215 second graders compare-contrast text structure in a mix of listening, speaking and reading/writing tasks in a span of about 2 months. Their structured lessons consisted of teaching clue words (e.g., compare, contrast), trade book reading and discussion, critical vocabulary concepts, paragraph reading and analysis, graphic organizers, compare-contrast questions summary and lesson review. The Williams et al. (2009) results supported the earlier Williams et al.

(2005) study which provided a combination of listening-reading comprehension instruction to promote the knowledge, skills and strategies of second graders to understand expository text. The Williams et al. (2009) investigation further confirmed that: (a) Systematic and explicit instruction, especially when combined with listening/speaking and reading/writing, can be effective for children as young as ages 7–8, (b) Such training leads to transfer to uninstructed compare-contrast texts; and (c) The instruction can be accommodated within the content area such as science. Similar studies in Chinese should validate the approaches used by Williams and her colleagues in their cumulative research program.

At the sentential level of comprehension native Chinese readers rely both on word meaning and the canonical subject-verb-object (SVO) word order in interpreting simple noun-verb-noun (NVN) Chinese sentences; but when there is a conflict between the two kinds of information word meaning or lexical constraint predominates (Miao, 1981, 1999; Miao & Zhu, 1992). In general, when the sentence is simple in structure and its content is familiar, Chinese children tend to adopt the semantic strategy; but there are complicated relationships between these two factors (Miao, 1999; Miao & Zhu, 1992). Word order in Chinese is fairly flexible with the use of subject-object-verb (SOV), and verb-object-subject (VOS), especially in oral communication. Despite these variations, Chinese sentences are basically of the SVO type (Chao, 1968; Li & Thompson, 1989; Sun & Givón, 1985).

It has been argued that the grammatical meaning of subject and predicate in Chinese should be treated as topic and comment (Chao, 1968; Li & Thompson, 1989). A topic is what the sentence is about and the comment is the rest of the sentence separable from the topic by a marker or a pausal particle. There are certain characteristics of topics and comments in Chinese sentences. One characteristic is that the subject in a sentence may not always be expressed. The following simple sentence begins with the verb "downed" in 下雨了。 ("Downed rain already" or "It rained"). Another example is: 這件事已解決了。 "This matter [someone] has settled [it]." Note that the subject "someone" does not need to be expressed. The same sentence can also mean in English: "This matter has been settled."

Another characteristic of Chinese sentences is the use of semimorphological markers such as *bei* 被 and *ba* 把 (to hold) in the absence of morphological markers such as inflection, tense, number, gender and case. The marker *bei* is meant to express unhappy or unexpected events. An example is: 我們被 [*bei*] 人打了。("We are [were] beaten by others") but not with the negation: *我們被 [*bei*]人不打了。("We were not beaten by others.") A further example is: 我恭賀你。 ("I congratulate you") but it is anomalous in Chinese to say *你被 [*bei*] 我恭賀。("You are congratulated by me.") The marker *ba* is used in a sentence such as 我把那本書賣了。("I [*ba*] that book sold") but this marker cannot be used with negation such as *我把那本書不賣了。 ("I [*ba*] that book not sold")

Another characteristic of the topic-comment nature of Chinese sentences is that an action in the comment or predicate may be directed inward and not outward to the object. An example is: 茶喝不? ("Tea drink or not drink?" or "Would you like to drink tea or not?") And yet another example is the OSV inverted object before the verb and before the subject 午飯吃了。 ("Lunch [I] have eaten.")

In brief, sentence comprehension involves spatial, temporal, contextual and pragmatic cues (see Li, Bates, & MacWhinney, 1993). The integration of these different information sources is constrained by these linguistic categories: (a) word-level constraints such as grammatical categories, (b) contextual constraints particularly important for the resolution of plausibilities and ambiguities, (c) working memory capacity and processing efficiency, and (d) phrase structure contexts (Gibson & Pearlmutter, 1998). A sentence such as "Visiting relation is fun" can be interpreted according to the phrase structure constraint or Halliday's (1994) constituency analysis with minimum and maximum bracketing in functional grammar. The topic could either be "relation" or the act of "visiting". A corresponding sentence in Chinese could be: "咬死了/獵人的狗or咬死了獵人的/狗。 (literally "[Biting dead] [hunter's dog]" or "[biting dead hunter] [dog]" or "The dog that bites dead the hunter." For more complex sentences involving relative clauses readers of English find it relatively easy to interpret head-initial relative clauses of the kind "The boy [who likes soccer]…" Readers of Chinese find it less difficult to interpret head-final relative clauses involving the genitive and obligatory relative clause marker *de* 的 of the kind "like soccer… *de* boy" (Yip & Matthews, 2007).

The notions of topic and comment, the relative role of word order and semantic interpretation are important in syntactic processing of Chinese sentences. Lack of such linguistic sensitivity is one source of writing errors in Chinese, even among adults (Tse, Shum, Miu, & Ki, 2001). From their corpus analysis of written errors of students Tse et al. give these examples of miswriting arising from misreading: (a) 我有一個爸爸。("I have one father") where the correct form should be without the article: 我有爸爸. (b) 王平被選為主席。("Wang Ping *bei* elected as chairman") where the semimorphological marker *bei* is used only to denoted negativity. The correct sentence should be: 我們選王平為主席 ("We elect Wang Ping as chairman"). (c) 我請你坐。Should read as 請坐 ("Please sit down") where the subject will not need to be expressed.

In addition to these linguistic markers being important for syntactic integrity and processing, verbal working memory has been shown to play a critical role in Chinese expository text comprehension. Leong, Tse, Loh, and Hau (2008) asked 518 Grades 3–5 Chinese students (mean age of 10 years) to read silently eight expository passages and to provide short written answers to the three inferential questions for each essay. These children were also administered two verbal working memory tasks in Chinese (reading span and tongue twister), two Chinese pseudoword tasks, two rapid automatized naming tasks (RAN letters and RAN numbers) and two onset-rime phonological segmentation tasks. Structural equation modeling and hierarchical multiple regression analyses showed that conjointly these tasks explained some 55 % of the individual variation in text comprehension. In particular, the reading span verbal memory task with *beta* values ranging from .306 to .466 predicted substantially text comprehension. Though both working memory tasks shared some of the variance when put jointly with the other tasks, verbal working memory's unique contribution remained relatively high in comparison. In particular, the direct effect of verbal working memory on text comprehension was high and was not mediated through pseudoword reading as shown in the structural equation modeling.

These findings are consonant with the meta-analyses results in English by Daneman and Merikle (1996). But multiple tasks and assessments over time are needed to examine alternative theoretical accounts of working memory capacity and usage (Alloway, Pickering, & Gathercole, 2006). In particular, the covariation between working memory and reading needs to be further investigated. Experimental studies have shown that children with reading disorders benefit significantly from strategy training such as rehearsal and cueing but these procedures may not explain fully the relationship between working memory and reading (Swanson, Kehler, & Jerman, 2010).

In addition to the need to explore the contribution of the processing and memorial components of working memory to Chinese text comprehension, there have been attempts at understanding the different levels of constructive activities as they relate to the depth of processing text. Law (2008) used the think-aloud protocol to examine grades 5 and 6 Chinese children's responses to text reading. From her analysis of the students' protocols she found different patterns of metacognitive strategies between skilled and less skilled readers. Skilled readers were shown to be able to relate text difficulties to their daily experience and to integrate information better than their less skilled peers.

From the perspectives of curriculum design, teaching methods and materials, Tse, Cheung, Loh, and Lui (2008) drew on data from the Hong Kong component of the 2006 PIRLS international study of reading performance (Mullis, Kennedy, Martin, & Sainsbury, 2006) to make concrete suggestions for Chinese curriculum materials for both instruction and learning. Tse and colleagues (Tse, Marton, Ki, & Loh, 2007) also suggested an integrative approach to teaching short Chinese text to young children by designing "readable" texts with fairly high frequency characters according to the Chinese Character Data Base (Kwan, 2003). These short texts emphasize characters and words of similar orthographic patterns, alliterative, rhyming and onomatopoeic words (e.g., "ding dong") and meaningful stories. These three important elements of configuration, phonology and semantics are combined with repeated practice in writing characters in isolation and in context to promote both reading and writing for young children. An example of such text materials is shown in Appendix 1.

Implications for Instruction

From the instructional perspective, many teachers of Chinese concentrate on the teaching of characters, words and phrases to the neglect of helping students to make inference from the information on the printed page. A common approach used in pedagogy is the 5 W strategies (what, who, when, where, why). While this widely practiced approach helps learners to answer specific surface questions, it does not go far into providing them with knowledge of the deeper level of text. Our suggestion would be along the following lines: (a) Read the passage to understand its general idea; (b) Understand the genre of the passage and pay attention to the words,

phrases and sentences used; (c) Annotate the main points and the important words and phrases; and (d) Read aloud the passage, paying attention to segmentation, stress, rhythm and other prosodic features (Miller & Schwanenflugel, 2006, 2008; Tse et al., 2008).

To give an actual example, students should be prepared with instructed words and phrases likely to encounter in reading or writing about a visit to, for example, Disneyland in Hong Kong. Such words as "lovely, dream-like, beautiful, creative, fantastic" will likely come up in the text. Pre-reading vocabulary such as "beautiful, variegated, astounding" is likely to be encountered in a passage on firework displays. This approach of enhancing vocabulary knowledge to aid reading comprehension is predicated on the instrumental hypothesis discussed by Anderson and Freebody (1981). The pre-teaching of relevant words and phrases is in keeping with the role of pre-instructed vocabulary found efficacious in the meta-analysis by Stahl and Fairbanks (1986) in promoting reading comprehension. A more recent meta-analysis further shows vocabulary instruction benefited students with reading comprehension difficulties more than those without reading problems (Elleman, Lindo, Morphy, & Compton, 2009). The finding of oral vocabulary and oral language generally as an important causal factor in children's reading comprehension is emphasized by Hulme and Snowling (2011). Language difficulties characterizing poor comprehenders can be ameliorated as shown in a randomized controlled trial by Clarke, Snowling, Truelove, and Hulme (2010). The Clarke et al.'s results were also supported in a longitudinal study by Nation, Cocksey, Taylor, and Bishop (2010).

To take two actual texts as further examples, one is on tidal waves for third grade and the other on thunder storm for second grade. To understand the texts and enjoy reading them teachers should help students to use their own knowledge and to build up mental imageries of the thunderous tidal waves, like thousands of white war horses galloping, roaring sound being like mountains crumbling and earth tearing asunder. Rather than asking the 5 W questions, teachers should point to the key first sentence pinpointing the tidal waves as one of the world's wonders. Likewise, the second grade passage on thunder storm describes the scene before the thunder storm (dark cloud hanging low, cicada not making a sound), during the storm (heavy wind, branches of trees waving violently, thunder getting louder) and the calm after the storm (sun out, a rainbow hanging in the sky, cicada making high-pitch noise). Again, mechanistic 5 W strategies do not help learners to acquire the mental imagery of both sound and motion in a thunder storm.

To further promote reading comprehension it is suggested these approaches should be tried: (a) Encourage students to read different kinds of materials including passages of different genre, stories, poems, and materials of practical use such as notices; (b) Emphasis should be on the precision and quality of reading (e.g., understanding of different structures from wide reading) and not just the quantity of reading; (c) Encourage reading of the same passages written from different angles (e.g., the topic of whale can be written as a scientific piece, an imaginative piece and the like); (d) Re-read the same passages from different perspectives (e.g., *Gulliver's Travels* read as a story in elementary grades may not emphasize the satirical aspects of social and religious orders in eighteenth century Europe as read by high

school students); and (e) Paraphrasing, summarizing and composing all promote reading comprehension (see subsequent sections). In sum, teachers should help students to construct meaning actively from text during reading by forming analogies, hypothesizing, asking questions, making predictions, and evaluating the text in relation to students' knowledge of the topic. The emphasis of this approach for elementary school children should be on explicit instruction of higher level thinking and not just repetitive practice (Pressley, 2002).

Writing Composition

Compared with reading literacy, essay writing or composing is a less well developed area in research. Graham and Perin (2007) suggested from their empirical studies and long-term observations in the classroom that they were not able to draw conclusions about common writing techniques such as providing feedback to students, teaching text structure, developing strategies of planning, revising and editing, and increasing writing practices. They did suggest using multiple approaches and using both experimental and single-subject designs in studying writing in students from grade 4 to adolescents.

From their intervention studies with struggling adolescent writers, Graham and Harris (2007) concluded that: (a) Explicit and systematic instruction should be an integral part of the writing program; (b) Students should be given clear goals of writing and be helped to develop, organize and evaluate their ideas of writing; and (c) Students should be helped to plan their writing through pre-writing by gathering information from books, media and other sources; writing conferences to develop ideas and content; and a writing environment in which planning is valued. In particular, writing research can make greater gain with well developed theories and processing models integrating linguistic, cognitive, biological, and socio-cultural perspectives (Miller & McCardle, 2011).

Earlier, Bereiter and Scardamalia (1987) proposed the "knowledge telling" and "knowledge transforming" approaches as a general framework for the composing process. The knowledge telling strategy in composing "tells *what the writer knows* within a domain demarcated by key words in the question and by the question's general form" (Bereiter & Scardamalia, p. 184, original italics). This approach is characteristic of novice and struggling writers. In comparison, expert writers plan, elaborate their goals, revise, verify their writing and add new connections to their memory. Their use of the knowledge transforming strategy emphasizing formulating and solving problems in answering inferential questions is a way of processing and developing knowledge and could be called "a model of intentional writing" (Bereiter & Scardamalia, 1987, p. 361). These researchers further found three basic factors in hampering children's written text production. The factors are: (a) Short-term memory loss because of the slowness of writing; (b) The motoric act of writing interfering with the writing process; and (c) Lack of cueing which disrupts the discourse process. Rather than viewing composing as a process in which mental

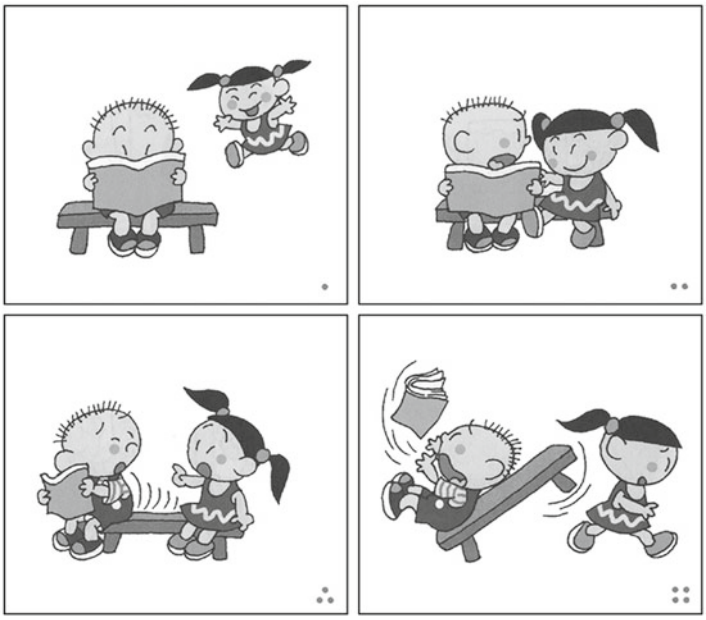

Fig. 4.1 Sample cartoon for composing (Reprinted with permission from Leong, C. K., & Ho, M. K. (2008). *Reading and Writing: An Interdisciplinary Journal, 21*(5), 559–586. doi:10.1007/s11145-007-9113-7)

products are produced, held in buffers sometimes lost through interference or decay, Bereiter and Scardamalia conceptualize writing as a process in which mental representations are being reconstituted continually. Admittedly, the knowledge telling and knowledge transforming approaches are not easy to put into classroom practice, as these researchers acknowledged.

In a study of component processes in language literacy in 361 Chinese students, Leong and Ho (2008) used stimulus cartoon pictures (Fig. 4.1) to elicit students' essay writing. The guiding principle for the design and the scoring of the essays was that of the knowledge transforming rather than the knowledge telling approach of Bereiter and Scardamalia (1987). Following Applebee, Langer, Nystrand, and Gamoran (2003) and Hayes (1996, 2006), Leong and Ho encouraged students in their reflection, text production and interpretation. The cartoons were found to be effective in maintaining the students' interest and in generating narratives of different quality texts.

In addition to the group analyses, a number of written protocols coming from poor and good language and reading comprehenders were carefully studied to examine patterns of their writing skills. An example of an essay with the rather bland title of小明在校裏看書 "Siu Ming Reading in School" was rated as poor by two experienced raters. The student failed to grasp the central concept of the four integrated cartoons. The knowledge telling approach was used to describe loosely the surface level of the meaning portrayed. There were also errors in the use of

words and unclear ideas. In particular, there was no comment on the events or the writer's personal reaction to the episode.

In contrast, the essay with the title of 誰對誰錯? ("Who is Right, Who is Wrong?") was rated as excellent by the raters. In 224 words in the first five paragraphs, the student clearly and succinctly described the reason and the result of the argument of the boy Siu Ming and the girl Fanny. The sentences were well constructed and the whole essay cohered quite seamlessly without embellishment. In particular, the gist of the essay came in the last three paragraphs. The writer pointed out, inter alia, that there are almost always two sides to an argument ("凡事是需要兩面看"); and pursuing who is right or who is wrong may not help settling disputes. The two contesting parties need to think from other people's perspective ("人們懂得為對方設想"). The concluding sentence was "I hope both Siu Ming and Fanny can understand the above reasoning and patch up their differences to remain good friends" ("我希望小明 和小芬能明白道理,和好如初。"). This very forceful ending also harks back to the writer's title to reinforce the idea that arguments have two sides. Thus in addition to being a component in assessing Chinese reading literacy, the essay writing also provides rich information on the students' text production and interpretation (Hayes, 1996, 2006). The two essays with English translation are shown in Appendix 2.

Enhancing Writing Composition

There are different ways to motivate young children and enhance their writing. One way is to encourage them to use the paradigmatic approach of semantic mapping. Figure 4.2 shows such a map drawn by a child of low reading ability to show different ways of making eggs (e.g., boiled, fried, egg omelette, etc.). This visual map can be preceded with discussion and actual demonstration of making eggs. The map can serve as a guide to writing up the different processes and ingredients of cooking, using appropriate terms (Tse et al., 2008, pp. 94–98). Another approach to encourage writing is by providing prompts and asking children to recode or change the meaning of the short text provided. Figure 4.3 asks the child to write up some funny or silly events in daily life and the answers were: ("wearing my coat the wrong way", "using hair shampoo for a bath") (Tse et al., 2008, p. 149).

And yet another way is to explore daily experience from street scenes to stimulate writing and to encourage students to write longer and more meaningful paragraphs. An example of a market scene in Hong Kong with the sale of roasted pork is shown in Fig. 4.4. This figure also includes sample items for augmenting sentences to longer and more complex ones and short comprehension questions (Ho, personal communication, June, 2011). Teachers' guidance in combining sentences or expanding them into longer and more complex ones enhances the quality of students' writing (Perin, 2007). Along these lines the authors (Ho, Loh, & Tse) have organized and conducted regular workshops for teachers of Chinese. Ho has also formed a "junior writers' club" to enhance young writers' writing via web

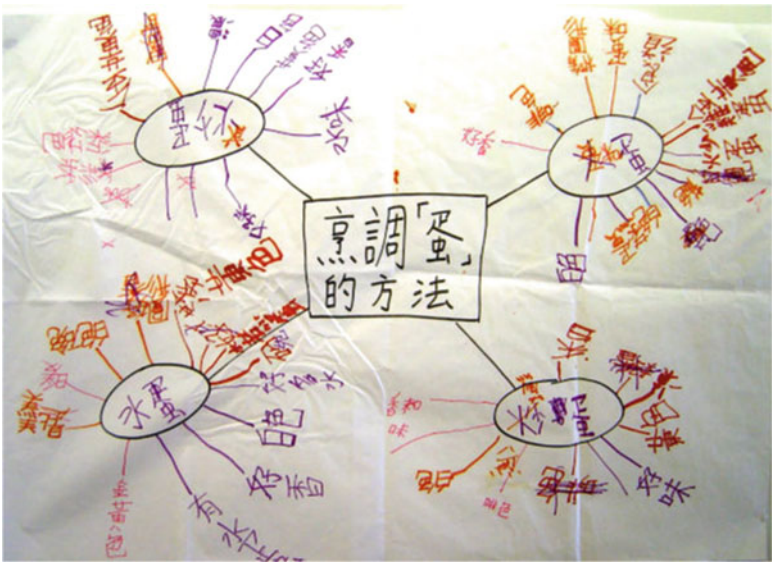

Fig. 4.2 Sample semantic map for composing (Tse et al., 2008)

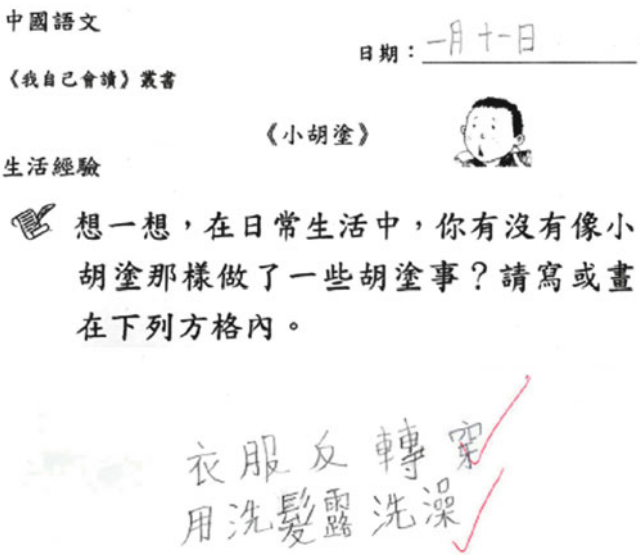

Fig. 4.3 Sample composing from prompt (Tse et al., 2008)

interactive writing and face-to-face meetings. These workshops and web interactive writing prove to be highly effective for teachers and learners.

An example is an imaginative piece by a 12-year-old student of the junior writers' club. This student wrote on the well-known folklore of a wood cutter who lost

Fig. 4.4 Typical street scene for reading and writing

his worn-out axe. He was told later by a fairy that he could have a gold one, a silver one and his own old axe as a reward for his honesty in refusing the gold and silver axes when first offered to him as not being his own. The twist is that the student went on to write about the same wood cutter whose old and plain wife slipped into the river and drowned. When the fairy offered him a beautiful maiden he took her immediately for his lost wife. When queried about his honesty, he answered that he might end up having three maidens, as with his three axes, whom he just could not afford to keep! This and other examples show both an imaginative and a bold approach to writing by the students. We have found from our studies the use of cartoons and daily scenes and our workshops for teachers to be interesting and effective ways to encourage even high school students to write more and better pieces.

Some Issues in Composing

This brings us to the perennial issue of both the quantity and quality of composing in Chinese (Ho, 2009). The question of quantity of composing relates to the number of words written and the number of practice sessions. The question of quality involves students' performance and teachers' criteria of annotating and scoring

students' essays. In terms of quantity it is generally agreed that from third to sixth grades the minimum number of words required should progressively move from 150 words to 300 words (Ho, 2009; Hong Kong Curriculum Development Council, 2008). In terms of quality the emphasis from lower to higher elementary grades and from struggling writers to expert writers should be elevated from emphasis on correctness of lexical items, punctuations, sentence construction to "higher order" components of the structure, cohesiveness and expressiveness of ideas in the composition (Hong Kong Curriculum Development Council, 2008; Shum, Law, Lam, & Chung, 2011). The criteria of annotating essays include self-correction, peer annotation, using symbols and tape recording for correction and related means.

While both quantity and quality of Chinese essay writing should be integrated and a balance sought, the aim should always be the cultivation of students' observation of events around them, of enhancing their listening, speaking, reading and writing performance and of their self regulated learning. The issue of quantity in the form of number and diversity of words used is also shown to be important in written English (Wagner et al., 2011). Wagner et al. further found in their confirmatory factor analysis that macro-organization (ordering of ideas), syntactic density, and handwriting fluency to be important factors with spelling and punctuation to have minimal effect sizes.

The genre of both reading comprehension and composing should progress from descriptive and narrative pieces to argumentation essays (Reznitskaya & Anderson, 2002). Argumentation is a process of thinking where students learn to marshal facts, to argue, to counter-argue, all based on plausibility and factual information (see also Anderson, Wilkinson, & Mason, 1991 on collaborative reasoning; Toulmin, 2003). In a quasi-experimental study using intact groups of 4th and 5th grade American students, Reznitskaya, Anderson, and Kuo (2007) systematically analyzed group discussions of controversial issues and explicit instruction of the principles of arguments. They evaluated reflective essays by noting the number of propositions supporting and opposing arguments. Collaborative reasoning discussions and explicit teaching of arguments were found to be beneficial. These researchers also noted the complexity of teaching and learning argumentation and the elusive nature of transfers to new situations involving argumentation knowledge. In a study of collaborative reasoning in fourth graders in two sites in China and one site in Korea, Dong, Anderson, Kim, and Li (2008) found their Chinese students showed a high degree of engagement and adaptation to collaborative reasoning, They were able to internalize their oral discussion, made intertextual references and generated arguments and counterarguments in essay writing compared with control students.

Reading-Writing Reciprocal Relationship

We should be able to apply the concepts, methods and findings from research in English into writing-reading, reading-writing relationships (Graham, 2006; Graham & Harris, 2000, 2007; Shanahan & Lomax, 1986) to the study of Chinese. In their

early study Shanahan and Lomax (1986) used linear structural equation modeling (LISREL) to study 256 s grade and 251 fifth grade American children. They found the interactive model to fit the data better in showing reading-to-writing at the second grade level, and writing-to-reading at both grade levels to provide the best model fit. These researchers showed more reading information (e.g., vocabulary, word analysis, word and sentence comprehension) was used in writing (e.g., spelling, vocabulary, sentence structure and essay organization) than the other way round. The other reason was that children did not have much opportunity to write. These researchers advocated that writing should be introduced early soon after reading instruction and that both product and process should be studied. We are in full agreement with these assertions. We should also distinguish between skills which are relatively automatic and efficient and strategies which are effortful and volitional.

In particular, Fitzgerald and Shanahan (2000) showed evidence of the early separation of writing and reading but a changing relationship over time. This is when writing and reading are found to be drawing on analogous mental processes. They emphasized the shared knowledge in writing and reading in: (a) Declarative knowledge (e.g.,, lexical knowledge of phonemic, graphemic and morphological awareness, syntax and text format); (b) Procedural knowledge such as accessing, and using general knowledge to integrate various linguistic and cognitive processes; (c) Domain knowledge such as vocabulary, semantics and prior knowledge; and (d) Metaknowledge or pragmatics in knowing the interactions of readers and writers and in monitoring one's own knowledge in composing and reading. These critical knowledge areas, shared in writing and reading development, require conjoint studies over time to monitor developmental trajectories, change and stability. Teachers should be helped to locate struggling writers and readers early and target instruction to enhance their cognitive and linguistic skills and strategies in both writing and reading.

Shanahan (2006, p. 176) further stated that the linguistic covariation between writing and reading typically did not exceed 50 %. However, Berninger, Abbott, Abbott, Graham, and Richards (2002) showed a significant bidirectional relation between the multilevel writing system (handwriting, spelling, and composing) and the multilevel reading system (word recognition, syntactic grammatical processing, discourse comprehension) in their research program predicated on a language systems theoretical framework with large samples of grade school children. Berninger et al. (2002) found that when multiple indicators were correlated the shared variance between composing and text-level reading comprehension was in the 65–66 % range.

Furthermore, Abbott, Berninger, and Fayol (2010) showed consistent and significant relationship from word spelling to text composing in their longitudinal structural equation modeling study covering writing and reading skills across multiple levels of language within and across Grades 1–7 over a 5-year span. Those children with strong spelling skills translated ideas into written words and from written words into written text better than their peers with weaker spelling skills. This performance might be a function of working memory processing. Abbott et al. emphasized that writing development is best modeled on multiple writing and

reading skills at different language levels. These levels include the subword level of handwriting, the word-level spelling and text-level composing. Similar conceptions and results come from Wagner et al. (2011). Wagner et al. found in their confirmatory factor analysis that macro-organization (ordering of ideas), syntactic density, and handwriting fluency to be important factors in writing with spelling and punctuation to have minimal effect sizes. These factors correspond to the text level, the sentence level and the word level as emphasized by Abbott et al. and further underscore the need to integrate all linguistic levels in learning to write and read.

The large covariation between reading comprehension and writing composition also begs the question of other sources of variation. Some of these other sources of variation could be the transcription skills of handwriting and spelling in composing (Graham, 2006; Graham & Harris, 2000). Handwriting fluency, punctuation and spelling were two of the five constructs found by Wagner et al. (2011) in their cross-sectional study of the development of written language in first and fourth grade American children. Similar to some of the findings of Wagner et al., Yan, McBride-Chang, Wagner, Zhang, Wong, and Shu (2012) have recently shown that speed of processing, speeded naming and handwriting fluency variables contributed an additional 12 % of the variation over and above the 35 % of the variation accounted for by vocabulary knowledge, dictation skill, age, gender and phonemic awareness in written composition quality in 9-year-old Hong Kong Chinese children. The plausible reason is that freeing up the cognitive correlates of speed and fluency allows for more resources for higher-level processing needed in composing. But Yan et al. also pointed out that it was difficult to gauge the relative importance of speed and fluency in writing.

In learning Chinese, copying characters and words correctly and fluently according to the proper stroke and radical sequence is a prerequisite to reading and spelling (Tzeng, 2002). There is also experimental evidence that writing, along with naming speed, plays a central role in Chinese reading acquisition (Tan, Spinks, Eden, Perfetti, & Siok, 2005). Removing impediments in transcription skills such as using dictated versions rather than writing long-hand compositions would produce more text. In addition, knowledge, familiarity with the writing topic, writing motivation over time, and regular reading and writing all affect writing composition (Graham, 2006).

Conclusion

The two areas of reading comprehension and writing composition in Chinese discussed in this chapter clearly need more theory-based research. Take reading comprehension as an example, both components of syntactic and semantic comprehension in sentences, paragraphs, and text require further studies. The memory and processing components of verbal working memory, lexical knowledge and fluency in reading comprehension need to be further specified. Essay writing or composing with its planning and collaborative writing lags behind in research, as compared

with reading. Students need systematic instruction to move from the knowledge telling to the knowledge transforming strategies in developing both concepts and procedures of composing.

Appendix 1

Sample Lesson for Training Spelling

吹肥皂泡 Blowing Bubbles

1.

小叮小噹吹泡泡。

太陽下，彩虹吐。

吹得高，飛入白雲霧。

吹得低，飄入紅花圃。

Little ding, little dong, bubbles blow.
Sun is low, colored rainbows flow.
Blow high, fly into white cloud.
Blow low, drift into red flowers crowd.

Appendix 2 (From Leong & Ho, 2008)

小明在校裏看書

有一天,小明在小息時候,他在球旁邊看書,他看了不久,就小麗來了問他可不可以和你一起看,小明就坐過小小就不和小麗看,小麗就走了小明很重,就椅子起了。

這件事,我覺得,書可以一起看,大家都是朋友。希望小明下一次看書都可以和其他同學一起看,大家都會說小明是好學生。如果小明沒有看書,其他同學就有,小明問他可不可以和他一起看,大家都說可以。

Siu Ming Reading in School

One day during recess Siu Ming was reading his book in the playground. After a little while, Lily came to ask if she could read together with him. Siu Ming moved a little bit further to the side and would not let Lily read the book. Lily then left. Siu Ming was quite a heavy boy and the bench tipped.

This incident tells me that the book can be read together. Both are good friends. When Siu Ming reads next time he can do so with his friends. Then other students will say he is a good boy. If Siu Ming is not reading and other students do, he can ask if they can read together. They will likely say yes.

Who Is Right, Who Is Wrong?

一天,小芬從處興高采烈地奔躍到小明那裏,小明坐在木椅上,正低頭尊注地看著手中厚厚書本。

One day Fanny was happily bouncing towards Siu Ming. The boy was sitting on the wooden bench and bowing his head, deeply absorbed in reading the thick book he was holding.

小芬跑到後便坐在小明旁邊,一心想與小明一起看書談天,豈料小明卻不願意與她分享。

Fanny ran behind and sat next to Siu Ming, hoping to read and chat together with him. But Siu Ming did not want to share what he was reading.

經過小芬的多番哀求後,小明依然無動於衷,他更移到椅子一端坐下,背靠小芬,不願分享手中書本。小芬見狀,她已受不了小明這自私的行為,斥責小明。

Even after repeated entreaty from Fanny, Siu Ming was unmoved. He further moved to one end of the bench with his back turned to Fanny and was unwilling to share his reading with the girl. Seeing this, Fanny could not bear this selfish behavior and scolded Siu Ming.

但事實上,小明是想在一個安靜的環境看書,他嘗試向小芬解釋,無奈小芬已向他口大罵。

As a matter of fact, all Siu Ming wanted was to be able to read in a quiet environment. He tried to explain this to Fanny, but she burst out scolding him.

及後,小芬憤怒得決定離開。小明在椅上一端,他失去平衡,跌倒在地上。

Later, Fanny was so angry that she decided to leave. Sitting at the end of the bench, Siu Ming lost his balance and fell to the ground.

大家覺得是小芬的錯,還是小明的錯呢?其實,凡事是需要兩面看;站於小芬立場,小明的行為的確是自私無禮,但站於小明立場,小芬又確是蠻不講理的。

Do you think this was the fault of Fanny, or of Siu Ming? There are always two sides to an incident. From Fanny's point of view Siu Ming was impolite and self-selfish. From Siu Ming's perspective Fanny was most unreasonable

因此,對與錯又有何緊要呢?只要在爭執後,人們懂得為對方設想,於他人立場新看整件事,那麼,一次爭執便成了一段經歷,再不是不能彌補,或是損友誼的事情了!

Therefore, what is so important about right and wrong? The thing to learn is that after an argument the two sides should think about the whole episode from the other's point of view. In this way, an argument becomes an experience and can be reconciled without losing friendship.

最後,我希望小明私小芬能明白道理,和好如初。

Finally, I hope both Siu Ming and Fanny can understand the above reasoning and patch up their differences to remain good friends.

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Chapter 5
Exploring the Relationship of Parental Influences, Motivation for Reading and Reading Achievement in Chinese First Graders

Qiuying Wang and Cassandra Coddington

Abstract One hundred and two 7-year-old first graders and their parents participated in a study examining Chinese beginning readers' motivation for reading and reading achievement in relation to parental and home influences. Children completed a small group administered questionnaire that assessed three theoretical dimensions of reading motivation, including perceptions of competence at reading, perceptions of reading difficulty, and attitudes toward reading. Parents completed a survey of their task values on reading, encouragement for challenging reading, support with printed materials and attitudes toward their child's reading. Results indicated that Chinese children's competence for reading was positively associated with reading achievement, while their perceptions of difficulty for reading were negatively associated with reading achievement. Parental and home influences were significantly associated with Chinese children's motivation for reading and reading achievement. The results are discussed in light of previous research findings and with reference to the cultural context of the present study.

Keywords Reading motivation • Chinese • Beginning readers • Parental influence • Reading • Self-concept

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_5,

It is well established in the West that motivation is a key factor in reading success (e.g., Baker & Scher, 2002; Guthrie & Coddington, 2009). Positive reading motivation has been found across cultures to be associated with higher reading achievement, deeper cognitive processing, greater conceptual understanding, and willingness to persevere when reading is difficult (Gottfried, 1990; Guthrie, Hoa, & Wigfield, 2007; Mazzoni, Gambrell, & Korkeamaki, 1999; Schiefele, 1991; Taboada, Tonks, Wigfield, & Guthrie, 2009).

Despite the centrality of motivational issues to learning to read, they have rarely been the focus of literacy research among Chinese students. The majority of the research on Chinese literacy development has focused on cognitive processing of the language and how the distinctive features of its orthography impact the acquisition of reading. Our knowledge about Chinese children's motivation for reading is limited, and empirical evidence linking the importance of reading motivation and Chinese literacy development is scarce (Wang & Guthrie, 2004). In addition, little is known about how parental roles affect Chinese children's motivation for reading and reading achievement.

The purpose of this study was to explore the relation between Chinese beginning readers' motivation for reading and reading achievement, and examine the role that Chinese parents play in the nurturance of children's motivation for reading. Reading motivation is a complicated and multi-faceted phenomenon. The present study focused on beginning readers' motivation because the early school years are of considerable consequence for shaping subsequent reading motivation and achievement (Morgan & Fuchs, 2007; Morgan, Fuchs, Compton, Cordray, & Fuchs, 2008).

Beginning Readers' Motivation for Reading

Reading engagement refers to the immersion readers experience when interacting with text (Guthrie & Wigfield, 2005; Schutte & Malouff, 2007). Motivation to read is central to reading engagement. Motivation theorists in general attempt to understand the choices that individuals make among different activities available to them and their effort and persistence at the activities they choose (e.g., Pintrich & Schunk, 2002; Wigfield & Eccles, 2002; Wigfield, Guthrie, Tonks, & Perencevich, 2004). Motivation is domain specific and differs across the different subject areas (Wigfield, 1997; Wigfield et al., 2004). Motivation for reading is multi-dimensional. Wigfield and Guthrie (1997) proposed a set of eleven motivational constructs for reading which include reading efficacy, importance, curiosity, involvement, preference for challenge, recognition, grades, competition, social compliance, and word avoidance.

The majority of research conducted on elementary student motivation has focused on an upper elementary school sample of students (grades 3–5). Though a few researchers have begun to focus specifically on the motivation of beginning readers (Chapman, Tunmer, & Prochnow, 2000; Coddington & Guthrie, 2009;

Lepola, Poskiparta, Laakkonen, & Niemi, 2005; Poskiparta, Niemi, Lepola, Ahtola, & Laine, 2003), our knowledge about early motivation for reading is limited, and empirical evidence linking parental influences and beginning readers' motivation for reading is scarce (Baker & Scher, 2002). One of the reasons is that there are few instruments appropriate for children who are not yet conventional readers. Researchers have addressed this measurement issue in a variety of ways. Some researchers have chosen to obtain teacher and/or researcher observations of student behavior as a proxy measure of student motivation (Graham & Golan, 1991; Lepola, Salonen, & Vaurus, 2000). The belief among these researchers is that beginning readers are too young to make accurate assessments of their motivation. Teachers or outside observers have been shown to provide more valid reports of student motivation, that are more highly associated with student achievement, than beginning readers provided for themselves (Coddington & Guthrie, 2009). Although teacher and researcher observations are highly associated with reading achievement, there is a question of what is actually being measured. Teacher and researcher observations measure student behaviors, but not necessarily the intention or motivation behind the behavior. One alternative is to design measures of student motivation that can be administered to beginning readers.

In conceptualizing the multidimensionality of reading motivation for young children, researchers designed self-report measures that were constructed to tap multiple dimensions of motivation (Saracho & Dayton, 1989; Scher & Baker, 1996). For example, the Motivation for Reading Scale assessed four areas: (a) enjoyment of reading, (b) value of reading, (c) self-concept as a reader, and (d) interest in library-related activities. Research studies using the Motivation for Reading Scale suggested that first grade students can distinguish between competence and task value in the domain of reading; they differentiate between what they enjoy and what might be important (Baker, Scher, & Mackler, 1997).

Chapman and Tunmer (1995, 1997, 2003) examined the development of reading self-concept in young children. Self-concept is generally considered to be a multidimensional construct (e.g., Byrne, 1984; Harter, 1986; Marsh & Shavelson, 1985) which is conceptualized as comprising three subcomponents: perceptions of *competence* in reading, perceptions of *difficulty* with reading, and *attitudes* toward reading. Though Chapman and Tunmer (1995) did not use the term motivation in conceptualizing their measure, the three dimensions of reading self-concept are somewhat akin to the reading efficacy, preference for challenge, and the curiosity dimension conceptualized by Wigfield and Guthrie (1997). A number of current theories suggest that self-perceived competence and task value are major determinants of motivation and task engagement. For example, Eccles, Wigfield, Harold, and Blumenfeld (1993) reported that by Grade 1, children's perceptions are differentiated across a range of self-concept domains (e.g., reading, math, and music), and between competence perceptions and subjective task values within each of those academic self-concept areas. Moreover, several research studies suggested that readers with positive self-concepts enjoy their reading experience, identify with what they read, and are likely to be intrinsically motivated (Meece, Anderman, & Anderman, 2006; Schunk, 2003).

Parental Influences on Beginning Readers' Motivation for Reading

Throughout a child's development, the involvement of parents remains central to the acquisition of reading. Parents play a critical role in nurturing children's motivation to read (Baker et al., 1997). To foster a love for reading, parents need to convey the perspective that reading is pleasurable and worthwhile (Baker & Scher, 2002). Those parents who introduce their babies to books give them a head start in school and an advantage over their peers throughout primary school (Wade & Moore, 2000). Children who have more opportunities to engage in literacy-related activities at home were found to have more positive attitudes toward reading, engage in more leisure reading, and have better reading achievement (Baker & Scher, 2002; Whitehurst & Lonigan, 2001; Yaden, Rowe, & McGillivray, 2000).

There is evidence in a number of U.S. research studies that parental influences affect U.S. children's reading motivation (Baker et al., 1997; Baker & Scher, 2002) and literacy development (Bracken & Fischel, 2008; Skibbe, Justice, Zucker, & McGinty, 2008). Baker and Scher (2002) examined children's motivation for reading in relation to parental beliefs and home literacy experiences in a sample of 65 first graders (6-year-olds) and found that beginning readers had positive views about reading. In addition, parental identification of "pleasure as a reason for reading" predicted children's motivation for reading (Baker & Scher, 2002). Another study revealed that parents' beliefs about reading are associated with differences in children's home reading activities, motivation, and achievement (Baker, Mackler, Sonnenschein, & Serpell, 2001; Lynch, Anderson, Anderson, & Shapiro, 2006; Serpell, Sonnenschein, Baker, & Ganapathy, 2002). Elements in parents' social context influence the goals and values parents have for their children, these values result in differences in parenting practices, and differences in parenting behaviors ultimately result in differences in child outcomes.

Though empirical evidence linking parental influences and Chinese children's motivation for reading is scarce, an increasing number of studies have begun to focus on the influence of Chinese parents on student motivation and achievement, as well as social and cognitive development (Chen, Chang, He, & Liu, 2005). Li and Rao (2000) examined the parental influences on Chinese preschoolers literacy development in Beijing, Hong Kong, and Singapore. They found that home literacy education significantly contributed to the prediction of Chinese literacy attainment in all three societies despite sociocultural variations.

Parental beliefs may vary as a function of cultural background (Phillipson & Phillipson, 2007). For example, in U.S. culture, personal autonomy and self-reliance are valued (Oyserman, Coon, & Kemmelmeier, 2002). Parents encourage children to pursue their own goals and respect children's choices (Chao, 1996; Hui & Triandis, 1986). Interestingly, in a study of Asian-American parents and students, parent–child home activity was negatively associated with

students' school achievement (Moon & Lee, 2009). This may be a result of the competing values of the traditional Chinese culture of the parents and the American values of the student and school system. Though parental beliefs may vary by culture, the association between parental beliefs and achievement has been established cross-culturally in Chinese and Ango-Saxon samples (Phillipson & Phillipson, 2007).

However, differences in parental beliefs may place different emphasis on certain tasks leading to different motivations within different cultures. For example, Chinese children's motivation for specific tasks is likely to be both individually and socially oriented. With respect to conceptions of reading, cultures invent different notions of literacy in context—different ideas about what constitutes good readers regardless of the basic cognitive process that are posited. In Mainland China, because of the strong emphasis on international relations, English, along with the Chinese language, is introduced in the first grade to most of children who attend local schools. The priority of reading instruction focuses on Chinese-English bi-literacy. While in the United States, second-language instruction typically does not start until secondary school. The priority of reading instruction focuses on native English. In light of the existing cultural differences, it is possible that Chinese parents may have different values, beliefs and expectations for their children that affect their children's motivation for reading and reading outcomes (e.g., Li & Rao, 2000; Wang & Guthrie, 2004).

To recapitulate, the present study specifically focused on the following goals: (1) to examine how Chinese beginning readers' motivation for reading is associated with their school reading performance; (2) to investigate how Chinese parental influences and practices (reflected as their task values on reading, encouragement for challenging reading, support with printed materials and attitudes toward their child's reading) are associated with children's school reading performance; and (3) to investigate how Chinese parental influences and practices are associated with children's motivation for reading.

Method

Participants

The participants were 102 first graders (65 boys and 37 girls) and their parents. All participants lived in a south suburb of Beijing, an urban environment, and were native Chinese speakers. The participants' ages ranged from 7.6 (90 months) to 7.10 (94 months) years when tested. 54 % of the children were from workers' families whose parents typically were elementary school or middle school graduates; while the rest were from well-educated families in which at least one of the parents had above tertiary-level education. None of the participants had any reported visual, hearing or speech impairments.

Measures

All measures originally written in English were translated into Chinese. As one step to establish the comparability of the English and Chinese measures, the Chinese instruments were back-translated into English by an independent translator and compared against the originals in English for equivalence of meaning. The translated version was then reviewed by three Chinese first-grade teachers and students' parents in China and confirmed in practice in a pilot study. None of the pilot study participants participated in this study.

1. Student motivation. The current study took a view of reading motivation that emphasizes the role of self-concept and value of reading. Therefore, Chapman and Tunmer's (1995) Reading Self-Concept Scale was adapted and translated into Chinese to measure beginning readers' motivation for reading.

   The scale contains items assessing perceptions of competence in reading (5 items), perceptions of reading difficulty (5 items), and attitudes or feelings toward reading (5 items). *Perceptions of competence* refer to beliefs regarding ability and proficiency in reading tasks. *Perceptions of difficulty* refer to beliefs that reading activities are hard, or problematic. *Attitude* refers to the affective component of reading self-concept, which is defined in terms of feelings toward and affinity for reading.

   The assessment was administered in a small group (15 children per group) to avoid distractions inherent in a large-group setting. A typical elementary classroom in China has about 40–50 students. The statement was read to children in order to get an index of motivation that was not confounded by limited reading skills. The statements were phrased to be compatible with the comprehension level of 7-year-olds, to reflect literacy experiences relevant to first graders, and to maintain a consistent response format.

   The administrator read each statement out loud. Then, the researcher asked whether the sentence had been understood. The item was repeated, and the children were asked to indicate "yes" or "no" to the item, according to how he or she felt. The response requirements of the scale were taught to children by examples until they understood.
2. Parents survey. Parents were asked to complete a survey (Wang, Gentile & Mifsud, 2003) of their task values for reading (7 items), encouragement for challenging reading (5 items), support with reading materials and print (10 items), and attitudes toward external feedback (7 items). Parents answered each item on a 1–4 scale, with 1 = very different from me, 2 = a little different from me, 3 = a little like me, and 4 = a lot like me. The participating students were required to take home a copy of parents' survey to their parents or primary caregiver to complete. A two-hour meeting was set up the following week for parents who have questions with the survey. The researcher was available to answer parents' questions during the meeting.

3. Reading achievement. The Level 1 version of Test of Basic Reading Skills (TBRS) was used as a standardized measure of Chinese children's reading achievement. TBRS is a norm-referenced group test on reading, designed for elementary level students in Hebei province in China. There are vocabulary, comprehension, grammar, and spelling subtests. The TBRS was scored using the key provided in the testing manual. Based on the TBRS score, comparisons can be made of one child's performance with what might be normally expected of other children in that school. Student reading achievement was assessed by the end of their first school year.

Results

Association of Parental Beliefs to Motivation for Reading and Reading Achievement

Intercorrelations (Pearson's *r*) of student perceptions of reading motivation, parental influences and reading achievement are reported in Table 5.1. The strongest statistically significant associations were ($p < .01$) within the parent influences constructs where correlations ranged from $r = .86–.92$. The absolute value of correlations between the three student constructs ranged from $r = .55–.61$, and were statistically significant. Correlations between student motivations and parent influences were also statistically significant and ranged from $r = .23–.38$. Consistent with previous research, parental influences and students' motivation for reading were associated

Table 5.1 Intercorrelations of reading achievement, children's motivation, and parental beliefs

	1	2	3	4	5	6	7	8	9
1. Reading achievement	–								
2. S. Motivation (total)	.17*	–							
3. S. Competence	.15*	.86**	–						
4. S. Attitude	−.02	.84**	.61**	–					
5. S. Difficulty	−.15*	−.86**	−.61**	−.55**	–				
6. P. Task values	.18*	.38**	.38**	.26**	−.32**	–			
7. P. Encouragement	.16*	.38**	.37**	.25**	−.34**	.88**	–		
8. P. Support	.17*	.36**	.35**	.25**	−.32**	.87**	.90**	–	
9. P. Attitude	.15*	.38**	.38**	.23**	−.36**	.86**	.88**	92**	–

S. Competence student perceptions of competence, *S. Attitude* student attitudes, *S. Difficulty* student perceptions of reading difficulty, *P. Task values* parent task values on reading, *P. Encouragement* parent encouragement for challenging reading, *P. Support* parent support with reading materials and print, *P. Attitude* parent attitudes toward external feedback

*$p \leq .05$ (2-tailed); **$p \leq .01$ (2-tailed)

Table 5.2 Multiple regressions predicting reading achievement from children's motivation and parental influences

Model	IVs	*R*	R^2	ΔR^2	ΔF	*Final ß*
Analysis 1: Student motivations						
1	S. Difficulty	.19	.11	.12	10.68**	−.19**
2	S. Competence	.22	.15	.10	7.59**	.13**
Analysis 2: Parent beliefs						
1	P. Values	.19	.10	.19	10.92**	.19**
2	P. Support	.24	.13	.17	5.63**	.14**
3	P. Encouragement	.29	.17	.09	3.77*	.15*
4	P. Attitudes	.32	.21	.06	2.86*	.16*

S. Competence student perceptions of competence, *S. Difficulty* student perceptions of reading difficulty, *P. Values* parent task values on reading, *P. Encouragement* parent encouragement for challenging reading, *P. Support* parent support with reading materials and print, *P. Attitude* parent attitudes toward external feedback

*$p \leq .05$ (2-tailed); **$p \leq .01$ (2-tailed)

with children's school reading achievement. Children's reading achievement was ($p < .05$) positively associated with total motivation scale ($r = .17$), parental task value ($r = .18$), parental encouragement ($r = .16$), parental support ($r = .17$) and parental attitude ($r = .15$). Children's reading achievement was ($p < .01$) negatively associated with students' perceptions of difficulty with reading (r = −.32 to −.36), which was expected and consistent with previous research.

Predicting Reading Achievement from Children's Motivations and Parental Influences

Regression analyses were conducted to examine whether parental influences and reading motivations explained variance in children's reading achievement. Family background (working class = 1; middle class = 2) was entered into the regression equation on the first block as a co-variate. In analysis 1, motivation variables specified in the second block were set for stepwise entry if they met the criterion of $p = .10$ to help ensure that potentially relevant independent variables were not excluded from consideration (Norusis, 1993). The motivation variables were Reading Competence, and Perception of Reading Difficulty. In analysis 2, parental variables specified in the second block were set for stepwise entry if they met the criterion of $p = .10$. The parental variables include parental task value, parental encouragement, parental support, and parental attitude. Diagnostic tests of normality, linearity, homogeneity of variance, and collinearity were conducted for each resulting regression equation. All equations met assumptions adequately.

In analysis one, children's perceptions of reading difficulty predicted 12 % of the variance in children's reading achievement, and perceptions of reading competence accounted for an additional 10 % of variance (Table 5.2). In analysis two, parental

Table 5.3 Hierarchical stepwise regressions predicting children's motivation scores from parental beliefs

Model	IVs	R	R^2	ΔR^2	ΔF	*Final β*
Student motivation (total)						
1	P. Values	.29	.13	.15	53.77**	.38**
2	P. Support	.35	.16	.13	46.01**	.33**
3	P. Encouragement	.39	.19	.10	33.41**	.29**
4	P. Attitudes	.46	.24	.07	28.81**	.22*
Perception of competence						
1	P. Values	.40	.16	.16	59.50**	.41**
2	P. Support	.44	.19	.18	35.02**	.38**
3	P. Encouragement	.48	.22	.20	23.44**	.33**
4	P. Attitudes	.53	.27	.24	17.56**	.30**

P. Values parent task values on reading, *P. Encouragement* parent encouragement for challenging reading, *P. Support* parent support with reading materials and print, *P. Attitude* parent attitudes toward external feedback

*$p \leq .05$; **$p \leq .01$

task values was a powerful predictor of children's reading achievement that accounted for 19 % of the variance. Parental support accounted for an additional 17 % of variance in children's reading achievement while parental encouragement and parental attitude predicted another 9 % and 6 % of the variance, respectively. All of the betas in both analyses were statistically significant and positive, except for student perceptions of difficulty, which was associated in a negative direction, indicating that for a unit increase in perceptions of difficulty, children's reading achievement decreased significantly.

Predicting Children's Motivation from Parental Influences

In order to determine whether parental and home influences predicted children's motivation for reading, separate regression analyses were conducted for the total motivation scale as well as the three subscales. Family background (working class = 1; middle class = 2) was entered into the regression equation on the first block as a co-variate. Parental variables were permitted to enter stepwise in the second block if they met the criterion of $p = .10$. Diagnostic tests of normality, linearity, homogeneity of variance, and collinearity were conducted for each resulting regression equation. The attitude and perceived difficulty subscale solution departed from normality and linearity; therefore, these analyses were not considered further.

As can be seen in Table 5.3, the same variables were significant predictors of Chinese children's motivation for reading in both analyses, but the relative amounts of variance they accounted for differed. For total student motivation, parent values contributed to predicting 15 % of variance, while parent support accounted for 13 %. Parent encouragement accounted for 10 % of additional variance while parent attitudes accounted for 7 %. For student competence, however, parent attitudes

(24 %) and parent encouragement (20 %) accounted for the most significant unique variance, while parent values (16 %) and parent support (18 %) accounted for additional variance. All of the parent support constructs were significantly and positively associated with student motivation and competence.

Discussion

To recapitulate, the present study specifically focused on the following goals: (1) to examine how Chinese children's motivation for reading is associated with their school reading performance; (2) to investigate how Chinese parental influences and practices (reflected as their task values on reading, encouragement for challenging reading, support with printed materials and attitudes toward their child's reading) are associated with children's school reading performance; and (3) to investigate how Chinese parental influences and practices are associated with children's motivation for reading.

The first major finding of this study was that Chinese children's perception of competence for reading predicted their school reading performance. This is significant because these findings are consistent with the more extensive literature on children's motivation in Western societies, which also finds that children's perceptions of reading competence are closely tied to their reading achievement. Perhaps even more interestingly, the results of this study found that student's perceptions of difficulty with reading predicted reading achievement in Chinese students. This finding represents two important theoretical implications.

First, this study revealed that perception of reading difficulty at a young age is negatively associated with achievement. This finding has been reported in other studies, but these studies have focused on Caucasian samples (Coddington & Guthrie, 2009). In addition, studies of Western samples that have looked at ethnicity differences have found that African-American students have a different motivation profile than Caucasian students, particularly when examining perceived difficulty and avoidance of reading (Guthrie, Coddington, & Wigfield, 2009). Thus, these results indicate that students from mainland China may be more consistent with the findings of more Caucasian samples.

Second, perceptions of difficulty in reading represented a distinct construct of motivation from perceptions of competence in reading, as both constructs significantly predicted reading achievement when the other was taken into account. Theoretically, this finding indicates that perceptions of difficulty are not the "negative" end of a single continuum of competence. Perceptions of difficulty contributed to predicting unique variance in achievement, which indicates that it is an entirely separate construct. This finding has been found in studies of perceptions of difficulty with Western samples (Chapman & Tunmer, 1995; Coddington & Guthrie, 2009), however, it had not been investigated in a Chinese sample of young children.

The second major finding of this study was that parent beliefs (i.e., values, support, encouragement, and attitudes) predicted children's reading achievement. Few studies

of young children have examined parent beliefs in conjunction with reading achievement, and those that have were Western samples (Baker & Scher, 2002; Chapman & Tunmer, 1999). The results of this study indicate that Chinese parents play a key role in supporting children's reading development and achievement, even at an early age. In particular, parent values and support were highly associated with children's reading achievement. Literacy research in the West has shown that what parents believe, say and do can make a difference on children's motivation for reading. Parents who express negative attitudes about reading and who discourage their children from wasting their time with books are unlikely to foster a love of reading (Baker et al., 1997). The results of this study indicate that Chinese students, like their Western counterparts, may be particularly in tune to the emphasis that their parents place on the skill of reading and the resources that their parents provide in helping them learn to read.

The third major finding of this study was that Chinese parents' beliefs predicted their children's total reading motivation and perceptions of competence. There is variation among families in beliefs, values, attitudes, and expectations parents hold with respect to literacy (Mason & Allen, 1986; Wallat, 1991). Gambrell (1996) reported that parental support is linked to long-term motivation to read. Baker et al. (1997) discovered that parental encouragement of children's reading is related to the child's attitude towards reading, regardless of socioeconomic status. This study indicates that Chinese parents' values, support, encouragement and attitudes are not only instrumental in developing Chinese student's reading skills, but also their sense of competence and motivation for reading.

In conclusion, this study provides evidence for the importance of student motivation and parent beliefs early in children's endeavors to read. Parent beliefs are essential for the development of student motivation and both parent beliefs and student motivation are important predictors of reading success. These findings are unique and extend the existing literature by examining the motivations and parental beliefs of a Chinese sample. Future research with Chinese students should continue to examine the relationship between student motivation, parent beliefs, and reading achievement. Particularly, areas of future study may focus on distinctions in student motivation profiles and parent beliefs for reading in first (Chinese) and second (English) languages. The results of this initial study, however, are consistent with the findings in the Western literature, which provides a foundation for the examination of more complex questions in future research.

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Part II
Reading Disability in Chinese Children

Chapter 6
Helping Children with Reading Disability in Chinese: The Response to Intervention Approach with Effective Evidence-Based Curriculum

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Abstract To accomplish effective evidence-based intervention for children with reading disability (RD), it is important to integrate basic and applied research findings and take into consideration some language-specific learning demands. In this chapter, research findings regarding the cognitive profile of Chinese RD are reported and the relevance of the profile for teaching Chinese children with RD is discussed. In particular, a Chinese tiered intervention model with core reading instruction curriculum, which we have developed and implemented in 37 primary schools in Hong Kong, is introduced. This Chinese model has successfully improved the various cognitive skills, literacy skills, and learning motivation of the children in the Program Schools. In particular, 18–58 % of poor readers in Tier 2 and 7 % dyslexic readers in Tier 3 remedial groups, who originally fell below the benchmark, reaching the benchmark of Chinese literacy after receiving the intervention for 1–2 years. Comparing the core reading components in Chinese and the Big Five in English suggests that different cognitive demands are needed for reading diverse orthographies—phonological training is essential for learning to read English, whereas orthographic and morphological training is significant for reading success in Chinese.

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_6,

Keywords Chinese • Orthographic skills • Morphological skills • Reading disability • Response to intervention • Tiered intervention model

Reading disability (RD), also called developmental dyslexia, has been studied for over a century in countries using alphabetic writing systems. Generally speaking, around 3–5 % of the school population in a Western country has RD. Even with adequate intelligence and sufficient educational opportunity, children with RD experience severe and persistent difficulty in word reading, spelling, and reading comprehension. RD is known to be familial and heritable (e.g., Chow, Ho, Wong, Waye, & Bishop, 2011; Ho, Leung, & Cheung, 2011; Snowling, Gallagher, & Frith, 2003; Wadsworth, Olson, Pennington, & DeFries, 2000). Delayed and inappropriate intervention often results in learning, emotional, and behavioral problems in these children. However, it was only in the last 15–20 years that we began to study RD in Chinese, despite that Chinese is the major non-alphabetic language with the largest reader population in the world. The Chinese language has been described as a logographic and morphosyllabic writing system with unique linguistic, phonological, orthographic and morphological characteristics that are different from those of alphabetic languages. The Chinese language, therefore, can be considered a very good case for examining the issue of cultural/linguistic universality and specificity in reading disability.

In this chapter, we will first give a review of the research literature on RD in Chinese. Then, we will introduce the Response-to-Intervention (RtI) approach for identifying and teaching children with RD and report how we implemented this approach and examined its effectiveness among Chinese elementary students in Hong Kong.

Characteristics of the Chinese Language

Before we examine RD in Chinese, we will first briefly describe the main characteristics of the Chinese orthography as some readers may find this unfamiliar. The basic graphic unit in Chinese is a character. There are about 4,600–4,900 commonly used Chinese characters in Hong Kong (Cheung & Bauer, 2002; Lee, 2000). Each Chinese character represents a morpheme and is pronounced as a syllable with a fixed grouping of onset, rhyme and tone. A lexical tone is understood as a relative fundamental frequency with a particular pattern which is considered suprasegmental as it cannot be an independent or discrete part of a word but can only be realized on a syllable or a rhyme. With a large number of morphemes represented by a limited number of syllables (around 1,300 in Mandarin Chinese), the problem of homophony in Chinese is extensive (e.g., Duanmu, 2009). Many syllables may have one or more homophones which carry different meanings (e.g., Packard, 2000).

Chinese is not as logographic as people think. Only a small percentage of Chinese characters convey meaning by pictographic or ideographic representation (Hoosain, 1991). About 80–90 % of Chinese characters are ideophonetic compounds, each comprising a semantic and a phonetic component (Kang, 1993). The semantic and phonetic components (also called radicals) are some stroke-patterns that provide meaning and sound cues of a Chinese character, respectively. For instance, in the character 燈 [dang]1[1] "lamp", 火 [fo]2 "fire" is the semantic radical which gives a cue to the meaning of the character (as fire was used to light an oil lamp in the olden days), and 登 [dang]1 "climb" is the phonetic radical which gives a cue to the pronunciation of the character. There are different degrees of semantic and phonological regularity/consistency in Chinese characters. The predictive accuracy of the pronunciation of an ideophonetic compound character from its phonetic radical is about 26 % if lexical tone is taken into consideration (Chung & Leung, 2008; Fan, 1986; Shu, Chen, Anderson, Wu, & Xuan, 2003; Zhou, 1980). Overall, semantic radicals are functionally more reliable than phonetic ones.

The orthographic rules in Chinese are rather complicated with all the above characteristics (e.g., having a large number of orthographic units and many homophones, different degrees of positional, semantic, and phonological regularities for radicals). Many of these rules are not formally taught in school but are acquired through repeated exposure to words in the sequence of character configuration knowledge, structural knowledge, radical information knowledge, positional knowledge, functional knowledge, and complete orthographic knowledge (Ho, Yau, & Au, 2003). It takes children nearly all their elementary school years to acquire a complete orthographic knowledge in Chinese.

Unlike alphabetic languages such as English, there is no inflectional system, such as subject-verb agreement and case marking in Chinese (Li & Thompson, 1981). Therefore, instead of using morphological transformation in alphabetic languages (through inflection or derivation), word compounding or morphosyntax is used in Chinese to show tense, number, and degree. The majority of Chinese words are multi-morphemic. Many of these words are formed by lexical compounding rules (Packard, 2000), and Chinese compound words tend to be more transparent and productive than those of English. Since there is a lack of inflectional system in Chinese, reading to comprehend Chinese sentences and texts means that the reader has to solicit syntactic information from the given linguistic constituents and their semantic relationships (Chao, 1968; Li & Thompson, 1981). Chik and her colleagues (2011) have reported that syntactic skills, in terms of word order, connective usage, and knowledge of morphosyntactic structure among Chinese first graders, significantly predicted sentence reading comprehension in Grade 2 after controlling for the children's age, IQ, and word level reading-related cognitive skills in Grade 1, and word reading in Grade 2. Syntactic skills are therefore important for reading comprehension in Chinese.

[1] All pronunciation notes for Chinese characters in this paper are Cantonese pronunciations. For instance, in the syllable [dang]1,/d/is the onset,/ang/is the rime, and "1" means that the syllable is in the first tone, i.e., a high level tone.

Cognitive Profiles of Reading Disability in Chinese

In conceptualizing the core skills for learning to read, the "triangle model extended" proposed by Bishop and Snowling (2004) is one of the few models incorporating both single-word processing and processing at the sentence or paragraph level. On reviewing the evidence on the reading difficulties encountered by children with dyslexia and specific language impairment, Bishop and Snowling reinstated the importance of context in language processing. Two major components of context, syntactic skills and discourse skills, were highlighted. This model is the conceptual framework for our analyses of the cognitive profile of Chinese children with RD and the basis for our curriculum development. Since the curriculum that we developed is for Chinese elementary school children, our review in this section will focus only on the cognitive profiles at the word level (orthographic and morphological deficit) and text level (syntactic deficit) of children with RD in this age range. Phonological deficit will not be reviewed here as it has been found to be less dominant in Chinese children with RD (Ho, Chan, Tsang, Lee, & Luan, 2004)

Orthographic-Related Deficit

According to the definition offered by Vellutino, Scanlon, and Tanzman (1994), orthographic skill is "the ability to represent the unique array of letters that defines a printed word, as well as general attributes of the writing system such as sequential dependencies, structural redundancies, letter position frequencies, and so forth". Given the different linguistic characteristics of the Chinese language listed above, Chinese dyslexic readers show a cognitive profile somewhat different from that of dyslexic readers using alphabetic languages. While the core problem of English-speaking children with RD is in phonological processing, it is expected that Chinese children with RD would show more problem in orthographic and morphological processing. At the word level, we have reported that rapid naming deficit (in 57 % of the dyslexic sample) and orthographic deficit (in 42 % of the dyslexic sample) are the major reading-related cognitive deficits in Chinese RD (Ho et al., 2004). Rapid-naming deficit in Chinese dyslexic children may also reflect their problems in developing a stable and strong orthographic representation that allows rapid retrieval. We suggest that orthographic-related difficulties may be the crux of the problem in Chinese developmental dyslexia. As described above, the orthographic rules in Chinese are rather complicated, so that the acquisition of orthographic skills becomes a hurdle for many Chinese dyslexic children.

Morphological Deficit

Apart from orthographic-related deficits, other studies show that morphological deficit may be another salient feature of RD in Chinese. Morphological awareness has recently been found to be an important predictor of reading success and failure

in Chinese (McBride-Chang, Wagner, Muse, Chow, & Shu, 2005; Shu, McBride-Chang, Wu, & Liu, 2006). Given the large frequency of homophones and word compounding in Chinese, morphological awareness is even more important in learning to read Chinese than in learning to read alphabetic languages (McBride-Chang et al., 2005). Chinese dyslexic children were found to perform significantly less well than age controls in morpheme production and judgment (Shu et al., 2006).

Syntactic Deficit

The studies reviewed above are mainly related to word-level reading-related cognitive deficits of RD in Chinese. Text-level cognitive deficits have been less well examined. In a recent study, we have found that Chinese children with RD performed significantly less well than age-matched readers in both word-level and text-level cognitive measures (Chik et al., 2012). Chinese senior graders (Grade 4 and Grade 5) with RD performed like junior average readers, who relied heavily on word-level skills like oral vocabulary and word semantics for text comprehension. These senior graders with RD have only acquired some discourse skills for understanding the general organization and schema of passages. Unlike typically developing senior graders, they did not acquire some advanced text-level reading related skills, like morphosyntax, for text comprehension. It was possible that these RD children had a relatively slow rate of word decoding to support their development of higher level and integrative skills required for text comprehension in senior grades.

In view of the diverse and persistent difficulties of children with RD, it is important to ask whether there are effective evidence-based methods for teaching these children. We submit that the Response-to-Intervention approach may provide an answer to this question.

The Response-to-Intervention Approach

The Response-to-Intervention (RtI) approach has received growing attention in recent years and its effectiveness has been established in studies conducted in North America (see Haager, Klingner, & Vaughn (2007) for a comprehensive review). This early prevention approach is based on monitoring students' progress, by means of curriculum-based measures, over the course of their participation in appropriate interventions. Students who make little progress are deemed to require a more intensive and specific intervention, and those with continuous non-responsiveness to intervention may be considered as having a learning disability. A three-tiered RtI model is generally used as an alternative to traditional methods for identifying and teaching students with RD. In this model, Tier 1 is whole-class intervention where quality core reading instruction is provided to all general education students. Those who fall below the benchmarks receive more intensive intervention. Tier 2 is small-group supplemental instruction, and Tier 3 is individualized intensive instruction.

In general, Tier 1 instruction should meet the needs of around 70–80 % of learners. The lowest 20–30 % of students may require additional support with Tier 2 intervention, and around 5–10 % may need more intensive support from Tier 3 intervention.

The RtI approach has been demonstrated to be effective in decreasing the percentages of children requiring special education. For example, in the Heartland Early Literacy project (HELP), the numbers of students who were placed in special education at the participating school were reduced by 14 % in kindergarten, by 34 % in first grade, by 25 % in second grade, and by 19 % in third grade (Tilly, 2003).

A Three-Tier Model of Reading Intervention in Chinese

Given that RD is common and persistent, it is important to identify and help children with RD as early as possible. Early identification and early intervention help to improve the success rate of intervention, prevent the reading problem from continuing into higher grades, and avoid the development of emotional and behavior problems associated with poor academic performance (Chan, 2002).

From our experience in Hong Kong, the problem of RD in Chinese is much more common than one expects. With a representative stratified random sample, our findings show that 9.7 % of the sample had RD, with 6.2 %, 2.2 %, and 1.3 % having mild, moderate, and severe difficulties, respectively (Chan, Ho, Tsang, Lee, & Chung, 2007). The percentage of children with severe literacy difficulties is close to the same figure for children learning alphabetic languages. Our experience with the tiered intervention model suggests that it could be an effective model for early identification and early intervention.

With the funding from the Hong Kong Jockey Club Charity Trust, our team has started to develop a tiered intervention model on Chinese language learning for junior elementary students (i.e., Grade 1 to Grade 3) in Hong Kong. This model has three core components: (1) a core reading program based on scientific research findings, (2) benchmark testing and progress monitoring to determine instructional needs, and (3) professional development for teachers to ensure that students receive quality instruction in reading. This 5-year project (2006–2011) has two phases. In the first phase (2006–2009), our effort has mainly focused on developing the curriculum and the assessment materials. The initial package was tested in three local primary schools. In the second phase (2009–2011), we implemented the model in another 34 primary schools of different types (big schools with 5 classes per grade, small schools with 1–2 classes per grade, schools with more special needs students, schools using Putonghua versus Cantonese[2] as the medium of instruction).

[2] Putonghua is the official language in mainland China and Cantonese is the dialect spoken by most Chinese people in Hong Kong. Written Chinese often corresponds to the spoken language of Putonghua while Cantonese may deviates from the written format in the use of vocabulary and syntax.

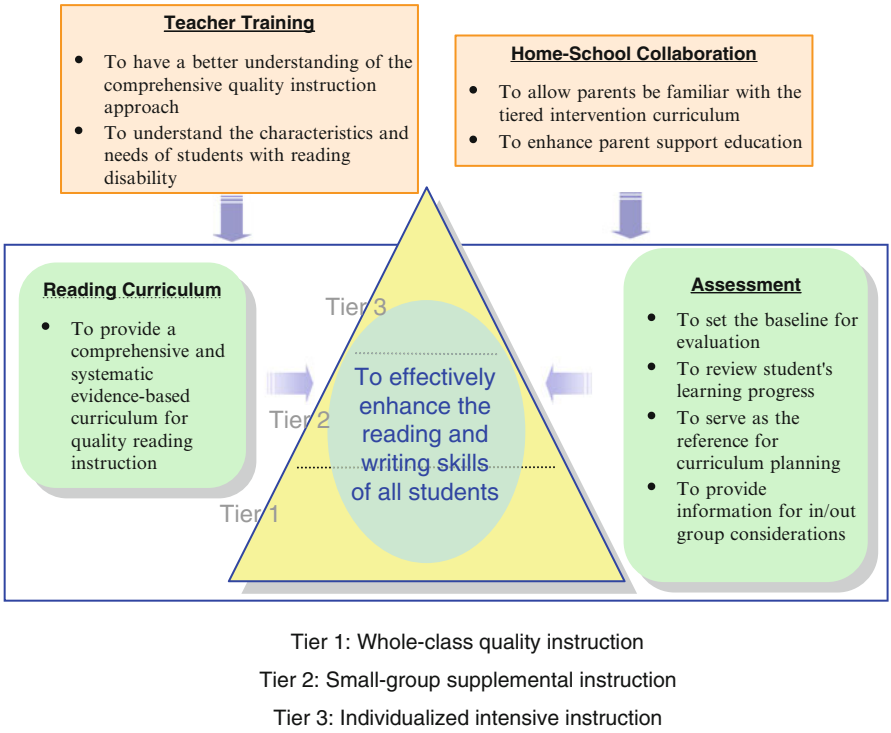

Fig. 6.1 Core components of the tiered intervention model in Chinese

We modified and fine-tuned the model and materials with the implementation in these diverse settings. In addition to the three core components (a reading curriculum, assessment, and teacher training), we have added a fourth component, home-school collaboration, to the model as shown in Fig. 6.1. We believe that parents are an indispensible partner to make the intervention successful and sustainable. We will review overseas practices and our experience with the model in the following sections.

Effective Evidence-Based Curriculum

After examining over 100,000 research studies related to reading instruction, the National Reading Panel (2000) has identified five core components of reading instruction in English: phonemic awareness (PA), phonics, vocabulary, fluency, and reading comprehension. These are called the Big Five. PA is the ability to notice, think about, and work with individual sounds in spoken words. The overall effect size of PA outcomes was large (e.g., 0.71 for Year 1 to Year 2 change, and 1.08 for Year 1 to Year 3 change in Tilly's (2003) study), and was especially significant for

word reading and reading comprehension. Phonics involves systematic instruction of letter-sound relations to reading and spelling of words accurately and quickly. The systematic phonics instruction significantly helps children learn to decode words more effectively. Vocabulary is about how children acquire an understanding of new words and concepts. Such word knowledge is associated more with reading comprehension than with word recognition (e.g., Braze, Tabor, Shankweiler, & Mencel, 2007; Nation & Cocksey, 2009). In some studies, vocabulary instruction has been found to improve students' performance in reading comprehension (e.g., Lubliner & Smetana, 2005; McDaniel & Pressley, 1989; Nelson & Stage, 2007). Fluency refers to reading quickly, accurately, and with appropriate expression. Fluency is an indicator of skilled reading and facilitates rapid integration of concepts in sentences and text. Comprehension refers to the process that enables the reader to build a mental representation of a text message and to make meaning of the text. Comprehension is the central and ultimate outcome of the reading process. Phonemic awareness, phonics, vocabulary, and fluency are considered essential components for achieving good reading comprehension.

Based on the reading instruction model in English and research findings of cognitive profiles of RD and reading acquisition in Chinese reviewed above, we have developed a core reading curriculum in Chinese. The curriculum emphasizes oral language as the basis, proceeding successively to word-level and text-level skills building. Some reading-related cognitive skills which are identified as important to Chinese reading acquisition are included in the curriculum design. A total of eight core components of cognitive-linguistic and literacy skills are developed and grouped into three levels of skill building—oral vocabulary and morphological skills (oral language skill building), orthographic skills and word recognition strategies (word-level skill building), reading fluency, syntactic skills, reading comprehension and writing strategies (text-level skill building). This curriculum framework is built upon the "triangle model extended" reviewed above. Both word-level and text-level cognitive-linguistic skills are found to be important for learning to read. Our conceptualization is also based on the Simple View of Reading that language comprehension and decoding skills are the core skills for reading comprehension (Gough & Tunmer, 1986) and this view has gained empirical support both behaviourally and genetically (e.g., Aaron, Joshi, & Williams, 1999; Catts, Hogan, & Adlog, 2005; Keenan, Betjemann, Wadsworth, DeFries, & Olson, 2006). We agree to Kirby and Savage's (2008) view that language comprehension includes a range of oral language skills like vocabulary, syntax, and the construction of mental schemas, while decoding involves a range of skills beyond phonological decoding, including orthographic processing, and rapid naming which make efficient word recognition possible. In this curriculum framework, teaching matches well with the progressive learning of the students from oral language, to word acquisition, and to sentence and passage comprehension.

More specifically, instruction on oral language skills includes building and expanding children's oral vocabulary (including appropriate use of vocabulary in different settings), and oral expression (including the use of complete sentences and systematic description of events) through vocabulary learning, sentence expansion

activities, and guided oral composition with everyday themes or scenarios (e.g., useful vocabularies in a supermarket). For the instruction on morphological skills, children are first taught the correspondence between a syllable and a meaning (i.e., a morpheme), and then some syllables with multiple meanings (i.e., homophones) through pictures and sounds of common objects. Characters with multiple meanings (i.e., homographs) and some simple word compounding rules are introduced later. Students are taught how to use the combination of morpheme meaning to understand unfamiliar words and sentences. Instruction on orthographic skills includes knowledge about basic Chinese character structures (left-right, top-bottom, and enclosed structures), functions, positions, and regularities of semantic and phonetic radicals. Students are also taught how to make use of the meaning of semantic radicals and sound of phonetic radicals to help word reading, and hence improve sentence understanding. For word recognition instruction, students are taught some word learning strategies (e.g., the use of colours to highlight different components of a Chinese character) to memorize the pronunciation and orthography of characters. For instruction on reading fluency, five high-frequency word lists with various themes, i.e., school, family, park, food, and emotion words, are provided as learning materials. Themes of these word lists are very familiar to students and knowing these high frequency words are highly useful to their daily reading and writing. After knowing how to read the words, students practice reading the word lists, sentences and passages with these words fluently and with appropriate intonation. Teachers would time their speed of reading in class from time to time. For syntactic skills instruction, children are taught simple word classes (e.g., nouns, verbs, and adjectives), short phrases (e.g., adjective + noun, and adjective + verb), main components of a sentence, correct word order (e.g., subject-verb-object), and the use of common connectives (e.g., because-therefore, although-but). Students are also taught how to use these skills for reading comprehension (e.g., finding the actor of an event) and writing syntactically correct sentences. For reading comprehension and writing instruction, the basic structure of a passage (e.g., different story schema), the importance of a title, and location of important content words and connectives are introduced with various learning activities and practices. Further details regarding the instruction of this curriculum could be found in Ho, Wong, Yeung, Chan, Chung, Lo, & Luan (2011).

Assessment

Assessment in the Tiered Intervention Model serves three functions: (1) screening for children that may require more attention, (2) progress monitoring for entry and exit decisions, and (3) assessment for informing instructional planning. Benchmark assessments, preferably three times a year, help in early identification of students at risk for reading problems. The data on ongoing progress monitoring help teachers adjust their instruction to ensure students' academic growth.

Before the publication of the Hong Kong Chinese Literacy Assessment for Junior Primary School Student (CLA-P) (Ho, Wong, Lo, Chan, Chung, Tsang, Lee, & Lo

2011), a standardized assessment tool used with the Chinese tiered intervention model, some experimental measures have been developed to achieve these assessment functions. Students were assessed three times a year (beginning of an academic year, end of the first term, and end of an academic year). Examination of the effectiveness of the model was based on these data and will be reported in later sections. Additionally, short informal continuous assessment exercises were designed for each learning unit for the purpose of evaluating students' learning in class. These short formative assessment tasks were designed to be conveniently administered, with the assessed goals closely linked to the content being taught in class. If the results revealed that most students did not grasp the concept fully, teachers were expected to re-teach the concept in the coming lessons before moving on to something new.

There are six subtests in five domains of the CLA-P, namely one-minute word reading and one-minute text reading (tests of fluency), usage of semantic radicals (an orthographic measure), morpheme identification (a morphological awareness measure), word order (a syntax measure), and text comprehension (a reading comprehension measure). Similar to the American practice, the fluency subtests were used for screening children with difficulties who may require additional intervention. School performance and other conditions were also considered when large number of students was screened for remedial support. The other subtests were used for progress monitoring and informing in-group or out-group decisions.

Teacher Training

Teachers play a key role in successful implementation of the RtI instruction (Chhabra, 2006; Danielson, Doolittle, & Bradley, 2007; Kratochwill, Volpiansky, Clements, & Ball, 2007). Recent studies indicated that trained teachers were observed to utilize significantly more explicit instruction than control teachers, and hence students being taught by the trained teachers performed better (Bos, Mather, Narr, & Babur, 1999; McCutchen et al., 2002; McCutchen & Berninger, 1999). For teachers' successful professional development, training needs to communicate a clear rationale to teachers, supply evidence-based curricular materials, and to provide teachers with feedback and support for the new practice.

In our project, there were two to three three-hour workshops for the participating Chinese language teachers each academic year. The workshops introduced the concept, materials, and techniques of teaching each component in the model. Teachers were given opportunities to discuss and practice the materials in the workshops. Apart from attending these training workshops, school teachers also received ongoing support from research team members once a month to discuss the prescribed lesson plans, their observations of children's progress, the obstacles or progress in conducting classes, and the timelines of implementation. Teachers in each school were also observed once or twice in each academic year by research team members during the Chinese language class. Discussion

meetings were held between teachers and research team members immediately after the observation to provide feedback and to support their instructional skills, classroom management, and strategies to motivate students.

Home-School Collaboration

The current model is relatively new to the parents and it has somewhat changed the content and method of assessment in school. Therefore, we familiarized Grade 1 parents with details of the curriculum and assessment through talks in the Parent Days at the beginning of Grade 1. A learning passport, which summarizes the core language skills and learning activities of the model, was distributed to the parents. This would facilitate their understanding of the curriculum and allow them to support their own children's learning more effectively. Participation of Tier 2 and Tier 3 parents is particularly important. Apart from attending parent seminars on different topics (homework management, language teaching skills, and social support), these parents were given regular written reports of their children's learning in the Tier 2 or Tier 3 groups. Some learning activities were suggested to parents together with the progress reports, so as to facilitate consolidated practices at home.

Implementation of the Intervention Program

Tier 1 Intervention

Tier 1 is a level of intervention for the whole class and the Tier 1 curriculum was designed to enhance and supplement the traditional Chinese curriculum. To implement the Tier 1 curriculum in the participating schools, around 240 min per week were spent on teaching the core skills in Grade 1 and Grade 2 with the activities developed by the research team. Teachers were coached on how to integrate the Tier 1 curriculum with their own Chinese language curriculum (e.g., using orthographic skills to learn characters in the passages of the traditional curriculum) to make it a school-based curriculum catering for the needs of their students. These skills were gradually integrated into regular teaching and the skills were not taught separately in Grade 3. In other words, there was no separate Tier 1 curriculum per se in Grade 3, but rather a consolidated and integrated curriculum on language instruction.

Tier 2 Intervention

Students were assessed on the one-minute word reading subtest of the CLA-P at the end of Grade 1 for the purpose of screening for Tier 2 intervention. Those who scored below 20th percentile in the fluency subtest and at or below 15th percentile in school performance were listed for consideration for Tier 2 support. A meeting among

language teachers, special needs support teachers, language and curriculum panels, and educational psychologists was held to discuss which student should receive Tier 2 remedial support. Factors like family background, health conditions, and motivation were considered. Students in Tier 2 remedial groups received on average 100–150 min of pull-out intervention support per week. Recommended teacher to student ratio is from 1:10 to 1:12, depending on situations and resources of the schools. Instruction was provided at a time during the day that did not conflict with the core reading lessons offered in the regular classroom. Teaching content included the same core reading components as in Tier 1 but the learning activities were structured to be in smaller steps with more practices. Differentiated training contents were designed to meet students' needs, i.e., teachers could modify the content and materials according to the abilities and progress of the students. All the subtests in the CLA-P were administered three times in an academic year to monitor students' progress.

Tier 3 Intervention

In principle, those in Tier 2 who continue to lag behind other students may be considered for more intensive Tier 3 support. Operationally, we suggest to the schools to consider those who have received Tier 2 intervention but still score below 15th percentile in three or more subtests of the CLA-P and with school performance within the bottom 10 % for Tier 3 support. Having a diagnosis of RD is an additional consideration as the Tier 3 groups are more suitable for students with RD than other types of disabilities (e.g., mental retardation and Autistic Spectrum Disorder). In our project, Tier 3 students received extra intervention support of 140–175 min per week. The size of Tier 3 groups was relatively small, with teacher to student ratio from 1:1 to 1:5. While students in the Tier 2 intervention groups were usually given the same instruction throughout a school year, each Tier 3 student was prescribed an individualized education plan (IEP) of different instructional components and more refined learning steps, which were selected with reference to the student's areas of weaknesses. The goals were set jointly by parents and teachers during IEP meetings, which were held three times a year. Some basic language skills (from the eight domains) were selected for teaching in Tier 3 groups and multisensory activities, slogans, visual diagrams, and body games were used to enhance understanding and memory. Learning contents were delivered in a more explicit and concrete manner. Both formative and summative assessments were conducted regularly to monitor students' progress in line with the learning objectives.

Effectiveness of the Tiered Intervention Model in Chinese

The present report on evaluating the effectiveness of the tiered intervention model was based on the Phase I data of our project because at the time of writing this chapter we still do not have a complete set of information and data available with the

Phase II schools. Details of implementation in Phase I may be somewhat different from those in Phase II but the core teaching components and the criteria for entering and leaving the intervention groups remain mostly the same. Since we have reported the effectiveness of Tier 1 intervention in a recent paper (Ho, Wong, Yeung, Chan, Chung, Lo, & Luan, 2011), we will only give a summary of the findings here. Readers may refer to the original paper for more details. For the evaluation of the effectiveness of Tier 2 and Tier 3 intervention, we will give a more detailed account in the following sections as we have not reported the results elsewhere.

Effectiveness of Tier 1 Intervention

The aim of the Tier 1 intervention study was to develop and examine a core curriculum for reading instruction in Chinese that could be used in a tiered intervention model (Ho, Wong, Yeung, Chan, Chung, Lo, & Luan, 2011). Multi-component intervention progammes are rare (Wanzek, Wexler, Vaughn, & Ciullo, 2010), and this study was rather comprehensive in covering the major important cognitive-linguistic components for reading. To evaluate the effectiveness of Tier 1 intervention, we have selected one Program school and one Control school in Phase I with a total of 223 children for comparison. The Control school was a kind of waiting list control as the students received support on model implementation 3 years after this study. All these children were followed for 3 years from Grade 1 to Grade 3. Findings of this study showed that Tier 1 quality intervention was beneficial for Chinese beginning readers and it was effective in enhancing their cognitive-linguistic and literacy skills. The positive effects were maintained for at least 1 year till the end of Grade 2. Progress in both word-level and text-level cognitive-linguistic skills predicted significant progress in reading comprehension. These findings are highly consistent with Yeung et al.'s (2011) proposed model of reading in Chinese. In the model, morphological awareness and orthographic skills are significant predictors of word reading but phonological awareness is not; and orthographic skills (namely semantic radical knowledge) and syntactic skills are significant predictors of sentence reading comprehension. Findings of our study supports that the core components of reading skills in Chinese are oral language, morphological awareness, orthographic skills, and syntactic skills. The dissimilar core components reflect the different cognitive demands required for reading in different orthographies—phonological training is essential for learning to read English, whereas morphological and orthographic training is important for reading success in Chinese. It is noted that the significance of word compounding and complicated orthographic rules require good morphological and orthographic skills for word learning in Chinese.

The traditional way of teaching Chinese in Hong Kong and in Mainland China has been the use of textbook passages. Students learn to recognize new words, vocabularies, sentence structures, passage types, etc. mainly through reading a number of prescribed passages. Particular cognitive-linguistic skills, for example, morphological awareness and syntactic skills, are seldom or never taught explicitly

and systematically in schools. Our study has pioneered a successful approach incorporating findings from cognitive and psycholinguistic research to regular classroom teaching of Chinese.

Effectiveness of Tier 2 and Tier 3 Intervention

Despite the positive findings reported above, some students still show little progress with Tier 1 intervention. These "non-responders" of Tier 1 intervention may require more intensive support in Tier 2 or Tier 3 remedial groups. Here we will report the results of students who had received 1 year Tier 2 intervention in Grade 2, 1 year Tier 2 intervention in Grade 3, or 1 year Tier 3 intervention in Grade 3 in three Program schools of Phase I of the project.

Participants

There were 44 Grade 2 students (with a mean age of 6.97 years, 27 boys and 17 girls), divided into 6 remedial groups, who had received Tier 2 intervention for 1 year in the Program schools. Their performance was compared with an equal number of students (with a mean age of 7.06 years, 25 boys and 19 girls) from the Control school where no remedial support was given to these poor readers. As shown in Table 6.1, Tier 2 students in the Program schools and the Control school did not differ in age, IQ, or literacy level (as measured by a standardized Chinese word reading test, details of the test will be given below) in Grade 2 or Grade 3. After 1 year of intervention when the children were promoted to Grade 3, 19 out of the 44 Tier 2 students in the Program Schools remained in Tier 2 intervention, 15 moved to Tier 3, while 10 went back to Tier 1. The 19 Tier 2 and 15 Tier 3 Grade 3 students had received respective intervention for 1 year in the Program schools. However, not enough matched students for Tier 3 were available from the Control school for comparison. Progress of Grade 3 Tier 3 students was only compared with the local benchmark.

Measures

Progress of the students was measured using standardized assessment and some experimental measures. A total of 10 measures were administered: an intelligence test (Raven's Standard Progressive Matrices), four cognitive-linguistic measures, one standardized literacy measure, and four experimental literacy measures. The Grade 2 students were administered all these measures while the Grade 3 students were administered the standardized literacy measure only. Results of the principal component analyses in Ho, Wong, Yeung, Chan, Chung, Lo, & Luan (2011) study confirmed that the cognitive-linguistic measures used largely fell into the proposed

Table 6.1 Mean, SD, and t-value of matched variables of Tier 2 students in Program Schools and the Control School

Measure	Mean	SD	Mean	SD	t
Grade 2 Tier 2:	Program schools (n = 44)		Control school (n = 44)		
Age (in months)	83.59	3.80	84.73	4.19	−1.33
IQ	103.57	11.23	106.07	14.99	−0.89
Chinese word reading (HKT)	7.50	2.58	8.43	2.71	−1.65
Grade 3 Tier 2:	Program schools (n = 19)		Control school (n = 19)		
Age (in months)	93.74	3.56	95.21	4.95	−1.05
IQ	108.26	10.75	105.95	11.76	0.63
Chinese word reading (HKT)	7.58	1.84	8.58	4.11	−0.97

All ps > .10

domains, namely oral language, morphological awareness, orthographic skills, and syntactic skills. Since detailed description of these measures could be found in the study by Ho et al. (2011), the measures will only be described briefly here.

Cognitive-linguistic measures. A morphological construction task was used as a measure of morphological structure awareness. Children were asked to construct new Chinese compound words for the presented objects or concepts based on previously learned morphemes. A pseudo-character meaning judgment task was an orthographic measure of the children's overall awareness of positions, functions, and semantic categories of different Chinese semantic radicals. Children were asked to circle one out of four pictures that might be semantically related to the meaning of the pseudo-character. Another orthographic task, phonological-relatedness judgment, was a measure of the children's awareness of the function of phonetic radicals. Children were asked to select one out of three choice characters that might have the same or similar pronunciation as the target pseudo-character. Word order was a syntactic task that measured the children's awareness of some basic Chinese sentence structure rules. Children were asked to arrange three to six sentence fragments to form a syntactically correct sentence.

Standardized literacy measure. A standardized literacy subtest, with Hong Kong norm, was taken from the Hong Kong Test of Specific Learning Difficulties for Reading and Writing (HKT-SpLD) (Ho, Chan, Tsang, & Lee, 2000). Children were asked to read aloud 150 Chinese words in the Chinese Word Reading subtest.

Experimental literacy measures. Four literacy tasks were developed to measure children's performance in word spelling, reading and writing text. In the Chinese word dictation task, children were asked to write from dictation some Chinese two-character words. The one-minute text reading task was a measure of the children's fluency in reading Chinese text. Children were asked to read aloud a given passage as quickly and accurately as possible within one minute. In the reading comprehension task, children were asked to choose from four choices the most appropriate word that could complete a sentence with a missing word. The passage writing task was used to assess children's ability to compose a passage with a given theme, which was about a happy birthday scene.

Results and Discussion

Tier 2 Group comparisons. To examine whether the Grade 2 Tier 2 groups in the Program schools showed greater improvement than the Control school, the difference between the pre- and post-intervention scores of percentages correct was calculated. Since the students were tested multiple times from Grade 1 to Grade 3 during the study, easier items were included in lower grades and more difficult ones in higher grades for the same set of tasks. Improvement rates were calculated based on the overlapped items between the two measurements. Table 6.2 presents the mean raw scores and standard deviations of the various measures before and after the intervention, and results of *t*-test for the comparison of improvement rates between the Program and Control schools. Effect sizes were also calculated in terms of Cohen's d statistic to indicate the effectiveness of the intervention. According to some published studies, typical effect size of educational and psychological interventions is about .33 (e.g., Chow, McBride-Chang, Cheung, & Chow, 2008). It was found that Program school Tier 2 students generally showed greater improvement than the Control sample. Statistically significant group differences were found in the pseudocharacter meaning judgment, word order, Chinese word dictation, one-minute text reading, and passage writing (all $ts > 2.08$, all $ps < .05$), and with effect sizes ranging from .45 to .88. Group differences on improvement in morphological construction and sentence reading comprehension did not reach statistical significance, but yielded effect sizes of .36 and .22, respectively. The result showed that Tier 2 intervention was quite effective in boosting the students' cognitive and literacy skills, particularly in orthographic skills, syntactic skills, spelling, reading fluency, and writing.

Comparison with the benchmark. Effectiveness of Tier 2 and Tier 3 intervention was further examined by the change in numbers of students meeting the benchmark of the standardized literacy measure after the intervention. To meet the benchmark, a student needs to have a scaled score of 9 or above in the HKT-SpLD Chinese word reading subtest. Mean scaled score of an individual subtest is 10 and one SD is 3. This benchmark indicates a performance at or above the 37th percentile among students of the same age group in the whole territory. Meeting the benchmark does mean an important improvement in Chinese literacy performance.

Table 6.3 shows the numbers and percentages of Grade 2 Tier 2, Grade 3 Tier 2 and Tier 3 students meeting the benchmark of standardized Chinese literacy test. For Grade 2 Tier 2, the percentage of students in the Program schools meeting the benchmark increased by 18 % after 1 year intervention, while the corresponding increment was 14 % in the Control school. For Grade 3 Tier 2, the percentage of students in the Program schools meeting the benchmark increased by 58 % while that in the Control sample was only 11 %. For the Grade 3 Tier 3 students, percentage of students meeting the benchmark increased by 7 % in the Program schools. No corresponding data from a matched Tier 3 sample were available from the Control school. The results showed that Tier 2 intervention was effective and the positive effect might accumulate for those who received 2 years of intervention rather than 1 year. Effectiveness of Tier 3 intervention might be relatively smaller given the severity of the reading problem of these children.

Table 6.2 Mean and SD of raw score before and after intervention, percentage of improvement, t-value and effect size of comparison between Program Schools and the Control School in Grade 2 Tier 2 students

	Program school (n = 44)			Control school (n = 44)				
Measure	Pre-intervention M (SD)	Post-intervention M (SD)	Percentage of improvement M (SD)	Pre-intervention M (SD)	Post-intervention M (SD)	Percentage of improvement M (SD)	t (1,86)	Effect size (d)
Morphological construction	2.64 (2.62)	5.34 (2.99)	22.54 (23.27)	3.20 (2.48)	4.89 (2.83)	14.02 (24.43)	1.68	0.36
Pseudo-character meaning judgment	3.70 (1.86)	6.11 (1.98)	26.77 (24.36)	3.57 (1.47)	4.48 (1.64)	10.10 (18.38)	3.62***	0.77
Phonological-relatedness judgment	4.75 (2.23)	6.07 (1.78)	14.65 (27.30)	4.98 (2.04)	6.07 (1.97)	12.12 (28.13)	0.43	0.09
Word order	3.93 (1.86)	6.84 (1.96)	32.32 (25.56)	5.00 (1.86)	6.91 (2.03)	21.21 (24.18)	2.09*	0.45
Chinese word reading (HKT)	7.50 (2.58)	8.68 (3.20)	7.39 (12.52)	8.43 (2.71)	9.39 (3.19)	5.97 (11.19)	0.56	0.12
Chinese word dictation	1.73 (1.50)	5.05 (1.57)	41.48 (21.70)	3.57 (2.02)	5.16 (1.98)	19.89 (27.27)	4.11***	0.88
One-minute text reading	69.32 (18.85)	114.50 (31.06)	80.68 (38.28)	90.39 (24.33)	121.43 (31.29)	55.44 (32.01)	3.36**	0.72
Sentence reading comprehension	2.82 (1.74)	5.30 (1.62)	30.97 (20.44)	3.95 (2.07)	5.95 (1.85)	25.00 (32.01)	1.04	0.22
Passage writing	3.25 (2.02)	5.52 (2.66)	17.48 (23.72)	4.91 (2.92)	5.57 (1.99)	5.07 (22.74)	2.51*	0.53

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 6.3 Number and percentage of Tier 2 and Tier 3 students in the Program Schools and the Control School meeting the benchmark of standardized Chinese literacy test

			Pre-intervention		Post-intervention		
		n	Number of student meeting the benchmark	%	Number of student meeting the benchmark	%	Percentage Change
Grade 2 Tier 2	Program schools	44	13	30	21	48 %	+18 %
	Control school	44	25	57	31	70 %	+14 %
Grade 3 Tier 2	Program schools	19	4	21	15	79 %	+58 %
	Control school	19	10	53	12	63 %	+11 %
Grade 3 Tier 3	Program schools	15	2	13	3	20 %	+7 %

Other areas of improvement. Other than improvement in cognitive and literacy areas, these children were also observed to show better skills and motivation in learning. Surveys were administered to the teachers and parents of the Program school students at the end of their intervention. Teachers and parents were asked to compare the students' performance before and after the intervention. Since no intervention was given to the Control school at the same time, survey regarding changes after intervention was not given to teachers or parents of the Control school. The parents of the Tier 2 and Tier 3 students were invited to express their agreement to 14 indicators of potential positive changes, using a 5-point scale, with "1" representing "strongly disagree" and "5" representing "strongly agree". Table 6.4 presents the results of the survey with parents. These parents had observed many positive changes after the intervention with all scores above 3. In particular, these parents indicated that their children showed greater confidence in learning Chinese (mean rating = 3.95), better interpersonal communication skills (mean rating = 3.90), better verbal expression skills (mean rating = 3.88), improved parent–child communication (mean rating = 3.80), more active in learning Chinese vocabularies (mean rating = 3.78) and reading Chinese story books (mean rating = 3.78).

Similarly, teachers of these students also observed improvement in students' learning behaviors. The students' Chinese language teachers and the remedial group teachers were invited to complete a questionnaire with nine potential positive learning behaviors on a 4-point scale with "1" representing "totally disagree" and "4" representing "totally agree". Table 6.5 shows that the teachers also observed many positive changes in the students (all items scored above 3). In particular, the Tier 2 and Tier 3 students were seen to be more active in class participation (mean rating = 3.44) and in preparing for Chinese tests (mean rating = 3.34) after the intervention. They showed notable improvement (mean rating = 3.24) and interest in learning Chinese (mean rating = 3.34). All these positive changes in learning motivation would help the students to sustain the positive intervention outcomes in the long run.

Table 6.4 Results of the post-intervention survey with parents of Tier 2 and Tier 3 students (n = 40)

Items	Mean score (Max. of 5*)
1. More active in learning Chinese vocabularies	3.78
2. More active in reading Chinese story books	3.78
3. More fond of going to book store and reading Chinese books in the library	3.63
4. More active to solve problems in Chinese homework by themselves	3.48
5. Less avoidant to studying for Chinese dictation	3.65
6. Less avoidant to learning Chinese vocabularies	3.68
7. More frequent in applying the skills taught in the intervention group to learn Chinese vocabularies	3.67
8. More frequent in applying the skills taught in the intervention group to prepare for Chinese dictation	3.64
9. More relaxed in handling Chinese tests and exams	3.65
10. Greater confidence in learning Chinese	3.95
11. Better interpersonal communication skills	3.90
12. Better verbal expression skills	3.88
13. Reduced parent–child conflict over homework	3.65
14. Improved parent–child communication	3.80

Note: *1 = Strongly disagree, and 5 = Strongly agree

Table 6.5 Results of the post-intervention survey with teachers of Tier 2 and Tier 3 students (n = 41)

Items	Mean score (Max of 4*)
1. Pay more attention to teachers' instructions	3.22
2. More active participating learning activities in class	3.44
3. Put more effort to class work	3.22
4. Turn in Chinese homework on time	3.20
5. Significant improvement in the ability to learn Chinese	3.24
6. Greater interest to learning Chinese	3.34
7. Greater confidence in learning Chinese	3.24
8. More active in preparing for Chinese dictation and tests	3.34
9. More willing to try to solve problems encountered in learning Chinese	3.17

Note: *1 = Strongly disagree, and 4 = Strongly agree

Conclusions

The present chapter has reported findings to demonstrate that the three-tier RtI model is effective in enhancing the reading-related cognitive skills and literacy skills of students in Chinese. The effectiveness of tiered intervention is further established with 18–58 % of poor readers in Tier 2 and 7 % dyslexic readers in Tier 3 remedial groups, who originally fell below the benchmark, reaching the

benchmark of Chinese literacy after receiving the intervention for 1–2 years. Therefore, the RtI approach is an effective method for helping junior elementary students with RD in Chinese parallel to the RtI approach in English. Successful early intervention provides a solid foundation for students with RD to face the challenges of more advanced learning ahead. Based on the findings of Ho et al. (2011) (on Tier 1 intervention) and those reported in the present chapter (on Tier 2 and Tier 3 intervention), we propose the core skills of reading instruction in Chinese to be oral language, morphological awareness, orthographic skills, and syntactic skills. Comparing the core reading components in Chinese with the Big Five in English suggests that different cognitive demands are required for reading different orthographies—phonological training is essential for learning to read English, whereas orthographic and morphological training is important for reading success in Chinese.

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Chapter 7
Rapid Automatized Naming and Its Unique Contribution to Reading: Evidence from Chinese Dyslexia

Jinger Pan and Hua Shu

Abstract Rapid automatized naming (RAN) is suggested to be a significant predictor of reading. However, how it is related to reading and whether it contributes uniquely to reading with phonological awareness statistically controlled is unclear. In this chapter, we reported a study of 45 fourth and fifth grade Chinese children with dyslexia and 45 age-matched controls. They were administrated processing speed tasks, auditory temporal processing, RAN, phonological awareness, Chinese character recognition, and timed word list reading. Results showed that Chinese dyslexic children performed poorer than typical developing children in all tasks. And principal component analyses revealed that RAN loaded in both phonological processing and processing speed component. RAN uniquely predicted Chinese timed and untimed word reading, while phonological awareness predicted only untimed Chinese word reading. The underlying mechanism and the role of RAN in Chinese were discussed.

Keywords Dyslexia • Chinese • Rapid naming • Phonological awareness

Since the work of Denckla and Rudel (1976) which established a significant relationship between rapid automatized naming (RAN) and reading, researches continue to investigate the subprocesses of RAN which account for its relationship with reading. The most dominant argument for this relationship is whether or not such a relation comes from the phonological component of RAN (e.g., Ziegler et al., 2010). In this chapter, we presented evidence from Chinese dyslexia for the link between RAN and reading by examining the lower level component in RAN and its relation to different literacy skills.

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_7,

RAN requires readers to name a list of familiar stimuli as rapidly as possible. There are usually four types of stimuli: letters, digits, colors, and objects. The former two types are usually termed alphanumeric naming, and the latter two nonalphanumeric naming. Alphanumeric naming tasks tend to be of stronger relationship with reading than non alphanumeric tasks.

In many languages, dyslexic children are characterized by having problems in reading speed. Mann and Wimmer (2002) showed that, when considered along with phonological awareness and digit span, RAN was the only significant predictor of reading speed in German, a transparent orthography. Deficits in naming speed are also considered to be dominant deficits of dyslexia in transparent orthographies. In English which is an opaque orthography in the alphabetic writing system, RAN still showed its importance in explaining variance of reading (Compton, 2003; Kirby, Parrila, & Pfeiffer, 2003). Besides reading accuracy, a link between RAN and reading speed is even more pronounced. Ziegler et al. (2010) found that RAN contributed significantly to five different transparent orthographies. Georgiou, Parrila, and Liao (2008) also found RAN a significant predictor of English reading fluency. These findings were found in both normal distributed samples and reading disables (e.g., Holopainen, Ahonen, & Lyytinen, 2001; Wimmer & Mayringer, 2002). However, some suggested that RAN tasks predict reading better in transparent orthographies than in opaque orthographies and that RAN tasks predict reading fluency better than accuracy (Mann & Wimmer, 2002; Patel, Snowling, & de Jong, 2004; Vaessen, Gerretsen, & Blomert, 2009).

Though arguments on the role of RAN still exist in different aspects, it was nevertheless found to be a significant predictor of Chinese, the most opaque orthography. Former studies showed that RAN was a consistent predictor of reading development in Chinese (e.g., Pan, McBride-Chang, Shu, Liu, Zhang, & Li, 2011), and also an early predictor of poor reading (Lei et al., 2011). And it predicted not only reading fluency but also reading accuracy, in both typically developing children and dyslexia (Chow, McBride-Chang, & Burgess, 2005; Ho & Lai, 1999; McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Shu, McBride-Chang, Wu, & Liu, 2006). Further, it is believed to be the most dominant deficit in Chinese dyslexia. Ho, Chan, Tsang, and Lee (2002) suggested that RAN deficit is an important cognitive profile of Chinese developmental dyslexia.

Several theories have hypothesized and stressed different aspects of RAN as its underlying mechanism connected with reading. The main difference of these arguments lies in whether the deficits in phonological component of RAN are responsible causing slow naming speed.

In non reading specific levels, RAN deficit is supposed to be related to slower processing speed (Kail & Hall, 1994) and/or deficit in temporal processing (Wolf, Bowers, & Biddle, 2000). Specifically, in the processing speed domain, RAN measures a general processing speed which is important for cognitive tasks such as reading (Cutting & Denckla, 2001; Kail & Hall, 1994). The slower the processing speed is, the worse reading is. This is similar to how RAN is related to the temporal processing domain, in which the possible relationship is based on the component of timing. Wolf et al. (2000) suggested that RAN is complex, while the phonological

processing is important in this task, timing is also important within and across each subprocesses of the task, which is also important for auditory temporal processing. There might be another possibility of the relation between RAN and temporal processing which is indirect. The phonological theory suggested that the phonological component of RAN is the crucial component in its role in reading and reading disabilities (Wagner & Torgesen, 1987), and Tallal and colleagues (Tallal, 1980; Tallal & Gaab, 2006; Tallal & Piercy, 1974) suggested that deficits of phonological processing result from poor auditory temporal processing.

If RAN deficit reflects the phonological processing problems, and that temporal processing is somehow related to phonological processing, we would expect a relationship between RAN and auditory temporal processing. However, White et al. (2006) investigated the relationship between lower level perceptual processing and reading and they did not find significant differences between dyslexic and the control groups in the perceptual tasks. They found that the two groups differed significantly in RAN and phonological awareness. Georgiou, Protopapas, Papadopoulos, Skaloumbakas, and Parrila (2010) also carried out a study in an orthographically consistent language but did not find such differences between the two groups. However, in Chinese, Meng, Sai, Wang, Sha, and Zhou (2005) found the auditory temporal processing predicted character naming with phonological awareness statistically controlled, and it also predicted phonological awareness. As for processing speed, Powell, Stainthorp, Stuart, Garwood, and Quinlan (2007) found that, children who were slow in RAN were significantly slower than chronological age controls in simple response task. However, they also found that processing speed deficits did not cause RAN deficits. Thus, while some suggested a relationship between RAN and processing in perceptual and general domain, existing findings are not consistent, and it is not clear whether these deficits exist among Chinese dyslexic children and whether they are related to RAN.

In reading specific level, Wagner and Torgesen proposed that RAN tasks assess the rate of accessing to and retrieving stored phonological information in long-term memory (Wagner & Torgesen, 1987). Therefore, RAN should be part of the phonological processing construct along with phonological awareness and phonological memory. However, some other researchers (e.g., Bowers & Wolf, 1993; Wolf et al., 2000) suggested that RAN deficit may be an index of difficulties in orthographic rather than phonological processing and that processes underlying naming speed represent a second core deficit in dyslexic children. Manis, Seidenberg, and Doi (1999) argued that while phoneme awareness is more related to the learning of systematic spelling-sound correspondences, the critical characteristic of the RAN is the rapid mappings between the visual stimuli and their names (e.g., a digit and its name, and that these mappings are arbitrary).

Chinese is an extremely opaque orthography. About 80 % of the Chinese characters are compound characters that consist of phonetic and semantic radicals. However, pronunciations of only 25 % can be predicted from their phonetic radicals (Shu & Wu, 2006). Previous studies have suggested that Chinese readers tend to use the strategy of sight word reading rather than decoding when a character becomes familiar (Ju & Jackson, 1995; Perfetti, Liu, & Tan, 2005). Given this, we should

expect a strong relation between RAN and Chinese reading, both for timed and untimed word reading if it reflects arbitrary mappings between graphic representations and their oral referents (Manis, Seidenberg, & Doi, 1999). However, if it is only the phonological component that matters (Ziegler et al., 2010), we should expect a strong effect of phonological awareness in both reading accuracy and fluency but a weak effect of RAN, particularly in accuracy.

Though many studies tried to explore the potential underlying deficits that cause problems in naming speed, there was not yet an agreement. In the current study, we tested a dyslexic group and a control group of children with character recognition, word list reading, phonological awareness, rapid digit naming, auditory temporal processing, and reaction time tasks which included simple and choice reaction time tasks in order to have a more detailed measure of processing speed. With these measures, we aimed to investigate: (1) whether there are significant differences between dyslexic and typical developing children in temporal processing and processing speed, and whether RAN reflects these processes; (2) whether or not RAN predicts reading in addition to phonological awareness. We conducted principal component analysis among tasks of phonological awareness, RAN and two reaction time tasks, to see whether RAN has shared components with both phonological related tasks and speed related tasks. We also conducted path analysis to investigate the similarities and differences between RAN and phonological awareness in predicting different reading tasks, and whether these relations differ between dyslexic and typical developing children.

Method

Participants

Forty-five fourth and fifth graders with reading difficulties (27 boys and 18 girls, mean age = 111.78 months, *SD* = 8.10) and 45 typically developing fourth and fifth graders (26 boys and 19 girls), matched by age, grade and nonverbal IQ were selected for participation from 907 children from a primary school in Tianjin, China. None of these children reported a history of learning disabilities. School records indicated that no deficits in hyperactivity disorder, broader language impairment, and/or hearing problems were noted among the participants. Table 7.1 presents basic information for the two groups. The two groups of children differed in neither age (t = .17) nor nonverbal IQ (t = −.01).

Selection Criteria. Since there is no standard scale of dyslexia in mainland China, we constructed the Chinese character recognition test as the measure of reading ability. The test consisted of 150 characters which were selected from *Elementary School Textbooks* (1996). Frequencies, number of strokes and the percentage of semantic-phonetic compound characters and non semantic-phonetic compound characters matched the properties of *Elementary School Textbooks* (Shu, Chen, Anderson, Wu, & Xuan, 2003). The reliability of this measure is .95. We chose

Table 7.1 Means and standard deviations, T values, and p values of tasks in the screening phase and reliability of the character recognition task

	Reliability coefficient	Dyslexia ($N=45$)		Control ($N=45$)			
		M	*SD*	*M*	*SD*	*t*	*p*
Age (month)		111.78	8.10	111.60	8.08	.10	.917
Raven's IQ (%)		55.44	24.23	55.49	24.76	−.009	.993
Character recognition (150)	.96	74.67	14.78	106.11	12.35	−10.95	.000

children in grades 4 and 5 because of that Chinese is an opaque orthography, it is not easy and unfair to label dyslexic children during early stages. In addition, given that Chinese is a complex language and orthography and that no clear criteria for diagnosis of dyslexia are yet agreed upon in Mainland China, it may not be fair to define a child as dyslexic until the upper-level grades when specific literacy problems are clearest in terms of identification. The Raven's Standard Progressive Matrices (Raven, Court, & Raven, 1996), with local norms (Zhang & Wang, 1985) was also administered in this study in order to prevent children with abnormally low IQs from being selected as dyslexic.

The 45 children who scored 1.5 *SD*s below the grade mean in the Chinese character recognition task but with normal nonverbal IQs (ranging from 25 % to 95 % in Raven's Standard Progressive Matrices) were designated as manifesting developmental dyslexia. The control group and the dyslexic group were matched in age and nonverbal IQ by person. The distribution of character recognition of the two groups did not differ statistically as indicated by the standard deviations. The screening ratio was about 5.0 %, which was similar to a large-scale investigation that used the same task to classify dyslexic children (Xue, 2008) and one other study of Chinese dyslexia (Li, Shu, McBride-Chang, Liu, & Xue, 2009) in which a common test for screening Mandarin-speaking Chinese children for dyslexia (Ding, Liu, Li, Zhao, Yao, & Tian, 2002, Shu, Meng, & Lai, 2003) was used. The correlation between our character recognition task and the Character Recognition Measure and Assessment Scale for Primary School Children (Wang & Tao, 1993) was .70 (Xue, 2008). The reliability of this test in the current study was also very high (.96), indicating that our character recognition task was a reliable screening tool for identifying Chinese dyslexic children.

Procedure

There were two phases in this study. The first one was the screening phase, and the other was the testing phase.

Phase 1 Screening. The screening phase was done a few months before the testing phase. All 907 children participated in the screening phase. The character recognition task was administered individually and took about 20 min and the Raven's Standard Progressive Matrices was a group test lasting approximately 40 min.

Table 7.2 Means, standard deviations, T values, and p values of all tasks administered to children in the dyslexic and control groups

Variable	Reliability coefficient	Dyslexia ($N=45$)		Control ($N=45$)		Comparison	
		M	*SD*	*M*	*SD*	*t*	*p*
Character recognition (max = 150)	.95	89.53	9.39	116.09	10.20	−12.85	.000
Word list reading		64.31	12.18	90.00	15.48	−8.57	.000
RAN (s)	.86	19.17	3.10	16.52	3.00	4.12	.000
Phoneme deletion (max = 26)	.82	15.11	4.56	19.87	3.16	−5.75	.000
Auditory temporal processing threshold (ms)		61.82	28.67	41.17	23.06	3.76	.000
Simple reaction time							
Reaction time (ms)		418.09	64.01	375.30	47.09	3.61	.001
Accuracy (%)		99.93	.00	99.87	.01	.45	.656
Choice reaction time							
Reaction time (ms)		573.91	84.94	508.37	67.58	4.05	.000
Accuracy (%)		96.73	.04	95.90	.04	1.06	.293

Phase 2 Testing. Children were tested individually in a quiet classroom at school. The order of the tasks was randomized and the whole testing procedure lasted for approximately 40 min. We administered to the children the Chinese character recognition task again in the testing phase, and the correlation between this task in the screening and testing phases was .93, indicating that even though the testing phase was done a few months later than the screening phase, children who were poor in reading remained so across the months. Table 7.2 summarizes the tasks given to the participating children.

Measures

Chinese Character Recognition. This task was the same as the one we used in the screening phase. It is an untimed measure. All the characters were taken from first to sixth grade level reading materials. The characters were listed according to their difficulties. Children were asked to name the characters they knew; guessing was allowed. The maximum score for this task was 150. The average frequency of these characters is 182 per million (ranging from 0 to 2,282). Both phonological decoding and lexical access strategies are required for this task, with phonological decoding being particularly useful for unfamiliar characters and direct lexical access likely for familiar characters.

Word List Reading. Children were asked to name a list of 180 two character words as rapidly and accurately as possible. All these words are from primary school text books and have been learned before grade 3. They are often seen in daily life and study by primary school students, such as “我们 (we)” and “汽车 (car)”. The mean frequency of these words is 212.77 per million (*Modern Chinese*

Frequency Dictionary, 1986). Children were asked to name them as soon as possible. Since characters included in this task were very simple, this task was administrated to test the children's ability rapidly retrieve the arbitrary mappings between print and sound. The total time needed to name the whole word list and the total number of naming errors were recorded, and the average numbers of words correctly named within 1 min was calculated as dependent variable of this task.

Rapid Automatized Naming (RAN). We used rapid digit naming in the current study. In this task, five numbers, 1, 2, 3, 5, 8, were repeated five times on a 5 × 10 matrix on a single sheet of paper. Children were asked to name all the numbers on the list as accurately and rapidly as possible. Each child named the list twice and the mean score was based on the average naming time across the two trials. This task has been used successfully before (e.g., Shu et al., 2006).

Phonological Awareness. Phoneme deletion was tested as the indicator of phonological awareness for Study 2. This task was successfully administered to Chinese higher grade primary school children in previous studies (Li et al., 2009; Shu et al., 2006). Children were required to pronounce a syllable with a given phoneme deleted. For example, the syllable/bu4/without the/b/sound is pronounced/u4/. There were 26 items, which included deletion of initial, middle and final phonemes. One point was given for each correct answer; thus the maximum score was 26.

Auditory Temporal Processing. Children learned to label an 800 Hz tone as 'low tone' and a 1,200 Hz tone as 'high tone' before the experimental trials, and were given practices and feedback. In the experimental trials, they were asked to judge which of the two tones comes first in a two-tone sequence. A two-alternative force-choice (2AFC) task and the 2-down-1-up staircase procedure were applied. The duration of the second tone was 50 ms, while the duration of the first tone equaled to the sum of duration of the second and the SOA of the two tones. This task was modeled closely on the tasks used by Au and Lovegrove (2001), which may reflect children's ability to discriminate between stimuli in short durations (Chiappe, Stringer, Siegel, & Stanovich, 2002). The tones were presented to participants via headsets, and reactions were recorded on the IBM ThinkPad notebook computer via E-prime software (Schneider, Eschman, & Zuccolotto, 2002). The initial SOA was set to 100 ms, and the initial step size was 15 ms. After 3 reversals, the step size reduced to 5 ms. 15 reversals were run in this task and the average of the last 10 reversals was calculated as threshold.

Simple Reaction Time. In this task, a fixation cross would appear on the screen for 500 milliseconds before the target stimulus. Children were required to reaction as quickly as possible to a given symbol set (three asterisks) appeared on the white computer screen after a delay of 1, 2, 3, or 4 s. The target stimulus was presented on the screen for 3 s and disappeared. The delay conditions were presented randomly to prevent the child from anticipating the length of the delay.

Choice Reaction Time. As in the simple reaction time task, a fixation cross would appear on the screen for 500 milliseconds before the target stimulus. After a delay of 300 milliseconds, children were asked to react as accurately and quickly as soon as possible to two different symbol set by pressing two keys.

Results

To exclude extreme values that were generally caused by temporary distractions, in the two reaction time tasks, reaction times that exceeded 3 standard deviations of his/her own average reaction time were removed (<1 %). Table 7.2 shows the means, standard deviations of all measures. The dyslexic group performed significantly poorer in all measures, except for accuracies in the two reaction time tasks.

Table 7.3 shows the correlations between all variables. Correlation between rapid naming and word list reading was higher than the correlation between rapid naming and character recognition ($r=-.71$ vs. $r=-.50$), while correlation between phoneme deletion and character recognition was higher than correlation between phoneme deletion and word list reading ($r=.64$ vs. $r=.54$). Besides, RAN correlated significantly with phoneme deletion ($r=-.46$), choice reaction time ($r=.55$), simple reaction time ($r=.49$), and auditory temporal processing threshold ($r=.38$).

We conducted principal component analyses with the full sample. Results showed that phoneme deletion, RAN, auditory temporal processing threshold, simple reaction time, and choice reaction time were classified into two components (see Table 7.4). One mainly focused on speed of processing, which explained 40.83 % of the variance, while the other one focused on phonological processing, which explained 31.57 % of the variance. RAN and the two reaction tasks were classified into the speed of processing component, while RAN, phoneme deletion, and auditory temporal processing threshold were loaded into the phonological processing component.

Table 7.3 Correlations among all variables

	1	2	3	4	5	6	7
1. Character recognition	–						
2. Word list reading	.76**	–					
3. Phoneme deletion	.64**	.54**	–				
4. RAN	−.50**	−.71**	−.46**	–			
5. ATP threshold	−.25[a]	−.26	−.35**	.38**	–		
6. Simple response time	−.47**	−.46**	−.32**	.49**	.19	–	
7. Choice response time	−.44**	−.52**	−.29**	.55**	.22*	.70**	–

Note. **p<.01, *p<.05

Table 7.4 Factors reviewed by principal component analysis

	Component 1	Component 2
Measure	Speed related processing	Phonological related processing
Auditory temporal processing threshold		0.853
Phoneme deletion		−0.725
RAN	0.618	0.539
Simple reaction time	0.889	
Choice reaction time	0.893	
% of variance	40.83	31.57

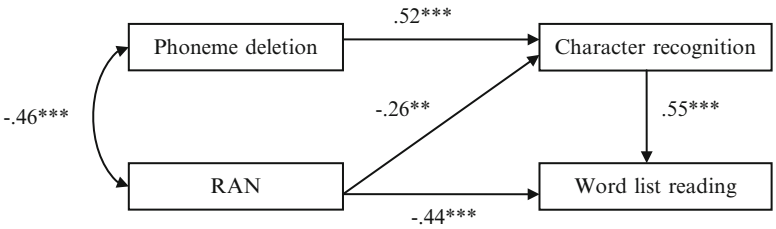

Fig. 7.1 Path analysis examining unique contribution of RAN to Chinese reading

In the reading specific level, we further tested the unique contribution of RAN to Chinese reading accuracy and fluency in addition to phonological awareness, path analysis was applied. Our path analysis was conducted with Amos 4.0, a structural equation-modeling program, and *t*-tests were used to examine the effects of predictors on reading.

Our results showed that effects of RAN on both character recognition and word list reading were significant, while PA predicted only character recognition (see Fig. 7.1). This model showed a statistical fit [$\chi^2(90) = .05$; $p = .830$; NFI = 1.00; RFI = 1.00; IFI = 1.00; TLI = 1.01; CFI = 1.00; RMSEA = 0.00]. The model explained 72.80 % of the variance in word list reading and 46.60 % of the variance in character recognition (see Fig. 7.1).

In order to test whether RAN predicted word list reading and character recognition differently, we then constrained the path from RAN to word list reading and the path from RAN to character recognition to be equal. The new model did not show a statistical fit [$\chi^2(90) = 4.46$; $p = .108$; NFI = 1.00; RFI = 0.99; IFI = 1.00; TLI = 0.99; CFI = 1.00; RMSEA = 0.12]. Statistical tests showed that these two models differed significantly ($\triangle\chi^2(5, N = 90) = 4.44, p < 0.05$). Thus, RAN reflected the process of rapid retrieval of familiar characters. To test whether the results of these path analyses differed between the two groups, a statistical invariance test was conducted to compare the two parameter-nested models. Results of the overall comparison showed no significant differences: $\triangle\chi^2$ (4, N = 90) = 8.47; $p > 0.10$; NFI = 0.99; RFI = 0.98; IFI = 0.998; TLI = 0.99; CFI = 1.00; RMSEA = 0.09; SRMR = 0.05. Overall, RAN was significantly associated with both accuracy and fluency in reading, though its effect on fluent reading was stronger than that on accurate word reading for Chinese children in intermediate grade levels, both with and without dyslexia.

Discussion

The present study examined deficits of auditory temporal processing, processing speed, phonological awareness, and RAN among Chinese dyslexic children. We also tested the critical component of RAN and its unique contribution to

Chinese reading. Although previous studies of the non reading specific processes on dyslexic children found different results, we nevertheless observed that in all tasks we tested, Chinese dyslexic children performed significant poorer than the age control group, even with their nonverbal IQ matched. We also find that both phonological processing and processing speed correlated significantly with RAN, and RAN contributed significantly to both timed and untimed Chinese word recognition.

For a long time, phonological deficit has been viewed as the core deficit of dyslexic readers, whether it is caused by some other deficits are under researchers interests. Ingram (1963) first raised that dyslexic children have difficulties in identifying and discriminating auditory stimuli, including speech and nonspeech sounds. This was then put forward, and researchers suggested that these difficulties would cause phonological processing problems which in a result, would lead to poor reading. RAN has been reported to be one of the significant measures that distinguish dyslexic children from typically developing children, and it might be related to auditory deficits in two ways as mentioned in Introduction. Former studies tried to study the underlying processes of RAN. In the present study, we did find significant differences between the two groups in auditory temporal processing, as well as phonological awareness and RAN. In our study, we found that auditory temporal processing was classified in the same component with RAN and phonological awareness. On one hand, it suggested the importance of phonological processing in RAN, as suggested by previous studies (e.g., Wagner & Torgesen, 1987; Ziegler et al., 2010). On the other hand, it also suggested the unneglectable aspect of processing speed in the RAN tasks (Kail & Hall, 1994), as RAN was also classified in the same factor with the two processing speed tasks. These suggested that from the subprocesses, RAN is at least partly different from pure phonological processing, and that both phonological processing and processing speed are important for RAN.

Interestingly, in the principle component analysis, we did not find auditory temporal processing to be in the same factor as the two tasks of processing speed that also had timing in its nature, suggesting that the timing components in these tasks are somewhat different. As previous studies suggested, the timing component in auditory temporal processing might as least partly related to the sound processing, which might be related to phonological processing. However, the timing component in the two processing speed tasks did not consist of any aspect of sound or phonological processing, it was a general processing speed. Former studies have found the co-occurrence of deficits in processing speed and RAN in reading disabilities (Catts, Gillispie, Leonard, Kail, & Miller, 2002; Powell, Stainthorp, Stuart, Garwood, & Quinlan, 2007), however, Powell et al. (2007) suggested that it is not simply the processing speed deficits cause poor performance in RAN.

If the relationship between reaction time tasks and RAN is based on the shared speed component, in what aspect(s) can this add to poor reading via RAN? One critical component might be the speed of mapping orthography to phonology. Though phonological decoding indeed represents an important route for word recognition, reading by sight is additionally salient in the reading process (for a review, see Ehri, 2005). Sight reading involves mapping printed words directly to

their oral referents without pauses between word parts (Ehri, 2005). Hulme, Goetz, Gooch, Adams, and Snowling (2007) recently found that phonological awareness is important for reading nonwords, while visual-verbal paired-associate learning (PAL) is important for reading exception word. They argued that visual-verbal PAL can be considered as an indicator of learning to read by sight, and their results supported the idea that sight reading is an important pathway to reading, apart from decoding itself. One aspect of the RAN process is this efficient sight reading (e.g., Wagner & Torgesen, 1987).

Chinese is at the extreme of opacity across orthographies. This opacity implies that sight reading should be more important in Chinese as compared with any other orthography. As Wolf et al. (2000) suggested, the timing component of every subprocesses of RAN might also play key roles in the task, and given the characteristics of unreliable phonetic radicals in Chinese characters, the importance of the speed of arbitrary mappings between orthography and phonology reflected by RAN should be more pronounced in Chinese reading (Manis et al., 1999). This is further supported by the findings from a longitudinal study among Chinese children (Pan et al., 2011) that RAN at age 5 was consistent and stable predictor to Chinese untimed character recognition at ages 7–10, even with phonological sensitivity measures statistically controlled, suggesting the importance of arbitrary mappings reflected by RAN task.

This is supported by the finding that RAN predicted both timed and untimed word recognition in Chinese reading, with phonological awareness statistically controlled. It suggested that RAN is at least partly independent of phonological processing. And if only the poor performance in general processing speed causes deficit in RAN, we should not have observed significant relationship between RAN and character recognition, which is an untimed task. This is in line with previous findings demonstrating that it was not only because of the speed component in RAN that RAN is linked to reading (Georgiou, Parrila, & Liao, 2008; Lervåg & Hulme, 2009; Powell et al., 2007). Meanwhile, our results also suggested that the character recognition task we used covered both decoding and lexical access process as measured by nonword reading and exceptional word reading respectively in English. Furthermore, RAN predicted word list reading while phonological awareness did not, this supported the idea that RAN taps as least partly the process of sight word reading. As introduced, words in the word list reading tasks are very simple and are supposed to be learned before grade 3, it is very easy for children to master, even for children with reading difficulties. The ability to use the sight word reading strategy is important for this task.

One limitation of our studies is that we could not distinguish whether the processing of orthography involves and partly influences RAN performance. Therefore, our results cannot favor one hypothesis over another in relation to explanations for why or how RAN is important for reading. Moll, Fussenegger, Willburger, and Landerl (2009) suggested that RAN does not measure orthographic skills; they hypothesized that the relation between RAN and literacy has to do with the automaticity of orthography to phonology associations at the letter and letter cluster level in alphabetic languages. However, orthographic knowledge in Chinese typically

refers to whether the radicals in a character are correctly formed and are placed in their legal positions within the character. This is different from orthographic knowledge in alphabetic languages focusing on letter string configurations. Moreover, there are about 200 semantic radicals and 800 phonetic radicals that are commonly used in compound Chinese characters for various orthographic configurations, much expanded from the 26 or so letters that comprise most alphabets, which makes orthographic knowledge in Chinese complex.

To summarize, the current study suggested that RAN is at least partly independent from phonological processing from the underlying components, and we established a strong relationship between RAN and both Chinese reading accuracy and fluency across children of different reading abilities. The importance of RAN in Chinese reading is strongly related to the characteristics of the Chinese writing system. RAN is, at least in part, a reflection of the process of mappings between visual form and pronunciations of characters, a strongly arbitrary function which is of particular importance in Chinese reading (Liao, Georgiou, & Parrila, 2008; Manis et al., 1999).

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Part III
Bilingual and Biliteracy Development in Chinese and English

Chapter 8
L1-Induced Facilitation in Biliteracy Development in Chinese and English

Keiko Koda, Chan Lü, and Dongbo Zhang

Abstract In an attempt to clarify the multi-layered complexities inherent in biliteracy development, this chapter addresses two overarching questions: How are previously acquired sub-skills assimilated in learning to read in later acquired, or additional, literacy; and how assimilated skills enhance reading sub-skills development in later acquired literacy? By comparing the requisite facets of phonological and morphological awareness for reading acquisition in Chinese and English, we made specific predictions regarding cross-linguistic contributions of previously acquired metalinguistic awareness to reading sub-skills development in later acquired literacy. We report two empirical studies conducted to test those predictions. The first study focused on the intra- and inter-lingual relationships in oral vocabulary knowledge, phonological awareness, and decoding skills in Chinese heritage language learners in the US. The second study examined cross-linguistic relationships in morphological awareness and lexical inference in Chinese children learning English as a Foreign Language in China. Findings from the studies are discussed in light of systematic variations in L1-induced facilitation that are attributable to task demands, linguistic distance between two languages, and L2 grapheme-language mapping experience.

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_8,

Keywords Biliteracy • Resource sharing • Phonological awareness • Morphological awareness • Chinese as a Heritage language • English as a Foreign language • Linguistic distance

Linguistic diversity has become a dominant characteristic of today's schools as bilingual learners constitute a large and growing segment of the school population. Despite the obvious significance, however, biliteracy development has attracted far less attention than it deserves. It is widely acknowledged that reading acquisition is more demanding when it involves two languages. Beyond that, however, little is known about how the involvement of two languages alters the course of reading development; how such alteration affects reading achievement; and most critically, how the challenges biliteracy learners face differ from the difficulties typically experienced by monolingual readers. As we seek to promote more skilled readers—particularly among those struggling to read two languages, recognizing the specific needs of biliteracy learners is becoming increasingly important.

Examining biliteracy development is far from simple because it is inherently more complex than monolingual reading acquisition. As noted above, biliteracy involves two languages and literacy learning proceeds differentially in two languages within each learner. Obviously, models of monolingual reading cannot adequately explain how reading sub-skills are acquired, refined, and maintained in two languages in biliteracy learners. In tackling the multi-layered complexities inherent in biliteracy learning, biliteracy research must clarify the conceptual and methodological foundations, on which biliteracy competence can be defined and measured as a multi-faceted and multi-lingual construct.

The primary objective of this chapter is to provide much-needed clarifications of biliteracy competence by (a) identifying the tasks that are universally required for learning to read; (b) isolating the sub-skills necessitated for achieving those tasks; and (c) comparing the linguistic demands for the utilization of the sub-skills between two languages. Collectively, the analyses yield a set of predictions regarding how previously acquired sub-skills are assimilated in learning to read in an additional language; and how the assimilated skills enhance reading sub-skills development in later acquired literacy.

Linguistic Constraints on Learning to Read

Reading Universals

Reading has several universal properties. One such property is the dependence of writing systems on language. According to the universal grammar of reading (Perfetti, 2003; Perfetti & Dunlap, 2008), writing systems represent spoken language, and therefore, necessitate language in encoding and decoding meaning in print.

Learning to read thus entails making links between the language and its writing system. To achieve this, children must first uncover *which language elements* are directly encoded in each graphic symbol (the general mapping principle) and then, deduce *how* they are encoded (the mapping details).

Although the grapheme-to-language mapping requirement is imposed on all learners in all languages, how it is accomplished varies across languages. In English, for example, children must understand that each letter represents a distinct sound—either a consonant or a vowel (the general mapping principle)—and then, gradually work out the details of sound-symbol correspondences (mapping details). Although the same realization is required of children learning to read Korean, they need to understand, in addition, that individual symbols must be packaged into syllable blocks, and then, learn the specific ways in which syllable blocks are formed (Park, 2008). In contrast, children learning to read Chinese must first recognize that each graphic symbol corresponds to the meaning and the sound of one whole morpheme, and subsequently, learn how single-unit characters are combined to form multiple-unit composite characters (Taylor & Taylor, 1995).

The distinction between the two mapping levels (general and detailed) is important because it provides a basis for distinguishing reading sub-skills necessary for language-specific demands and those satisfying language-neutral requirements. To grasp the general mapping principle, as an illustration, children need to gain the basic insights that print relates to speech; that speech can be segmented into a sequence of sounds; and that the segmented sounds correspond to units of graphic symbols in the writing system. Because none of these insights involves language-specific details, once developed in one language, they are readily available and fully functional in subsequent literacy learning in another language.

This, however, is not necessarily the case for mapping details. The skills required for language-specific mappings are shaped to accommodate the grapheme-language relationships specific to a particular language. Therefore, once acquired in one language, those skills may not be serviceable in another. What is common across languages in those mappings lies only in the task itself—that is, prior literacy experience fosters an explicit understanding of what is to be accomplished in learning mapping details. All in all, learning to read demands systematic deductions of how spoken language elements are mapped onto the graphic symbols that encode them. Predictably, such deductions are greatly facilitated by metalinguistic awareness—the ability to analyze and manipulate language forms.

Metalinguistic awareness is a multi-dimensional construct, as it consists of a number of facets, each relating to a distinct feature of language (e.g., Kuo & Anderson, 2008). The utility of metalinguistic awareness lies in its capacity for enabling children to analyze a word into its sub-lexical constituents, and in so doing, providing them direct assistance in learning the specific pattern of grapheme-to-language mappings that is optimal for their language. Beyond the initial stage of learning to read, metalinguistic awareness plays a different, but equally vital, role in later stages of reading development. As an enabler for word segmentation and analysis, it allows children to identify familiar elements in an unfamiliar word, making it possible to extract partial information from the word in inferring its sound and

meaning (Nagy & Anderson, 1999). In brief, metalinguistic awareness promotes analytical and constructive approaches to reading comprehension and new word learning through reading.

Reflecting its multidimensionality, metalinguistic awareness evolves gradually over time as its diverse facets mature at disparate rates. Phonological awareness emerges as a result of children's growing understanding of the phonological structure of spoken words. They are initially sensitized to larger phonological units in speech and gradually refine their sensitivity to distinguish smaller units (Ziegler & Goswami, 2006). Similarly, morphological awareness develops in sequence. English speaking children, as a case in point, become sensitive to inflectional morphemes in structurally transparent words well before schooling starts (Berko, 1958; Carlisle, 2003), but the productive use of inflectional information does not occur until Grade 2 or 3 (Bear, Invernizzi, Templeton, & Johnson, 1996). The awareness of derivational morphemes is a late-developing facet, emerging between grade 4 and grade 8 (Ku & Anderson, 2003; Tyler & Nagy, 1989, 1990). The maturation of metalinguistic awareness thus is subject to general developmental constraints, while it is aligned with the properties of the words to which children are dominantly exposed at different ages.

Cross-Linguistic Variations

Although the early phases of literacy acquisition depend on children's rudimentary understanding of structural regularities, the initial sensitivity is gradually refined through encoding and decoding words in print (e.g., Bowey & Francis, 1991; Perfetti, Beck, Bell, & Hughes, 1987; Vellutino & Scanlon, 1987). In this respect, literacy and metalinguistic awareness are developmentally interdependent and mutually enhancing. The reciprocity gives rise to cross-linguistic variations in reading sub-skills development because each facet of metalinguistic awareness relates to a distinct feature of language.

Such variations have been examined in studies involving children learning to read a variety of languages. For example, Korean children develop sensitivity to both syllables and phonemes; and the skills to manipulate the two levels of phonology similarly predict their word reading ability (McBride-Chang et al., 2005). Their phonological awareness thus implicates the dual-level (syllable and phoneme) representations in the Hangul script. In contrast, the English orthography represents phonemes and morphemes. While bound by phonemic constraints, it has a tendency to preserve morphological information in its graphemes. Many English spelling irregularities can be explained more readily by morphemic, rather than phonemic, constructions. Reflecting the dual-unit (phoneme and morpheme) representations, English literacy demands both phonological and morphological awareness (e.g., Carlisle, 1995; Carlisle & Katz, 2006; Carlisle & Nomanbhoy, 1993; Fowler & Liberman, 1995). In morphographic Chinese, however, the grapheme-morpheme connections are more prominent than grapheme-phonology linkages. Morphological

awareness has been found to be a stronger predictor of children's initial reading success in Chinese than is phonological awareness (Ku & Anderson, 2003; Li, Anderson, Nagy, & Zhang, 2002).

The Psycholinguistic Grain Size theory (Ziegler & Goswami, 2005, 2006) offers a plausible explanation of how variations in decoding development occur in typologically diverse languages. According to the theory, the optimal size for grapheme-to-phonology mappings in a particular language is determined by the amount of orthographic information necessitated for decoding. In phonologically transparent orthographies, symbol-to-sound correspondences are regular and consistent. Decoding in these systems requires little orthographic information because it utilizes letter-by-letter, grapheme-to-phoneme translation. Therefore, the grain sizes optimal in phonologically regular systems are small at the phonemic level. In contrast, decoding in phonologically opaque orthographies demands far more orthographic information, and thus, necessitates larger grain sizes, such as syllables, rimes, and morphemes.

In sum, as the enabler for word segmentation and analysis, metalinguistic awareness is causally and reciprocally related to reading acquisition. Because of its direct connections to distinct linguistic features metalinguistic awareness offers a window for exploring cross-linguistic variations in reading sub-skills development. In specific, it offers a methodological basis for comparing the linguistic demands for the required grapheme-to-language mappings in two languages. Such comparisons allow fairly precise estimates of linguistic distance between the languages involved. This, in turn, affords reasonably accurate predictions regarding the degree of facilitation stemming from shared metalinguistic resources in biliteracy development.

Mechanisms of Cross-Linguistic Resource Sharing

Psycholinguistic theories hold that linguistic knowledge emerges from abstracting structural regularities implicit in input (Ellis, 2002). In this view of learning, language is seen as a set of relations between forms and functions (Van Valin, 1991), and its acquisition as the internalization of those relationships through cumulative experience of mappings between corresponding forms and functions (MacWhinney & Bates, 1989). The more frequently a particular pattern of mappings is experienced, the stronger the links holding the corresponding elements together. Learning thus involves a gradual transition from deliberate efforts to automatic execution, rather than an all-or-nothing process, and its outcomes are a dynamic, ever-changing state, rather than a static entity. The internalization of a particular form-function relationship can be recognized as such when the activation of the mapping it entails becomes automated (Logan, 1988).

Under this view of learning, transfer can be conceptualized as automatic activation of *previously established* (referred to as "L1" hereafter) mapping patterns triggered by linguistic input in a *later acquired* (referred to as "L2" henceforth)

language. In this view, transfer transpires regardless of the learner's intent (non-volitional); and that its occurrence cannot be easily controlled (non-selective). Thus, the current conceptualization of transfer presupposes that L2 mapping skills emerge from cross-linguistic interaction between transferred L1 mapping skills and L2 input; that the emerging skills continue to evolve through input experience in the new language; and that the resulting L2 skills reflect both L1 and L2 form-function relationships.

By extending this line of reasoning, biliteracy development can be defined as the process of establishing grapheme-to-language mappings in two languages (Koda, 2007). Given that mapping skills formation is guided by metalinguistic awareness, we can assume that transferred L1 metalinguistic awareness facilitates L2 mapping skills development. Because distinct facets of metalinguistic awareness are reciprocally linked to specific features of language, we can also presume that L1-induced facilitation varies across diverse awareness facets to the extent that the properties of relevant linguistic features are similar between two languages. Similar variations also exist as metalinguistic awareness entails both language-neutral and language-specific facets. Under these assumptions, we hypothesized that variations in L1-induced facilitation are brought on by three factors: (a) task demands, (b) linguistic distance, and (c) L2 mapping experience.

The first factor, *task demands*, refers to the distinction between the tasks requiring language-neutral sub-skill and those involving language-specific sub-skills. When transferred, the facets of metalinguistic awareness promoting language-neutral sub-skills, such as those entailed in learning the general mapping principles, should be readily accessible in learning to read in another language. Those facets, if available, provide all learners with direct and equal facilitation in L2 reading development. However, such uniformity cannot be expected in language-specific sub-skills, because they are adjusted to L1-specific properties.

Because no two languages are identical, language-specific skills, when transferred, must undergo varying amounts of modification to be functional in an additional language. Given that some combinations of languages are more closely related than others, the amount of modification necessary for such adjustment varies to the extent that two languages share similar structural properties. Linguistic distance thus is another factor determining the degree of L1-induced facilitation. When L1 and L2 are structurally similar, transferred metalinguistic awareness is readily serviceable in guiding the formation of L2 mapping sub-skills. Conversely, when the two are distinct, transferred awareness is of limited use without substantial modification.

Because such modification occurs only through L2 mapping experience, the nature of L2 print input is the third factor affecting the utility of transferred metalinguistic awareness. Ultimately, however, it is the quality (linguistic properties) and quantity (frequency) of L2 input experience that determines the level and form of L2 metalinguistic awareness and the role it plays in subsequent reading sub-skills development. A small, but growing, number of studies has begun to incorporate detailed analysis of L2 input properties as the basis for generating hypotheses

regarding the relative ease at which varying facets of L2 metalinguistic awareness, as well as related reading sub-skills, are established (Koda, Lü, & Zhang, 2008; Wang, Liu, & Perfetti, 2004).

To sum up, biliteracy development is jointly constrained by L1 and L2 metalinguistic awareness. Although L1 metalinguistic awareness, if sufficiently developed, is available in L2 learning to read, its involvement is not uniformly facilitative in the formation of L2 metalinguistic awareness. Because languages differentially vary across diverse features, disparate facets of metalinguistic awareness in any combination of two languages variably share their properties. Given that L1-induced facilitation occurs only to the sub-skills that impose similar linguistic demands between two languages, the utility of transferred awareness varies according to the extent that two languages share their structural properties. When transferred, incongruent metalinguistic facets must be substantially adjusted to L2-specific properties. Such functional accommodation necessitates cumulative mapping experience with L2 print input.

To better understand biliteracy competence, its unique characteristics—L1-induced facilitation, in particular—must be systematically examined. As a multi-lingual, multi-faceted construct, however, biliteracy competence cannot be easily captured and measured empirically. One way of pursuing the multi-layered complexities inherent in this construct is to compare the utility of transferred metalinguistic awareness in learning to read in an additional language. Because of its direct connections to specific linguistic features, metalinguistic awareness offers an ideal window for exploring the cross-linguistic nature of biliteracy competence. To that end, biliteracy research must incorporate a sequence of analyses: (a) construct identification (specifying the focal facet of metalinguistic awareness and its specific contribution to reading sub-skills development); (b) linguistic analysis (identifying the linguistic demands for acquiring the focal awareness facet and related sub-skill in each language involved); and (c) cross-linguistic comparison (determining the extent to which the linguistic demands vary between two languages). Collectively, these analyses make it possible to convert highly complex cross-linguistic issues into empirically testable hypotheses. The sections that follow describe two studies directly addressing the hypothesized variation in L1-induced facilitation in biliteracy development.

Examining L1-Induced Facilitation: Phonological Awareness

Given that the initial task in learning to read entails learning to map between spoken language and writing system, differences in the grapheme-language relationships between two languages should have a major impact on the utility of transferred L1 metalinguistic awareness in L2 reading development. The study described in this section focused on such an impact stemming from disparate grapheme-phonology relationships in Chinese and English. Based on the

differences in the method of encoding phonological information graphically between the two languages, we identified specific disparities in the linguistic demands for acquiring the requisite mappings. The goal of this study was to explore the hypothesized variation in L1-induced facilitation in reading development in school-age Chinese heritage language (CHL) students learning to read English (primary) and Chinese (additional) concurrently. In specific, the study compared the relative contributions of two orally based competences—oral vocabulary knowledge and phonological awareness—to decoding development both within and across languages.

Although both oral vocabulary knowledge and phonological awareness are known to be vital to reading acquisition, their contributions are clearly distinguishable. While phonological awareness promotes word segmentation and analysis integral to letter-by-letter, grapheme-to-phoneme translation, oral vocabulary knowledge provides the linguistic foundation necessary for phonological information retrieval from stored lexical memory (Nagy & Anderson, 1999). Because of their distinct functions, the two are variably involved in learning to read in typologically diverse languages. In English, as described above, its dual-unit (morpheme and phoneme) orthographic representations require phoneme-level analysis and morpheme-based information retrieval (e.g., Dickinson, McCabe, Anastasopoulos, Peisner-Feigberg, & Poe, 2003). English-speaking children therefore rely on both phonological awareness and oral vocabulary knowledge in decoding development. In contrast, in Chinese, phonology is encoded holistically in a graphic symbol at the morpheme level. So character decoding does not need phoneme-level analysis, necessitating oral vocabulary knowledge to a much greater extent.

As shown in Table 8.1, recent studies involving school-age Chinese-English biliteracy learners have demonstrated that (1) phonological awareness is related between the two languages, but oral vocabulary knowledge is not; (2) that phonological awareness and oral vocabulary knowledge contribute to decoding within each language; and (3) that transferred phonological awareness provides facilitation only when L2 decoding demands sub-syllabic segmentation and analysis. Given the disparate cross-linguistic relationships in phonological awareness and oral vocabulary knowledge, we hypothesized that the two orally based competencies are differentially shared between the two languages; that the facilitation stemming from transferred L1 phonological awareness will be greater than that from oral vocabulary knowledge, if sub-syllabic analysis is required in L2 decoding; and that oral vocabulary knowledge contributes to decoding only within each language. We tested these hypotheses by posing three research questions: (1) Are there cross-linguistic relationships in oral vocabulary knowledge and phonological awareness in Chinese-English biliteracy learners? (2) Is there any difference in the way oral vocabulary knowledge and phonological awareness contribute to decoding within each language? and (3) Is there any difference in the way oral vocabulary knowledge and phonological awareness contribute to decoding across languages?

Table 8.1 Summaries of studies on transfer of phonological awareness in Chinese-English biliteracy acquisition

Study	Mean age (yr)	Subject #	Phonological awareness tasks	Outcome variables	Results
1. Gottardo, Yan, Siegel, and Wade-Woolley (2001)	10.2	65	Rhyme detection	Real word reading	English phonological processing was related to English word and pseudoword reading
			Phoneme detection & deletion (E)	Pseudoword reading	Chinese phonological awareness contributed to English word reading significantly even after other English phonological processing variables were controlled
			Tone detection (C)	Oral cloze	Chinese phonological awareness was significantly correlated with English phonological processing
					Chinese oral language proficiency and word reading performance were not strongly related to English word reading

(continued)

Table 8.1 (continued)

Study	Mean age (yr)	Subject #	Phonological awareness tasks	Outcome variables	Results
2. Gottardo, Chiappe, Yan, Siegel, and Yan (2006)	10.1	40	Phoneme categorization	Real word reading (E)	English phonological awareness was significantly related to English word reading
			Rhyme detection	Pseudoword reading (E)	Rapid naming was related to English word reading
			Phoneme deletion (E)	Simple character reading (C)	Oral cloze in English was related to English word reading
			Tone detection (C)	Complex character reading (C)	Chinese oral cloze was related to Chinese character reading
				Pseudo character reading	
				Character (C) disambiguation (C)	
				Oral cloze	
				RAN	
3. Bialystok, McBride-Chang, and Luk 2005	6.3	70	Syllable deletion	Real word reading	Facilitation from transferred skills occurred similarly to language-neutral skills for three bilingual groups (Chinese-English, Hebrew-English and Spanish-English). However, facilitation from transferred language-specific skills was observable among bilingual students learning to read two alphabetic languages (Spanish-English and Hebrew-English), but not
			Phoneme onset deletion	Receptive oral vocabulary (PPVT)	
			Phoneme counting (E)		

4. Luk and Bialystok (2008)	6.4	57	Syllable deletion (onset, medial, final)	Real word reading	Phonological awareness was strongly related between Chinese and English
			Phoneme onset deletion	Receptive oral vocabulary (PPVT)	In English, word reading was related to all the cognitive and linguistic measures, except for syllable deletion in the medial and final positions
			Phoneme counting (E)		In Chinese, reading was related only to receptive vocabulary and Raven's Matrices and none of the phonological measures
			Tone awareness (C)		Word identification was not related between the two languages after general cognitive background factors were accounted for, but the cross-linguistic relationship in phonological awareness remained strong
5. Wang, Perfetti, and Liu (2005)	8.2	46	Onset matching	Real word (E)	Tone awareness contributed significantly to English
			Rime matching	Character reading (C)	Pseudoword reading even when English phonemic-level processing skill was taken into consideration
			Phoneme deletion (E)	Pseudoword reading (E)	
			Tone matching (C)	Real Pinyin reading (C)	
				Pseudo-Pinyin reading (C)	

(continued)

Table 8.1 (continued)

Study	Mean age (yr)	Subject #	Phonological awareness tasks	Outcome variables	Results
6. Wang, Cheng, and Chen (2006)	8.9	64	Phoneme deletion (E)	Real word reading (E)	Oral vocabulary and phonological awareness contributed to word reading within each language
			Onset detection (C)	Receptive oral vocabulary (PPVT)	
			Rime detection (C)		
			Tone detection (C)		
7. Wang, Yang, and Cheng (2009)	6.81	78	Phoneme deletion (E)	Real word naming (E)	Chinese tone and onset awareness each explained a significant amount of the variance in English real word reading after taking into account other predictor variables in English
			Onset detection (C)	Pseudoword naming (E)	Tone awareness accounted for more variance than onset awareness.
			Rime detection (C)	Character naming (C)	Chinese onset awareness also explained a significant amount of the variance in English pseudoword reading
			Tone oddity (C)		
				Receptive oral vocabulary (PPVT)	

Note: If a task was administered in both languages, it is then unmarked in the table. For language-specific tasks, (E) indicates that this task was only administered in English; (C) indicates that this task was only administered in Chinese; *PPVT*: Peabody picture vocabulary test

Method

Participants

Thirty-seven Chinese heritage language learners (mean age = 7.65 years, SD = .85) from a weekend Chinese School in Western Pennsylvania participated in the study. They were in Grade 1 to Grade 2 classes in local public schools instructed in English during the week, and attended Grade 1 to Grade 2 Chinese language classes at the weekend school. Two sets of parallel tests in English and Chinese designed to measure oral vocabulary knowledge, phonological awareness and decoding skills were administered in class.

Measures

Oral vocabulary knowledge was assessed with 60 items from the Peabody Picture Vocabulary Test-Revised (PPVT-Revised; Dunn & Dunn, 1997). Following the practice of previous studies (e.g., Pasquarella et al., 2011; Wang et al., 2006), a parallel Chinese test was adapted from the English PPVT. There was no overlapping item between the two tests.

Phonological Awareness was assessed with auditory discrimination and deletion tasks. In the former task, 30 stimuli were randomly selected from the Auditory Discrimination Test (Wepman & Reynolds, 1986). The participants heard each pair of words twice, and were asked to indicate their judgment by circling either S (same) or D (different) on the answer sheets provided. The Chinese auditory discrimination test followed the same design and tapped into children's ability to discriminate onsets, rimes, and tones in Chinese. The deletion task in English required the participants to remove a sound from the beginning or the end of a word and measured children's ability to manipulate sound units in a word. The English phoneme deletion tasks were adapted from Stahl and Murray (1994) and CTOPP (Wagner, Torgesen, & Rashotte, 1999). Participants were asked to delete the initial or final phoneme. The deletion task in Chinese asked the children to remove the onset or the rime of a Chinese syllable. Test items were adapted from the Wang et al. (2006)'s study.

Decoding was measured with real word naming and pseudoword naming tasks. English real word naming was assessed by the word recognition subtest from the Woodcock Reading Mastery Tests-Revised (WRMT-R; Woodcock, 1998). 45 words were randomly selected from the subtest and were presented in order of difficulty. Chinese real word naming was comprised of a list of 45 target characters derived from the curriculum from which the children were instructed. The list progressed from single-unit characters to composite characters and also progressed from less complex characters to more complex ones involving more strokes. An additional measure in Chinese, *real Pinyin naming*, was also used to measure the children's decoding skill,

given that Pinyin was a part of their literacy learning in Chinese. The ten real Pinyin syllables were randomly selected from the Chinese phonological inventory.

Pseudoword Naming in English was measured by a list of 45 pseudowords from the word attack subtest in the WRMT-R (Woodcock, 1998). Given that being able to use phonetic information in naming characters is a later developed skill (e.g., Shu, Anderson, & Wu, 2000), we did not include a pseudo-character naming measure in Chinese.

The Raven's Standard Progressive Matrices test (Raven, Raven, & Court, 1998) with 30 items was used to measure the children's nonverbal intelligence as a control variable. In all the tasks, one point was given for an accurate answer.

Procedure

Data were collected as part of the participants' instructional activities during their classes at the weekend school. The nonverbal intelligence test and the oral vocabulary knowledge test were given in groups first, followed by the decoding tasks and the phonological awareness tasks, which were given individually. In all tasks, the children were given two practice items and then the test items.

Results and Discussion

Means and standard deviations are listed in Table 8.2. Table 8.3 presents the correlations between all the variables. English and Chinese oral vocabulary knowledge did not significantly correlate to each other. No significant relationship was found in phonological awareness between the two languages, either. Within Chinese, oral vocabulary knowledge was significantly correlated with character naming ($r = .750$, $p < .001$), as well as with phonological awareness ($r = .343$, $p < .05$), but not with Pinyin naming. Phonological awareness was significantly correlated with both character naming ($r = .504$, $p < .01$) and Pinyin naming ($r = .479$, $p < .01$). Within English, oral vocabulary knowledge was significantly correlated with both real word naming ($r = .445$, $p < .01$) and pseudoword naming ($r = .433$, $p < .01$), but no significant correlation was found between oral vocabulary knowledge and phonological awareness. Phonological awareness was significantly correlated with both real and pseudoword naming ($r = .445$, $p < .01$ and $r = .560$, $p < .001$).

In sum, no systematic relationship was found in either oral vocabulary knowledge or phonological awareness between the two languages. However, the two were differentially related to the decoding variables within each language, as well as across languages. In order to address the hypothesized contributions of these orally based variables to decoding development, a series of hierarchical regression analyses was performed using decoding scores as the criterion variables, and oral vocabulary knowledge and phonological awareness as the predictors.

Table 8.2 Mean correction rates and standard deviations (SDs) of all measures

	Grade 1	Grade 2	Overall
Tasks	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Raven's	.740(.099)	.813(.166)	.771(.136)
Chinese			
Oral vocabulary	.577 (.097)	.684 (.110)	.617 (.113)
Phonological awareness	.587 (.093)	.556 (.123)	.574 (.109)
Auditory discrimination	.855 (.105)	.735 (.223)	.806 (.172)
Onset deletion	.502 (.168)	.460 (.139)	.467 (.156)
Rime deletion	.475 (.102)	.473 (.120)	.478 (.109)
Real character naming	.553 (.071)	.632 (.102)	.585 (.092)
Real Pinyin naming	.638 (.154)	.780 (.237)	.696 (.205)
Pseudo-Pinyin naming	.429 (.269)	.664 (.232)	.525 (.277)
English			
Oral vocabulary	.585 (.126)	.696 (.091)	.628 (.125)
Phonological awareness	.609 (.084)	.628 (.108)	.616 (.093)
Auditory discrimination	.629 (.088)	.701 (.147)	.658 (.119)
Initial phoneme deletion	.585 (.165)	.611 (.128)	.596 (.147)
Final phoneme deletion	.600 (.146)	.589 (.122)	.595 (.134)
Real word naming	.668 (.082)	.793 (.155)	.721 (.131)
Pseudoword naming	.629 (.111)	.743 (.200)	.673 (.091)

In the regression analyses for the Chinese variables, oral vocabulary knowledge and phonological awareness in Chinese were used as the predictor variables and Chinese real word naming and Pinyin naming scores as the criterion variables. In the first set of analyses, Chinese real word naming was entered as the criterion variable, oral vocabulary knowledge and phonological awareness as the predictors, and age and nonverbal scores as the control variables. The analyses revealed that Chinese oral vocabulary knowledge accounted for 48.4 % ($\Delta R^2 = .418$; $p < .001$) of the variance in Chinese real word naming, and it remained significant even after the portion of the variance explained phonological awareness was partialed out. The result suggests that oral vocabulary knowledge was a significant predictor of Chinese word naming, over and above phonological awareness, for this group of children. In the subsequent analyses, Pinyin naming was used as the criterion variable with the same set of predictors. The results showed that Chinese phonological awareness explained a significant portion of the variance in Pinyin naming ($\Delta R^2 = .176$, $p < .05$), whereas Chinese oral vocabulary knowledge did not make any unique contribution to Pinyin real word naming. These results indicate that Chinese oral vocabulary knowledge is a direct and significant contributor to character reading, but the contribution of phonological awareness is restricted to Pinyin naming. Phonological awareness contributed to decoding development in alphabetic Pinyin, but not in Chinese characters.

An additional set of hierarchical regression analyses was also performed to compare the relative contributions of oral vocabulary knowledge and phonological awareness to real word and pseudoword naming in English. In each analysis, the

Table 8.3 Correlation for all measures

	1	2	3	4	5	6	7	8	9	10	11
1. Age	–										
2. Raven	.543*	–									
Chinese measures											
3. COVK	.268	.253	–								
4. CPA	.013	.435*	.343*	–							
5. CRN	.265	.351	.750***	.504**	–						
6. CPYN	.368*	.35	.083	.479**	.208	–					
7. CPPYN	.431*	.356	.166	.033	.140	.443**	–				
English measures											
8. EOVK	.374*	.361	.054	.021	.029	.253	.253	–			
9. EPA	.075	.197	.037	.252	−.001	.259	.288	.313	–		
10. ERN	.370*	.221	.105	−.107	.112	.258	.462**	.445**	.461**	–	
11. EPN	.262	.220	.047	.049	.035	.332*	.433**	.411*	.560***	.882***	–

Note. Raven = Nonverbal Intelligence; *COVK* = Chinese oral vocabulary knowledge, *CPA* = Chinese phonological awareness, *CRN* = Chinese real character naming, *CPYN* = Chinese Pinyin naming, *CPPYN* = Chinese pseudo-Pinyin naming, *EOVK* = English oral vocabulary knowledge, *EPA* = English phonological awareness, *ERN* = English real word naming, *EPN* = English pseudoword naming

*$p < .05$; **$p < .01$; ***$p < .001$

scores on real word naming were entered as the criterion variable, oral vocabulary knowledge and phonological awareness as the predictors, and age and nonverbal scores as the control variables. Oral vocabulary knowledge was significant when entered before phonological awareness, accounting for 15.1 % of the variance in English real word naming ($p < .05$). However, oral vocabulary knowledge was not significant after removing the variance explained by phonological awareness. Phonological awareness on the other hand was consistently significant in explaining the variance in real word naming, regardless of the order of entry. An additional set of regression analyses was repeated with English pseudoword naming as the criterion variable. The results showed that English oral vocabulary knowledge accounted for a significant amount of the variance only before the portion of the variance explained by phonological awareness was removed ($\Delta R^2 = 22.1$ %, $p < .05$). As for pseudoword naming, phonological awareness was responsible for 21.2 % of the variance in pseudoword naming, above and beyond oral vocabulary knowledge ($p < .01$).

The final set of analyses was conducted to compare the hypothesized L1-induced facilitation in L2 decoding development. The Chinese word reading measures (i.e., character naming and real Pinyin naming) were the criterion variables and English oral vocabulary knowledge and phonological awareness the predictors. Age and non-verbal intelligence were used as the control variables. The analyses revealed that the two English oral competencies provided little facilitation in Chinese character naming; that English phonological awareness significantly contributed to Chinese Pinyin naming after the variances explained by the Chinese variables and English oral vocabulary knowledge ($\Delta R^2 = .118$, $p < .05$) were removed.

Viewed together, these results suggest that oral vocabulary knowledge and phonological awareness differentially promote decoding development in the two languages. It appears that in learning to read Chinese, school-age CHL learners quickly develop an understanding of the holistic, yet indirect, nature of the grapheme-phonology relationships in Chinese characters, and utilize stored lexical information (oral vocabulary knowledge) to bootstrap character learning and processing. In contrast, they rely on phonological awareness to a greater extent than oral vocabulary knowledge in decoding English words. The differential contributions of the two orally based competencies in Chinese and English clearly reflect differential demands imposed by the grapheme-phonology relationships between the two languages. When phonological awareness is transferred from primary (English) to additional (Chinese) literacy, L1-induced facilitation occurs only to the sub-skills imposing similar demands in additional literacy.

Examining L1-Induced Facilitation: Morphological Awareness

Biliteracy acquisition also entails learning the requisite grapheme-to-morpheme mappings in two languages. As described earlier, the grapheme-morpheme relationships considerably vary in Chinese and English. While compounding is the

primary method of word formation in Chinese (Li & Thompson, 1981; Packard, 2000), English utilizes both affixation and compounding (Plag, 2003). In English, a morpheme is represented by a sequence of letters, and morphemic letter strings are linearly concatenated to form a complex word. In contrast, in Chinese, a single character holistically encodes an individual morpheme. Many single-unit characters are combined to form multi-unit characters and serve as their components. The vast majority of Chinese characters in use are multi-unit composite characters, consisting of two components, one supplying phonological information of a complex character (referred to as *phonetics*) and the other offering the character's partial meaning (called *radical*). Because of the function assigned to radicals, the ability to identify and manipulate radical information (*radical awareness*) is also considered as a facet of Chinese morphological awareness (Nagy et al., 2002).

Based on these properties, we predicted that distinct morphological awareness facets are differentially related between the two languages in Chinese-English biliteracy learners. Given the high productivity of compounding in both languages, compound awareness is similarly prominent in the two languages. When transferred from one language to the other, this facet provides more facilitation than the other facets that are unique to one language (derivational awareness dominant in English and radical awareness specific to Chinese). In recent years, interest in morphological awareness is escalating. A small, but growing, number of studies have explored the role of morphological awareness in Chinese-English biliteracy development (see Table 8.4). Their findings generally confirm that compound awareness serves as a shared resource in biliteracy learning; and that facilitation from compound awareness occurs only from the dominant to less dominant language. Although these findings offer partial support for the prediction regarding L1-induced facilitation stemming from shared metalinguistic awareness, it is not yet clear to what extent and how such L1-based contributions vary across disparate facets of morphological awareness.

To gain a better understanding of the impacts of previously acquired metalinguistic awareness, the present study tested the hypothesized variation in L1-induced facilitation between shared and language-specific reading sub-skills. In specific, the study, which is more fully described in Zhang (in press), compared the relative contributions of two distinct L1 morphological awareness facets (compound and derivational) to L2 word meaning inference among native Chinese-speaking children learning to read English as a Foreign Language (EFL) in China. Two questions were posed to guide the study: (1) Does Chinese morphological awareness facilitate English word meaning inference? (2) If it does, is there any difference in the way compound and derivational awareness contributes to English word meaning inference?

Table 8.4 Summaries of studies on transfer of morphological awareness in Chinese-English biliteracy acquisition

Study	Participants	Age	Proficiency	Morphological awareness	Outcome variables	Results
Wang et al. (2006)	Chinese-English Bilingual children in the U.S.	Chinese Grades 2 and 4	English dominant	derivational awareness and compound awareness in both languages	word reading and reading comprehension in both languages	English compound awareness uniquely predicted Chinese character reading and reading comprehension; such an effect was not found from Chinese to English, for both English word reading and reading comprehension
Wang, Yang, and Cheng (2009)	Chinese-English Bilingual children in the U.S.	Grade 1	English dominant	compound awareness in both languages	word reading in both languages	English compound awareness explained a significant, unique amount of variance in Chinese character reading; such an effect was not found reversely from Chinese to English in predicting English real as well as pseudo word reading
Cheung, Chung, Wong, McBride-Chang, Penney, and Ho (2010)	Chinese learners of English in Hong Kong	3rd year kindergarteners; 2nd and 4th graders	Chinese dominant	compound awareness in Chinese; derivational awareness in English	word reading and vocabulary knowledge in both languages	Chinese compound awareness uniquely predicted English word reading, but not vocabulary knowledge, over and above English phonological processing skills

(continued)

Table 8.4 (continued)

Study	Participants	Age	Proficiency	Morphological awareness	Outcome variables	Results
Zhang, Anderson, Li, Dong, Yu, and Zhang (2010)	Chinese learners of English as a Foreign Language in China	5th graders	Chinese dominant	compound awareness in both languages	compound awareness in both languages	Transfer of compound awareness from Chinese to English in that the groups that experienced intervention on Chinese compounding performed better in English compound awareness than did the control group which did not receive such training. Reverse transfer of compound awareness from English to Chinese was observed among children with higher reading proficiency
Pasquarella et al. (2011)	Chinese-English Bilingual children in Canada	1st to 4th graders	English dominant	compound awareness in both languages; derivational awareness in English	vocabulary knowledge and reading comprehension in both languages	English compound awareness, but not English derivational awareness, predicted Chinese vocabulary knowledge and Chinese reading comprehension

Method

Participants

Participants were 204 Mandarin-speaking 6th graders from a public elementary school in a small county in Northeast China. They included 115 boys and 89 girls with an average age of 12.08 years (*SD* = .61). From Grade 3, these children had four 40-min English classes per week. With about 18 weeks in a semester, they should have received over 350 h of classroom instruction at the time when the current study was conducted.

Measures

Derivational awareness task. We used parallel tasks to measure derivational awareness in English and Chinese. In both languages, the Morphological Relation task asked the children to judge whether the second word in a word pair "came from" the first word. It included 10 related and 10 unrelated word pairs. The Affix Choice task measured the children's knowledge about the functions of derivational affixes. The children were presented with 10 grammatically simple sentence frames, each followed by three derived words sharing a stem. In the Chinese task, all stems were pseudo characters. For example, 他长大后想当一位___ (*He wants to be a ___ after he grows up*) (□化, 可□, □家). They were to select an appropriate derived form to fill into each sentence.

Compound awareness task. Parallel tasks were used to measure compound awareness in English and Chinese. The Compound Structure task measured the understanding of the modifier-head structure of nominal compounds in the two languages. The children were to choose a better answer to a riddle from two given options (i.e., the "*Bee grass* or *Grass bee*" task used in Nagy, Berninger, & Abbott, 2006). The task consisted of 20 items. The Morpheme Discrimination task was constructed following Ku and Anderson (2003). It was designed to measure the understanding that a word part shared by different words may vary in meaning. The children were presented with 10 groups of three words; two words in each group were compound words with the target word component having the same meaning. The children were to circle the word that did not belong.

Lexical inference task. Lexical inference was operationally defined as making appropriate predictions of meanings of unknown morphologically complex words based on morphological analysis and knowledge of the meanings of constituent morphemes. It was measured with parallel tasks that covered 15 derived and 15 compound words for both Chinese and English. Those target words were low in frequency and had been unknown to the children. Each word was followed by four meaning choices in the respective language. The children were to select the best interpretation for each word. To give an English derivative example, the target

word *reachable* was presented with four meaning choices, including (a) *to touch something*, (b) *very far away*, (c) *able to be grasped*, and (d) *to ache again*.

Procedure

Data were collected in the participants' regular English and Chinese classes near the end of their Grade 6 year. All tasks were printed on paper and administered in a whole class format. The morphological awareness tasks were administered first, followed by the lexical inference tasks. In all tasks, the children first worked on a practice item and then the test items. To minimize potential confounding of decoding ability, children were encouraged to ask their English teachers about pronunciations of words included in the tests.

Results and Discussion

Means and Standard deviations are listed in Table 8.5 and intercorrelations among the measured variables are shown in Table 8.6. We used Structural Equation Modeling (SEM) to examine L1-induced facilitation stemming from transferred morphological awareness in L2 lexical inference. In the measurement part of the baseline model for transfer of L1 compound awareness, Compound Structure and Morpheme Discrimination were to load on the factor of Compound Awareness, for both Chinese and English. Compound Word Meaning Inference in both languages had only one indicator, namely, the children's performance on the compound word part of the lexical inference task. Similarly, in the measurement part of the baseline model for transfer of L1 derivational awareness, the two measures of derivational awareness (i.e., Morphological Relation and Affix Choice) were to load on the factor of Derivational Awareness, for both English and Chinese. Derived Word Meaning Inference in both languages had only one indicator, namely, the children's performance on the derived word part of the lexical inference task in the respective language. Based on our analyses, we hypothesized that morphological awareness contributes to lexical inference within each language; that L1 morphological awareness positively relates to L2 morphological awareness; and that L2 morphological awareness, L1 lexical inference, and L1 morphological awareness jointly facilitate L2 lexical inference.

The hypothesized variation in L1-induced facilitation was also examined through separate SEM analyses. The baseline model for Chinese compound awareness showed very good model fit, χ^2 (6, $N = 204$) = 5.191, $p = .520$; $CFI = 1.000$; $RMSEA = .000$ (CI: .000 and .084). All factor loadings were significant in the measurement model. A Wald Test suggested that the baseline model would become more parsimonious with no significant change of goodness of model fit if the path from Chinese Compound Awareness to English Compound Word Meaning Inference

Table 8.5 Means and standard derivations of all variables

Variables	*n*	*MPC*	*SD*
Chinese morphological relation	20	.698	.13
Chinese affix choice	10	.759	.17
Chinese compound structure	20	.873	.15
Chinese morpheme discrimination	10	.782	.13
Chinese derived word meaning inference	15	.752	.18
Chinese compound word meaning inference	15	.634	.16
English morphological relation	20	.588	.13
English affix choice	10	.380	.15
English compound structure	20	.705	.14
English morpheme discrimination	10	.553	.18
English derived word meaning inference	15	.292	.11
English compound word meaning inference	15	.323	.13

Note: *n* = number of items, *MPC* = Mean proportion correct

Table 8.6 Cross-linguistic correlations between morphological awareness and lexical inference

	EMADER	EMAAFFIX	EMACOMST	EMAMORDI	ELEXDER	ELEXCOM
CMADER	.277***	.115	.196**	.165*	.056	.039
CMAAFFIX	.190**	.194**	.171*	.155*	.105	.044
CMACOMST	.261***	.088	.152*	.128	.108	.099
CMAMORDI	.234***	.145*	.046	.211**	.047	.076
CLEXDER	.316***	.208**	.187**	.191**	.097	.188**
CLEXCOM	.315***	.095	.218**	.209**	.080	.213**

Note: CMADER = Chinese morphological relation, *CMAAFFIX* = Chinese affix choice, *CMACOMST* = Chinese compound structure, *CMAMORDI* = Chinese morpheme discrimination, *CLEXDER* = Chinese derived word meaning inference, *CLEXCOM* = Chinese compound word meaning inference, *EMADER* = English morphological relation, *EMAAFFIX* = English affix choice, *EMACOMST* = English compound structure, *EMAMORDI* = English morpheme discrimination, *ELEXDER* = English derived word meaning inference, *ELEXCOM* = English compound word meaning inference

*$p < .05$; **$p < .01$; ***$p < .001$

was removed. The optimized model after the Wald Test displayed very good model fit, χ^2 (7, $N = 204$) = 5.494, $p = .600$ (*CFI* = 1.000; *RMSEA* = .000 with a CI of .000 and .074). It was more parsimonious and showed no significant change to the baseline model ($\Delta\chi^2$ [1] = .303, $p = .582$). It was thus considered the final model for the cross-linguistic relationship between compound awareness and compound word meaning inference in Chinese and English. In the final model, which is graphically presented in Fig. 8.1, Chinese Compound Awareness significantly predicted both Chinese Compound Word Meaning Inference ($\beta = .883$, $p < .001$; 77.9 % of variance explained) and English Compound Awareness ($\beta = .785$, $p = .003$; 61.6 % of variance explained). English Compound Awareness and Chinese Compound Word Meaning Inference together explained about 6.9 % of the variance in English Compound Word Meaning Inference. However, neither variable's unique contribution achieved

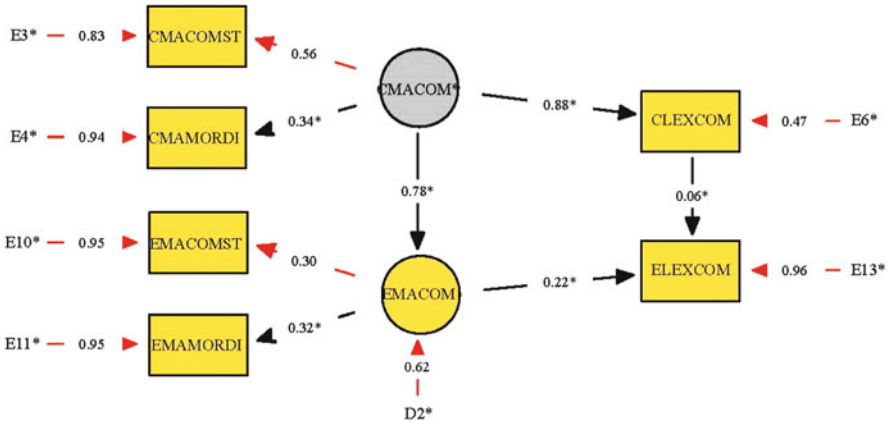

Fig. 8.1 Final model of transfer of compound awareness (*Note*: $N = 204$. *CMACOM* = latent variable of Chinese compound awareness, *CMACOMST* = Chinese compound structure, *CMAMORDI* = Chinese morpheme discrimination, *EMACOM* = latent variable of English compound awareness, *EMACOMST* = English compound structure, *EMAMORDI* = English morpheme discrimination, *CLEXCOM* = Chinese compound word meaning inference, *ELEXCOM* = English compound word meaning inference)

significance, $\beta = .216$, $p = .525$ for English Compound Awareness and $\beta = .063$, $p = .795$ for Chinese Compound Word Meaning Inference. The indirect effect of Chinese Compound Awareness on English Compound Word Meaning Inference via English Compound Awareness and Chinese Compound Word Meaning Inference, which was equal to the total effects of Chinese Compound Awareness in the final model, were significant, $\beta = .225$, $p = .013$.

The baseline model for transfer of L1 derivational awareness also displayed very good model fit, χ^2 (6, $N = 204$) = 6.106, $p = .411$ (*CFI* = .999, *RMSEA* = .009 with a CI of .000 and .092). All factor loadings were significant in the measurement model. Once again, a Wald Test showed that removing the direct path from Chinese Derivational Awareness to English Derived Word Meaning Inference would make the baseline model more parsimonious but lead to no significant change in the goodness of model fit. The optimized model after the Wald Test displayed very good model fit, χ^2 (7, $N = 204$) = 6.229, $p = .513$ (*CFI* = 1.000, *RMSEA* = .000 with a CI of .000 and .074) and $\Delta\chi^2$ [1] = .123, $p = .726$. Thus, the optimized model was considered as the final model. In the final model, English Derivational Awareness ($\beta = .211$, $p = .095$) and Chinese Derived Word Meaning Inference ($\beta = -.003$, $p = .978$) together explained about 4.4 % of the variance in English Derived Word Meaning Inference. Neither variable's unique contribution achieved significance. The indirect effect of Chinese Derivational Awareness on English Derived Word Meaning Inference via English Derivational Awareness and Chinese Derived Word Meaning Inference, which was equal to its total effects, was not significant, $\beta = .131$, $p = .051$ (Fig. 8.2).

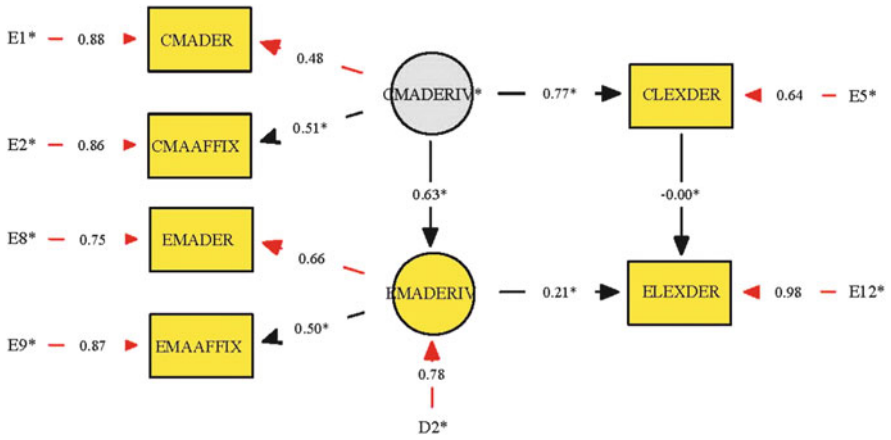

Fig. 8.2 Final model of transfer of derivational awareness (*Note*: $N = 204$. *CMADERIV* = latent variable of Chinese derivational awareness, *CMADER* = Chinese morphological relation, *CMAAFFIX* = Chinese affix choice, *EMADERIV* = latent variable of English derivational awareness, *EMADER* = English morphological relation, *EMAAFFIX* = English affix choice, *CLEXDER* = Chinese derived word meaning Inference, *ELEXDER* = English derived word meaning inference)

Given that compounding is a productive method of word formation in both Chinese and English (Packard, 2000), the significant contribution of Chinese compound awareness to English compound word meaning inference is not surprising. However, a parallel contribution was not observed of derivational awareness, which pertains only to English. Overall, the findings corroborate those emanating from previous studies involving Chinese-English biliteracy learners (e.g., Pasquarella et al., 2011; Wang et al., 2006), providing further support for the hypothesized distance effect on L1-induced facilitation in L2 reading development. Of greater import, Chinese compound awareness was not significant in explaining any unique variance in English compound word meaning inference. The analysis revealed that Chinese compound awareness contributes to English word inference only indirectly through English compound awareness and Chinese inference ability.

In sum, using SEM analysis, the study examined the facilitative impact of transferred L1 morphological awareness on L2 morphological awareness and lexical inference ability. The results showed that L1 compound awareness contributed significantly, albeit indirectly, to L2 word meaning inference, whereas the impact of L1 derivational awareness was far more limited. These findings provide empirical support for the hypothesized variation in L1-indueced facilitation arising from linguistic distance in Chinese-English biliteracy acquisition. Pedagogically, they suggest that Chinese children's L1 compound awareness is a good resource that can be exploited to enhance their word learning ability in English as a Foreign Language. Because of the limited facilitation from transferred derivational awareness, children may substantially benefit from explicit instruction on English derivational morphology.

Summary and Conclusions

The goal of this chapter was to provide some clarification on cross-linguistic constraints on biliteracy development in two typologically diverse languages, Chinese and English. We posed two questions: How are previously acquired sub-skills assimilated in learning to read in later acquired, or additional, literacy; and how assimilated skills enhance reading sub-skills development in later acquired literacy? By comparing the linguistic demands for the acquisition of phonological and morphological awareness, we made specific predictions regarding cross-linguistic facilitation stemming from previously acquired metalinguistic awareness in later acquired literacy. The predictions were tested in two studies.

The first study compared the contribution of phonological awareness to decoding in English (primary literacy) and Chinese (additional literacy) in first and second grade Chinese heritage language learners in the US. Phonological awareness was a significant predictor of decoding in English, but not in Chinese. Instead, Chinese decoding was predicted by oral vocabulary knowledge. Cross-linguistically, English phonological awareness contributed differently to decoding performance in alphabetic Pinyin and Chinese character. The second study examined the relative contributions of two morphological awareness facets (compound and derivational awareness) in Chinese (primary literacy) to lexical inference in English (additional literacy). Because the two morphological awareness facets are not equally prominent in Chinese, both intra-lingual and inter-lingual variations were predicted in the extent to which the two facets of Chinese morphological awareness contributed to English lexical inference. The contribution of Chinese morphological awareness was indeed found only in the prominent facet (compound awareness).

Viewed collectively, these findings provide empirical support for systematic variations in cross-linguistic facilitation in biliteracy development. The observed variations were by and large predictable from similarities, or lack thereof, in the linguistic demands imposed by the linguistic and orthographic properties of both Chinese and English. All in all, the findings suggest that bilitearacy development is jointly constrained by two languages even when they are typologically distinct.

Acknowledgements We would like to thank the students who participated in the two empirical studies, and the two anonymous reviewers for their comments on an earlier version of this chapter. Study 2 was previously reported and published as Zhang (in press; DOI:10.1017/S0142716412000070) in *Applied Psycholinguistics*. We thank Cambridge University Press for granting us permission to reproduce some contents of that paper for this chapter.

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Chapter 9
Effect of Early Bilingualism on Metalinguistic Development and Language Processing: Evidence from Chinese-Speaking Bilingual Children

Li-Jen Kuo and Tae-Jin Kim

Abstract Psychologists have long been interested in the impact of early bilingualism on children's cognitive development. However, despite vigorous investigation into the topic, research on the effect of bilingualism on metalinguistic awareness and language processing has remained largely unexplored, either producing mixed findings or revealing advantages that cannot be ascribed solely to bilingualism per se. Many Chinese-speaking children around the world speak a second language, usually one that is typologically distant from Chinese, which affords an opportunity for isolating extraneous factors and identifying effect of bilingualism per se and provides a fertile ground for studying theories of early bilingualism in a broader cross-linguistic context. The purpose of this chapter is two-fold. First, it provides a critical review of the conceptual and methodological challenges in conducting research on the metalinguistic development and language processing of bilingual children. Second, it reports two empirical studies with Chinese-speaking bilingual children that were designed to investigate *structural sensitivity theory* Kuo & Anderson (Scientific Studies of Reading, 14, 365–385, 2010), an augmented theoretical framework to examine bilingual cognitive advantage in the verbal domain.

Keywords Bilingualism • Chinese • Metalinguistic • Language processing

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Burgeoning literature has demonstrated the impact of bilingualism on children's cognitive development. Bilingual children have been found to display more advanced skills than monolinguals on cognitive tasks that contain conflicting or misleading cues, such as the ambiguous figure reversal (Bialystok & Shapero, 2005), the dimensional-change card sorting (Bialystok, 1999; Bialystok & Martin, 2004) and the Simon tasks (Martin-Rhee & Bialystok, 2008) and false belief reasoning (Kovacs, 2009). These tasks share the cognitive demand in requiring children to control their attention—a process that parallels bilinguals' unique experience of switching between two competing language systems, selecting the structures of the target language and inhibiting interference from the non-target language (Bialystok, 2009). Findings from recent studies have suggested that this unique cognitive demand facilitates bilingual children's development of executive control, which includes the following primary processes: inhibition, cognitive flexibility and updating information in working memory (Bialystok, 2001, 2009; Miyake, Freidman, Emerson, Witzki, Howerter, & Wager, 2000).

Although bilingualism is a verbal experience, only a handful of studies have reported a bilingual advantage in the verbal domain with a focus on cognitive flexibility, information updating in working memory and the inhibition aspect of executive control (e.g., Ben-Zeev, 1977; Bialystok, 1986a, 1988; Cromdal, 1999; Cummins, 1978; Davidson, Raschke, & Pervez, 2010; Gathercole, Sabastian, & Soto, 2002; Gathercole, 2007; Yelland, Pollard, & Mercuri, 1993). It should be noted that while there is a large body of literature comparing the language and literacy development of bilingual children to monolingual children, the emphasis tends to be on identifying areas where bilingual children are lagging behind (e.g., Lipka, Siegel & Vukovic, 2005). These studies are informative; nonetheless, they do not directly answer the question of how early bilingual experience shapes the language learning mechanism with respect to executive control.

To date, most of the existing tasks designed to study bilingual effects in the verbal domain are metalinguistic tasks that evaluate children's ability to process structural features of one of their two languages. For example, research on syntactic awareness using grammaticality judgment tasks has demonstrated that balanced bilingual children are more readily than their monolingual peers in accepting sentences that are grammatically correct but semantically incongruous, such as *A cat barks,* (Bialystok, 1986b, 1988; Cromdal, 1999; Davidson et al., 2010; Gathercole et al., 2002; Gathercole, 2007). Contrary to children's natural inclination to attend to semantics, the task requires children to redirect their attention to structural properties of language.

While a bilingual effect on the development of syntactic awareness has been documented consistently with children speaking various pairs of languages, research on the effect of bilingualism on other areas of metalinguistic awareness and language processing has either remained largely unexplored, produced mixed findings or revealed advantages that cannot be ascribed solely to bilingualism per se. For example, in the area of phonological processing, the observed bilingual advantage has usually been interpreted as *transfer* of phonological skills developed through experience with the specific features of one of the two languages. Most of the observed advantage has been limited to bilinguals who speak a language with one of the

following features: (a) simpler and more regular phonological structure (e.g., Italian, which has only five vowels and no diphthongs, in Campbell & Sais, 1995); (b) more salient segmental units (e.g., French, which has more salient syllables than English, in Bruck & Genesee, 1995); or (c) a more transparent orthography (e.g., Spanish and Hebrew, as compared with Mandarin and English, in Bialystok, Majumder, & Martin, 2003; Bialystok, Luk, & Kwan, 2005).

Structural Sensitivity Theory

While cross-language transfer indeed plays an important role in the language and literacy development of bilingual children, a topic of substantial theoretical significance is whether effects of bilingualism exist beyond cross-language transfer. In other words, an area that remains largely unexplored in existing research is whether bilingualism affects the language acquisition and processing mechanism with respect to executive control, or whether the influence of bilingualism is simply limited to cross-language transfer alone and is modulated by the saliency of specific linguistic features of the additional language.

To more comprehensively conceptualize the effect of bilingualism on language development beyond cross-language transfer, Kuo and Anderson (2010) proposed *structural sensitivity theory.* Formulated on the basis of the seminal work by Hakuta and Diaz (1985) and recent studies of bilingual effect on non-verbal processing by Bialystok (1999) & Bialystok & Martin(2004, 2005), *structural sensitivity theory* postulates that bilingual experience may allow young children to develop a greater readiness to reorganize linguistic input and impute linguistic structure. Such bilingual facilitative effect may stem from two sources. First, in order to overcome interlingual interference, bilinguals may habitually attend to structural features of language and be able to flexibly inhibit attention to other less relevant aspects of linguistic information when needed. Second, having access to two languages may render structural similarities and differences between languages more salient, orienting bilinguals to parameters along which languages may vary. Such orientation may allow bilingual children to form representations of language structure at a more abstract level.

Methodological Challenges in Studying Bilingualism in the Verbal Domain

Two methodological challenges must be addressed in designing verbal tasks to more precisely identify the effects of bilingualism on metalinguisitc development and language processing beyond cross-language transfer. The first challenge is the choice of the language to be employed in the task. Most of the bilingual children have been studied in comparison to their monolingual peers who speak a language natively that the bilingual children learn as a second language. As indicated in research on vocabulary size, bilingual children are usually less proficient in either of

their two languages when compared to their monolingual peers (e.g., Bialystok, Luk, Peets, & Yang, 2010; Oller & Eilers, 2002). Because metalinguistic tasks may be highly correlated with language proficiency (e.g., Kuo & Anderson, 2006, 2008; Lipka & Siegel, 2007), while bilinguals' superior performance on metalinguistic tasks than their monolingual peers may be ascribed to their unique bilingual experience, it would be difficult to pinpoint the source of any observed delay in the development in metalinguistic processing by the bilinguals, as such delay can be attributed to a number of factors, including lower proficiency in the test language and interference from the additional language.

The second methodological challenge lies in the design of the verbal tasks. Even if superior performance in verbal tasks by bilinguals over their monolingual peers is observed, it remains questionable whether their advantage over monolingual children can be attributed to a general advantage from bilingualism. Bilingual children may pay particular attention to structural features of a second language because attention to form or grammar is generally more emphasized in second language instruction than in first language instruction (Kuo & Anderson, 2008). Receiving more explicit instruction in structural properties of a second language, although a likely part of the bilingual experience, is not an intrinsic aspect of bilingualism.

One approach to address the aforementioned challenges is to design tasks that focus on linguistic units or structures shared between the languages spoken by both the bilingual and the monolingual participants. To isolate the influence of cross-language transfer and explicit instruction unique in second language classrooms, the structures or units to be examined should (a) have comparable frequency in both languages or lower frequency in the additional language of the bilinguals and (b) are less likely to be explicitly taught in both languages or are only explicitly taught in the languages spoken by both the bilinguals and the monolinguals but not in the language only spoken by the bilinguals. For example, in the domain of phonological awareness, one can either limit the stimuli to phonological segments shared between the two languages and those conforming to the syllable structure of the language spoken by both the bilingual and the monolingual participants, or one can use novel syllables with which the bilingual and the monolingual participants are equally unfamiliar. If bilinguals are found to show superior performance over their monolingual peers in processing these structures or units, it can be then argued that the advantage stems from their experience with the two structures in different linguistic contexts, which allows them to compare and contrast the structures at a more abstract level.

Following the paradigm described above, Kuo and Anderson (2010) provided initial empirical support for *structural sensitivity theory* in their study on the development of phonological awareness with Mandarin-Southern-Min bilinguals and Mandarin-speaking monolinguals in Taiwan. Southern-Min, a regional dialect in Taiwan, does not have its own writing system, thus isolating cross-language influence from access to a more transparent language. The bilingual and monolingual children in the study also both spoke Mandarin natively, which excluded the influence of explicit instruction unique in L2 context. The stimuli in the onset awareness task varied along two dimensions *syllable novelty*—novel versus extent,

and *onset overlap*—shared versus Mandarin-only, which yields a total of four types of items. Shared items contained syllables with onsets that exist in both Mandarin and Southern-Min. Mandarin-only items contained syllables with onsets that exist only in Mandarin, but not in Southern-Min. Extant items contained syllables that exist in Mandarin. Novel items contained syllables that consist of Mandarin onsets and rimes but violate the phonotactics of both Mandarin and Southern-Min. In other words, novel items exist neither in Mandarin nor Southern-Min. The results show that while the bilinguals and the monolinguals performed similarly on items that contained Mandarin-only onsets, a pronounced bilingual advantage was observed in segmenting and comparing syllables with onsets that exist in both of their languages. The advantage was ascribed to bilinguals' richer experience with these segments in more variable phonological contexts, which corroborates research that shows contextual variability is a key factor in facilitating the abstraction of phonological segments and the acquisition of phonology (Gomez, 2002). Furthermore, while the bilinguals performed similarly to their monolinguals on phonological awareness tasks that involved existing syllables in Mandarin, they consistently outperformed their monolingual peers on tasks that involved novel syllables that violate the phonotactic constraints of both Mandarin and Southern-Min. The finding suggests that bilingual experience may have expedited the development of the ability to disassociate phonological segments from syllables, enabling bilingual children to segment novel syllables into subsyllabic units more efficiently than their monolingual peers. Similar results in support of *structural* sensitivity theory in the domain of phonological awareness were obtained in Kuo, Uchikoshi, Kim, Li, & Kowalczyk (2011) with Japanese-English bilingual children.

Another approach to address the methodological challenges in isolating factors of cross-language transfer or language instruction is to investigate bilinguals' ability to *acquire a new language* rather than comparing them to monolinguals on a language both groups speak but may have divergent learning experiences with and different proficiencies in. One of the few studies employing this approach was conducted by Nation and McLaughlin (1986). They investigated the process of learning an artificial syntax by monolingual, bilingual, and multilingual adults. The experiment consisted of a learning phase, during which stimuli following an artificial syntax were presented without any explicit instruction, and a test phase, during which participants were asked to judge the grammaticality of new stimuli derived from the artificial syntax they had learned during the study phase. The results showed that the multilingual group performed significantly better than the bilingual group and the monolingual group. While Nation and McLaughlin argued that the results suggest greater cognitive flexibility among the multilingual speakers, because the language background of the participants was not documented in sufficient details, it cannot be established from their study whether greater cognitive flexibility was the cause or the consequence of advanced proficiency in multiple languages.

More recently, in a vein similar to Nation and McLaughlin's study, Kovacs and Mehler (2009) compared how 12 month-old preverbal bilingual and monolingual infants simultaneously acquire two different speech regularities. The bilingual

infants had daily exposure to two languages from birth. One of the languages was Italian and the other languages varied across the bilingual participants. The two speech structures used in the experiment both involved tri-syllabic speech items differing in the order of syllables repeated: AAB structure (e.g., lo-lo-vu) vs. ABA structure (e.g., lo-vu-lo). Results from the preferential-looking experiments showed that the bilingual infants outperformed the monolingual infants, which suggests that bilinguals are more flexible at learning new speech structures than monolingual children. Kovacs and Mehler concluded that having had to learn a distinct set of regularities from each of the languages from a mixed input, the bilingual infants may have shown specific enhancements in processing multiple regularities in linguistic stimuli, avoiding interference between the two and developing a mechanism that allows them to more efficiently extract patterns from two novel languages.

Because the bilingual participants in Kovacs and Mehler (2009) were selected from those with exposure to two languages from birth rather than on the basis of the their current bilingual proficiency as in Nation and McLaughlin (1986), the results provide more direct evidence for bilingual's superior learning of multiple speech structures. Nonetheless, Kovacs and Mehler (2009) shared a limitation with Nation and McLaughlin (1986) in that the bilingual participants were diverse in bilingual experience and it was not evident whether the tested structures, AAB or ABA, existed in bilingual's linguistic repertoire. In other words, without considering the structures of the languages spoken by the bilingual and monolingual participants, it cannot be ruled out that cross-language transfer, rather than bilingualism per se, was the sole cause of the difference observed between the bilinguals and the monolinguals.

In light of the limitations inherent in the studies described about, Kuo and Anderson (2012) conducted a study on the acquisition of novel phonotactics with Mandarin-Southern-Min bilingual children and Mandarin-speaking monolingual children. Phonotactics refers to constraints on the way phonemes co-occur in a language. For example, in English, the only consonants that can follow/p/at the beginning of a word are/l/and/r/(e.g., *play*, *pray*), but in German,/p/can also be followed by/f/and/s/to form initial consonant clusters (e.g., *Pferd, Psychologie*). The syllables in the artificial language used in Kuo and Anderson were composed of existing onsets and rimes in Mandarin, the dominant language of both the bilingual and the monolingual participants in the study. The experimentally manipulated phonotactic constraint did not exist in Mandarin or Southern-Min. During the study phase, participants listened to the artificial language without being given any explicit instruction on its phonotactic constraint. Immediately after the study phase, participants completed a two-option forced-choice task in which they heard two syllables at a time and need to determine which of the two sounded more like the language they had just heard. Half of the test items contained a syllable from the study; the other half contained a syllable derived from the experimentally manipulated phonotactic constraint but not presented during the study phase. Results with children from kindergarten to first grade showed that the bilingual children consistently excelled

their monolingual peers on differentiating the syllables conforming the experimentally manipulated phonotactic constraint from those that violate it. Because the manipulated phonotactic constraint did not exist in either of the bilinguals' two languages, the study provided more convincing results in support of structural sensitivity theory (Kuo & Anderson, 2010).

The Present Study

Many Chinese-speaking children around the world speak an additional language, usually one that is typologically distant from Chinese (e.g., English), lacks a writing system, or is not acquired through formal instruction. The typological disparity between the two languages they spoke, combined with the absence of a writing system or formal instruction of the additional language, isolates confounding factors associated with cross-language transfer and explicit instruction, thus providing a fertile ground for studying the effect of bilingualism per se on metalinguistic development and language processing. As discussed in the previous section, it has been demonstrated in research with Chinese-speaking bilingual children that bilingual effect on phonological processing may go beyond cross-language transfer and be characterized by sensitivity to structural features of language (Kuo & Anderson, 2010, 2012). It is plausible to speculate that the superior structural sensitivity bilingual children demonstrated in phonological processing (Kovacs & Mehler, 2009; Kuo & Anderson, 2010, 2012) may also be observed in morphological processing and syntactic processing because phonology, morphology and syntax operate essentially on similar distributional principles (Chomsky, 1965; Chomsky & Halle, 1968). For example, as mentioned earlier, in English, the only consonants that can follow/b/and/p/at the beginning of a word are/l/and/r/(e.g., *bloom, broom, play*, *pray*). The/b/and/p/sounds belong to a class of consonants called *bilabial plosives;* the/l/and/r/belong to a class of consonants called *liquids*. The distributional rule for consonant clusters that begin/p/and/b/in English can be formalized as the following distributional constraint –[BILABIAL PLOSIVES]+[LIQUIDS]. Similar distributional constraints are also present in the domain of morphology and syntax. In morphology, for example, the nominal suffix *–tion* can only be attached to verbs, as in *speculation, estimation,* and *distribution*, but not to adjectives; the nominal suffix *–ty*, can only be attached to adjectives (e.g., *tranquility, sanity*) but not verbs. In syntax, constraints exist on the distribution of words of different parts of speech. For example, adjectives generally come before nouns in English, but after nouns in French. Given the similarity of the operation of the distributional principles across different levels of linguistic structures, it is reasonable to expand our previous research on bilingual metalinguistic development from phonological processing to morphological and syntactic processing. The remainder of this chapter will report empirical studies that investigate the structural sensitivity of Chinese-speaking bilingual children in morphological and syntactic processing.

Experiment 1: Bilingualism and Morphological Processing

The purpose of this experiment is to examine how bilinguals and monolinguals attend to the structural properties of complex compounds differently by comparing Chinese-English bilinguals to English-speaking monolinguals. The structure to be examined is the formation of adjectival compounds with a verb and an object in English.

It has been argued by linguists that the structure of adjectival compounds with a verb and an object is primarily determined by the syllable count instead of semantics or syntax (Duanmu, 2003). When the verb is monosyllabic, the object tends to follow the verb rather than preceding it. Contrastively, when the verb is disyllabic, the object tends to be fronted before the verb. These patterns have been observed in English as well as in Chinese, both with a canonical word order of subject-verb-object. For example, in English, the modifier in the complex compound, *breakneck speed*, has the order of verb-object because *break* is monosyllabic. In Chinese, the word for radio, 收音機, [*shou*]V-[*yin*]N–[*ji*]NOMINAL HEAD, which literally means *receive-sound machine*, also shares the verb-object order in the modifier with a monosyllabic verb. However, in *heart-breaking news*, because the verb is attached with the suffix *–ing* and has two syllables, the object is fronted. Likewise, in Chinese, in the word for garbage-processing factory, 垃圾處理廠, [*lese*]N [*chuli*]V [*chang*] NOMINAL HEAD, the object in the adjectival compound is fronted because the verb is disyllabic. Duanmu argued that the structure of adjectival compounds with a verb and a noun, as determined by the syllable count of the verb, suggests a universal principle in compound processing.

The structure [NOUN –DISYLLABIC VERB]ADJ – NOMINAL HEAD was chosen to be the target structure for the experiment with Chinese-English bilingual children and English-speaking monolingual children because it appears in both Chinese and English with a significantly lower frequency in Chinese than in English. While Chinese is a language rich in compounds, both the [VERB-OBJECT] ADJ-NOMINAL HEAD structure and the [OBJECT-VERB] ADJ-NOMINAL HEAD structure are low in frequency. In a list of the most frequent 5,000 Chinese words compiled by the Beijin Language and Culture University (Chinese Proficiency Test, 2010), only 13 out of the 5,000 most frequent words bears the structure of [VERB-OBJECT] ADJ-NOMINAL HEAD and none bears the structure of [OBJECT-VERB] ADJ-NOMINAL HEAD. A search on Google corpora, the most powerful and comprehensive existing text search engine to date, was conducted to investigate the relative frequencies of the two structures in English and in Chinese. As summarized in Table 9.1, the frequency of the least common adjectival compound with the [VERB-OBJECT] ADJ-NOMINAL HEAD structure on the Chinese Proficiency Test list is about 50 times greater than a frequent adjectival compound with the [OBJECT-VERB] ADJ-NOMINAL HEAD structure. Contrastively, in English, the frequency of a more common adjectival compound with the [VERB-OBJECT] ADJ-NOMINAL HEAD structure, *breakneck*, is about a quarter of the frequency of a somewhat common adjectival compound with the [OBJECT-VERB] ADJ-NOMINAL HEAD structure, *heart-breaking*. Therefore, if any advantage is observed in processing adjectival compounds with the [OBJECT-VERB] ADJ-NOMINAL

Table 9.1 Token frequencies of high-frequency adjectival compounds in English and in Chinese retrieved from Google Corpora

	English		Chinese	
Order	Adjectival compound	Token frequency	Adjectival compound	Token frequency
Verb-object	Breakneck	8,270,000	收-音-機 *shou-yin-ji* receive-sound-machine	49,900,000
Object-verb	Ground-breaking	32,900,000	垃圾-處理-廠 *lese-chuli-chang* garbage-process-factory	1,250,000

Table 9.2 Number of participants with different degree of experience in Chinese at home (N = 29)

	Percentage of talk in Chinese					
	0 %	25 %	50 %	75 %	100 %	N.A.
Talk directed to the participant by other family members	1	3	6	7	12	
Talk by the participant	3	9	6	7	4	
Talk between the participant and the sibling(s)	7	9	4	0	3	6

HEAD structure in English among the Chinese-English bilinguals, it cannot be explained by a cross-language transfer account, but instead the presence of parallel compound structures in Chinese, which allows Chinese-English bilingual children for comparison and to attend to these shared cross-linguistic structural regularities.

Method

Participants. The participants included 28 monolingual English-speaking children (*Mean* = 116 months; *SD* = 11) and 29 Chinese-English bilingual children (*Mean* = 112 months; *SD* = 14) in grade 3. The Chinese-English bilinguals were recruited from two weekend heritage Chinese schools in a Chicago suburb. The monolingual children were recruited from an elementary school in the same school district. Findings from the parental surveys indicate that the two groups were comparable in SES. None of the participants had documented learning disability.

The monolingual children were all native speakers of English and none of them had regular exposure to another language. Parents of all the bilingual children were native speakers of Chinese. Only three of the bilingual children were not born in the US: one immigrated to the US at the age of one; one at the age of two, and the other one at the age of seven. Of the 27 children who were either born in the US or immigrated to the US before the age of two, the mean age at which they started to attend an English-speaking daycare or being cared by an English-speaking babysitter was 3 (*SD* = 1); the mean age at which they started to attend weekend Chinese school was 5.24 (*SD* = 1.6). Table 9.2 summarizes the percentage of Chinese used at home

by the participants and their family members. As can be seen, the majority of the parents (63 %) spoke Chinese to their children more than 75 % of the time; only 36 % (N = 11) of the children spoke Chinese to other members in the family more than 75 % of the time; among the 23 participants with siblings, only 3 of them spoke Chinese to their siblings more than 75 % of the time. 11 (37 %) of the participants have at least one family member who did not speak English and could only communicate in Chinese. The mean hours participants spent on assignments in Chinese every week was 2.32 (*SD* = 1.13); 6 of the participants reported that they took additional Chinese class for an average of 1.2 hour (*SD* = .91) every week; 3 of the participants reported they took additional weekly class in Chinese. Participants' rating of their interest in attending weekend Chinese school was 3.39 (*SD* = .92) on a scale of 5, with 1 being not interested at all and 5 being very interested.

Instrument and procedures. A two-option forced-choice test in English was developed to assess the children's awareness of the [OBJECT- DISYLLABIC VERB] ADJ-NOMINAL HEAD structure. The test consisted of a total of 24 questions, in which half of them were filler questions. Each question consisted of a prompt with a brief description of a novel device and two novel compounds as choices. For example, *Dr. Kazer's five dogs are fed by a robot. Which of the two names for this robot sounds better? A dog-feeding robot* or *a feeding-dog robot.* The two novel compounds as the choices of each question had the same verb, object and head noun, but differed in two respects. In the less confusable condition, the verb and the noun were in the same order but only one of the verbs was disyllabic with the suffix *–ing* (e.g., *dog-washing* vs. *dog-wash*). In the more confusable condition, the two choices had the same object and the *–ing*-suffixed verb, but the order of the two differed (e.g., *dog-washing* vs. *washing-dog*). The two conditions were labeled by confusability for two reasons. First, contrasting two choices with different words, as in the less confusable condition, should presumably be easier than contrasting two choices with the same words but in different word order, as in the more confusable condition. Second, to select the correct answer in the more confusable condition, which contains the [OBJECT VERB] word order, participants would have to overcome the inclination to select the option with the structure of [VERB OBJECT], which follows the canonical word order in both English and Chinese.

The words in the prompt and the component words used to form the novel compounds in the experiment are all high frequency English words. The descriptions and the choices were read to the children to minimize any variance in decoding. Students were first told a story about a creative inventor and then instructed to select a better name for each novel device the inventor developed based on the description provided for each question. To minimize effect of structural syntactic priming (Bock & Griffin, 2000; Bock, Dell, Chang, & Onishi, 2007; Chang, Dell, Bock, & Griffin, 2000), half of the descriptions of the novel devices in each condition as well as in the filler questions were in active voice with the verb preceding the object, and the other half were in passive voice with the verb following the object.

A short-term memory assessment was also administered because the ability to retain information in the prompt may affect their performance on the task. Short-term memory was assessed in a forward digit-span task. In this task, children were

Table 9.3 Means and standard deviations of proportion correctedness for the short-term memory, compound morphology and syntax acquisition tasks by language group

	Monolingual		Bilingual	
	M	*SD*	*M*	*SD*
Short-term memory	5.18	1.01	5.26	2.03
Compound morphology				
More confusable	.77	.18	.86	.18
Less confusable	.89	.14	.87	.17
Syntax acquisition	.60	.22	.75	.21

asked to repeat increasingly long strings of digits presented auditorily. Digits were ordered randomly in each string with two constraints: (1) None of the digits appeared more than once in strings with less than 9 digits; and (2) None of the digits appeared more than twice in strings with 10 or more digits. The digit strings were pre-recorded at a rate of one second per digit with a digital audio recorder in a phonetic lab. When an error was made, the child was tested with another digit string of the same length. Testing terminated when errors were made again with a digit string of the same length. The child's score was the number of digits in the last correct series.

Results and Discussion

Because participants were instructed to make their best choice based on their own judgment and do not skip any questions, there was no missing answer. Therefore, proportion of correct judgments rather than d-prime scores were used in the analysis. Descriptive of the results are summarized in Table 9.3. The reliability for the test (Cronbach's alpha) is .86.

Results from the short-term memory task are also summarized in Table 9.3. A one-way ANOVA on the scores revealed no effect of group, $F\,(1, 55) = .034$, $p = .85$. No correlation was found between short-term memory and performance morphological awareness task, $r = .04$, $p = .77$.

One-sample t-tests against chance level (.50) were first performed on the proportion of correct judgments on the morphological awareness task by condition and group. Participants from both groups performed significantly higher than that would be expected by chance across both conditions (monolingual: less confusable, $t\,(27) = 15.10$, $p < .001$; more confusable, $t\,(27) = 8.2$, $p < .001$; bilingual: less confusable, $t\,(28) = 11.80$, $p < .001$; more confusable, $t\,(28) = 10.92$, $p < .001$), which suggests that both groups of children had developed awareness of formulating adjectival compounds with the [OBJECT-DISYLLABIC VERB] ADJ-NOMINAL HEAD structure.

A repeated measure analysis of variance was performed with Group as the between-subject variable and Condition as the within-subject variable. Results revealed a significant interaction between Group and Condition, $F\,(1, 55) = 4.93$, $p < .05$, $\eta^2 = .08$. Further analysis revealed that the monolingual English-speaking

children scored significantly higher in the less confusable condition than in the more confusable condition, F (1, 27) = 8.82, $p < .01$, $\eta^2 = .25$. The Chinese-English bilinguals performed slightly better in the less confusable condition than in the more confusable condition, but the difference did not reach statistical significance, F (1, 28) = .07, *n.s.* Furthermore, the Chinese-English bilinguals and the English-speaking monolinguals did not differ on the less confusable condition, F (1, 55) = .22, *n.s.*, but on the more confusable condition, the Chinese-English bilinguals performed significantly better than the English-speaking monolinguals, F (1, 55) = 4.50, $p < .05$, $\eta^2 = .06$.

Taken together, the results suggest that while both groups of children had developed awareness of formulating adjectival compounds with the [OBJECT-VERB] ADJ-NOMINAL HEAD structure, the Chinese-English bilingual children were more able to attend to such structure in the more confusable condition than the English-speaking monolingual children. Consistent with *structural sensitivity theory* (Kuo & Anderson, 2010), the findings show that having access to two languages allow children to compare and contrast structural features of language at a more abstract level and develop more advanced metalinguistic awareness than their monolingual peers. It should be noted that because the [OBJECT-VERB] order in adjectival compounds has a significantly lower frequency than the [VERB-OBJECT] order in Chinese, a simple cross-language account, which would predict that the Chinese-English bilingual would perform worse in the more confusable condition, cannot explain the results. Results from the experiment corroborate findings on bilinguals' enhanced ability to direct their attention to aspects of information relevant to a particular task and inhibit irrelevant information (e.g., Martin-Rhee & Bialystok, 2008; Bialystok, 2009), such as potential inference of the dominance of [VERB-OBJECT] order in adjectival compounds from Chinese in this case.

Experiment 2: Bilingualism and Syntactic Processing

The purpose of this experiment is to examine whether bilinguals' advantage in structural sensitivity extends to the domain of syntax. Syntax refers to the way words and phrases of different lexical categories (i.e., part-of-speech) are allowed or required to co-occur in a language. For example, in English, the presence of an article (e.g., *a, the*) always predicts the presence of a following noun. An adjective can occur between an article and a noun, but it is optional (i.e., ARTICLE + (ADJ) + NOUN). Languages vary considerably in the way the words and phrases are categorized lexically and the way they are required or allowed to co-occur to form grammatical sentences (e.g., Bloomfield, 1933; Harris, 1951).

In Experiment 2, Chinese-English bilingual children and English-speaking monolingual children were compared on their ability to acquire the syntax of an artificial language. Because the syntax of the artificial language does not exist in the bilinguals' linguistic repertoires, confounding factors present in previous research (e.g., Ben-Zeev, 1977; Bialysotk, 1986a; Kovacs & Mehler, 2009; Nation &

McLaughlin, 1986), such as cross-language transfer or effect of literacy instruction, can be isolated. Drawing upon *structural sensitivity theory* (Kuo & Anderson, 2010), it is hypothesized that because bilingual linguistic experience requires these children to constantly shift between two syntactic systems, they should develop more enhanced sensitivity to the distribution of syntactic units than their monolingual peers.

Method

Participants. The participants were the same as the ones described in Experiment 1.

Description of the syntax of the artificial language. The syntax of the artificial language was adapted from the one used by Saffran (2002). Below is a description of the syntax, where S representing a sentence, P representing a phrase, and all other letters representing one lexical category:

$$\mathrm{S} \rightarrow AP + BP + (CP)$$

$$AP \rightarrow \mathrm{A} + (\mathrm{D})$$

$$BP \rightarrow CP + \mathrm{F}$$

$$CP \rightarrow \mathrm{C} + (\mathrm{G})$$

Each lexical category consisted of two to four monosyllabic pseudo-words which conforms the phonotactic constraints of English. The syntax of this artificial language contains the type of predictive structure found in natural languages (Aslin, Saffran, & Newport, 1998; Rescorla, 1966; Saffran, 2001a, b). For example, in phrase A, words from category A can occur without words from category D, but the presence of words from category D perfectly predicts the presence of words from category A. The same relationship is present between C words and G words. In a similar vein, B phrases can occur without G words, but if a G word is present, a B phrase must precede it. Figure 9.1 presents a summary of the syntax, vocabulary, sample phrases and sentences used in Experiment 2.

Importantly, the directionality of the syntax of the artificial language is the opposite of the English and Chinese (Saffran, 2002). In both English and Chinese, predictors precede the member of the phrase that they predict. For example, in English, articles precede nouns; in Chinese, the object marker *ba3* precedes objects. Any attempt to project English or Chinese syntax onto the artificial language should have resulted in poor learning outcomes.

Each test trial consisted of a pair of sentences: a novel grammatical sentence that was not present in the study list and an ungrammatical sentence. The study and test lists were pre-recorded with a digital audio recorder in a phonetic lab by a native-speaker of English.

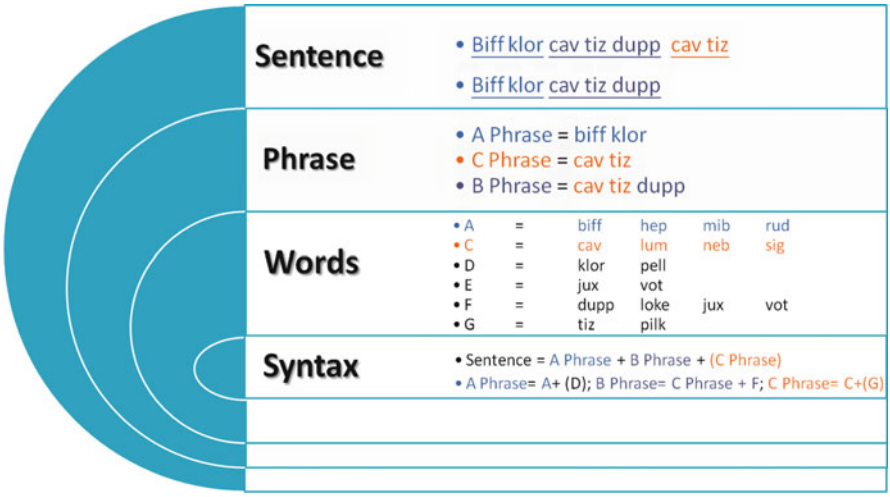

Fig. 9.1 Syntax, vocabulary and sample phrases and sentences used in the syntax acquisition task (Adapted from Saffran, 2002)

Experimental procedures. The experiment contained three phases: Practice phase, study phase and test phase. In the practice phase, children were told that languages vary in the way words can be combined and the goal of the activity was for the researcher to find out how they acquired a new language. There were two practice trials. Each trial consisted of two sentences composed of the same real English words but the words were in different order. Children were informed that they would hear two sentences on each trial and should indicate on their test sheet whether the first or the second sounded more like an English sentence. The test sheet contained the item numbers and two lines for each item. Children marked an "X" on the first line if they thought the first sentence sounded more like an English sentence. The syntactically correct sentence in the first practice trial also made sense semantically. The syntactically correct sentence in the second trial did not make sense semantically, which required children to make their judgment based on their syntactic knowledge.

In the study phase, children heard the study list four times. The study list contained sentences generated by the artificial syntax. The full list can be found in the Appendix 1of Saffran (2002). Following previously used procedures for statistical learning with young children (e.g., Kuo & Anderson, 2010, 2012; Saffran, 2002), an activity was developed to keep the children engaged during the study phase. They watched a PowerPoint slide presentation with pictures of extraterrestrial creatures while listening to the study list. They were instructed that they were going to learn a language from Mars and needed to listen to the sentences carefully. None of the pseudo-words used during the study phase was associated with any of the referents in the PowerPoint slides. The study phase lasted about 20 min.

Immediately following the study phase was the test phase, in which children heard two sentences on each trial through the headphone and indicated which of the two sounded more like the language from Mars they had just heard. Below is a sample of the stimuli of sentences used in the test phase:

Rud pell neb dupp
Rud pell dupp

Each sentence contained no more than 5 single syllable pseudo-words. A full list of the stimuli used in the study phase can be found in the Appendix 2 of Saffran (2002). No visual presentation was involved in the test phase.

Results and Discussion

Proportion of correct judgments for the syntax acquisition task was calculated and the results are also summarized in Table 9.3. Because the ability to retain information in short-term memory may be related to the acquisition of grammatical rules (e.g., Martin-Rhee & Bialystok, 2008; Kuo & Anderson, 2010), correlational analysis was first performed between short-term memory and performance on the syntax acquisition task. The analysis revealed no correlation between the two variables, $r = .09$, $p = .51$. The finding is somewhat inconsistent with the results reported from the experiments with phonotatic learning in Kuo & Anderson (2012), where a significant correlation was found between short-term memory and the performance on the language acquisition task. The difference may be attributed to the fact that none of the test stimuli used in this experiment was present in the study phase, whereas in Kuo & Anderson (2012), half of the test stimuli were present in the study phase.

To examine whether participants succeeded in learning the artificial syntax, one-sample t-tests against chance level (.50) were performed on scores from artificial syntax task by Group. The results show that participants from both groups performed significantly better than would be expected by chance (monolingual: $t(27) = 2.41$, $p < .05$; bilingual: $t(28) = 6.34$, $p < .001$). The finding suggests that both groups could successfully discriminate sentences that followed the experimentally manipulated artificial syntax from those that violated them. Consistent with previous research on statistical learning of language with monolingual speakers of diverse age groups and language backgrounds (e.g., Chambers, Onishi, & Fisher, 2002, 2003; Kuo, 2009; Kuo & Anderson, 2012; Onishi, Chambers, & Fisher, 2002; Saffran, 2000), the results revealed that both groups of children were able not only to learn the syntax of the artificial language but also to generalize the grammar to new contexts.

The effect of bilingualism on the acquisition of syntax was evaluated in a one-way ANOVA. Because there is no group difference in short-term memory and short-term memory was not correlated with performance on the syntax acquisition task, it was not included as a covariate in the analyses. A significant effect of group was

found, F (1, 55) = 6.67, $p < .05$, $\eta = .11$, with the Chinese-English bilingual group outperforming the monolingual group.

Because the directionality of the predicative syntax used in the experiment was the opposite of English and Chinese, any differences between the Chinese-English bilingual group and the monolingual English-speaking group cannot be explained by a cross language transfer account or attributed to effect of language instruction. Taken together, these findings suggest that while both the monolingual and the bilingual children were able to acquire the experimentally manipulated syntax, children with experience in two languages acquired the regularities more efficiently than their monolingual peers.

General Discussion

While bilingualism may have an impact on children's language development through various avenues, including cross-language transfer of literacy skills unique to a specific language—L2 instruction focusing children's attention to form, it is of equal theoretical significance to identify the linguistic consequences of bilingualism per se, that is, being exposed to two linguistic systems on a regular basis. Achieving this goal requires evidence from research that can isolate factors associated with but not an intrinsic aspect of bilingualism. Many Chinese-speaking children around the world speak a second language, usually one that is typologically distant from Chinese, which provides a fertile ground for studying this aspect of bilingual consequences.

The present study with Chinese-English bilingual children was conducted to determine whether bilingual advantage in structural sensitivity identified in phonological processing (Kuo & Anderson, 2010, 2012; Kuo et al., 2011) extends to other linguistic domains, namely morphology and syntax. The dominant language of the bilingual children at the time of the study was English, but they had consistent exposure to Chinese at home and received weekly literacy instruction in Chinese. Experiment 1 compared Chinese-English bilingual children to English-speaking monolingual children on the way they constructed novel adjectival compounds with a verb and an object. While both groups had acquired the structure of [OBJECT-DISYLLABIC VERB] ADJ-NOMINAL HEAD in English, the bilinguals children outperformed their monolingual peers in the more confusable condition, in which they need to inhibit potential distraction from the canonical word order of subject-verb-object and attend to the structure of [OBJECT-DISYLLABIC VERB] ADJ-NOMINAL HEAD. Because the structure of [OBJECT-DISYLLABIC VERB] ADJ-NOMINAL HEAD has a fairly low frequency in Chinese, and the majority of the adjectival compounds in Chinese bears the structure of [VERB-OBJECT], the observed advantage cannot be explained by a cross-language transfer account. Instead, the findings are consistent with the prediction made by structural sensitivity theory (Kuo & Anderson, 2010), which postulates that having access to two linguistic systems allows bilingual children to compare and contrast structural properties of language, thereby attending to more abstract level of linguist structures.

Experiment 2 focused on how bilingual and monolingual children differed in the way they acquired novel syntax. The syntax of the artificial language contains the type of predictive structure found in natural languages but the directionality of the syntax is the opposite of the English or Chinese (Saffran, 2002). The superior performance of the bilinguals on the task replicates previous research comparing bilinguals or multilinguals to monolinguals in the acquisition of novel syntax (Kovacs & Mehler, 2009; Nation & McLaughlin, 1986). The more refined design of the current experiment further reinforces evidence for bilingual advantage in this process.

The two experiments reported in this chapter have several limitations that should be considered in future studies. First, because of the time constraint, the language proficiencies of the children were not formally assessed. Given that the experiments examined the processing of linguistic structures that either are more prominent in the second language of the bilingual children or exist in neither of the bilinguals' two languages, lack of the proficiency data may not affect the results significantly as it could be in other studies on bilingual language development. In Experiment 1, the examined structure was a word formation rule in English, the native language of the monolingual children and the dominant language spoken by the bilingual children. Previous research has consistently shown that bilingual children tend to lag behind their monolingual peers in language proficiency (e.g., Bialystok, McBride-Chang, & Luk, 2005; Oller & Eilers, 2002). Therefore, it would be plausible to assume that the Chinese-English bilinguals' proficiency in English would be at best on par with their English-monolingual peers and any disparities in English proficiency between the two groups should favor the English-speaking monolingual children. Experiment 2 focused on the acquisition of a novel syntactic rule that exists neither in English nor Chinese. Therefore, participants' language proficiencies in English or Chinese should have little direct impact on the group comparison results. Nonetheless, because previous research has demonstrated that the degree of bilingualism is crucial in determining its cognitive and linguistic consequences (Bialystok, McBride-Chang, & Luk, 2005), had proficiency data been collected, a more comprehensive understanding of the way bilingualism affects metalinguistic development and language processing could have been obtained.

Second, in addition to the degree to which a child is bilingual, another factor that may intercede and modify the linguistic consequence of bilingualism is the child's age (Bialystok, 2001). Most of the bilingual advantages in the linguistic domain observed in previous research disappeared by first grade (e.g., Bruck & Genesee, 1995; Chen, Anderson, Li, Hao, Wu, & Shu, 2004). Participants in the experiments reported in this chapter were third graders, well beyond the age by which bilingual advantage was identified among bilingual children in previous research. The disparity may arise from differences in the tasks being used or the domain of linguistic knowledge being examined. A cross-sectional study concurrently investigating the development in phonological, morphological and syntactic processing would pinpoint the role of age in studying the impact of bilingualism. Future studies in these directions should provide a more integrated view of the linguistic consequences of early bilingualism.

Acknowledgement This research was supported by a Summer Research and Artistry Grant and a College of Education Deans' grant from Northern Illinois University awarded to Li-Jen Kuo.

We are grateful to Chih-Ping Lo, Elena Lyutykh and Fred Lu for their assistance with data collection. We also thank the students, teachers, and administrators who so graciously participated in or facilitated this research.

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Chapter 10
Contributions of Phonology, Orthography, and Morphology in Chinese-English Biliteracy Acquisition: A One-Year Longitudinal Study

Min Wang, Candise Y. Lin, and Chen Yang

Abstract This short-term longitudinal study followed 50 Chinese-English bilingual children from Grade 1 to Grade 2 to investigate the contribution of phonology, orthography, and morphology to biliteracy acquisition across time and across languages. Cross-language cross-time transfer was evident that Chinese onset awareness in Grade 1 predicted English real word reading in Grade 2. Within language across time, Chinese rime awareness at Grade 1 was a significant predictor of Chinese character reading in Grade 2. English phonemic awareness in Grade 1 accounted for unique variance in English real and pseudoword reading in Grade 2. These results highlight the importance of phonological awareness in long term reading development in bilingual children.

Keywords Biliteracy development • Phonology • Orthography • Morphology • Chinese reading • English reading • Cross-time cross-language transfer

Introduction

Phonology, orthography, and meaning are three of the major lexical constituents that contribute to reading development (e.g., Plaut, McClelland, Seidenberg, & Patterson, 1996; Seidenberg & McClelland, 1989). The keys to being a successful reader, thus, are the development of awareness of and the ability to manipulate phonological, orthographic, and meaning units (also referred to as morphological units) in a given word. Research on biliteracy acquisition has shown that these three lexical components are also important for children learning to read in two languages

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_10,

simultaneously. Furthermore, phonological, orthographic, and morphological awareness in one language can be transferred and facilitate reading development in the second language. This cross-language transfer has been observed in bilingual children learning to read two typologically similar orthographies (e.g., Spanish and English: Lindsey, Manis, & Bailey, 2003; Ramirez, Chen, Geva, & Kiefer, 2010; French and English: Deacon, Wade-Woolley, & Kirby, 2007, 2009; Jared, Cormier, Levy, & Wade-Woolley, 2010) as well as children learning to read in two typologically distant orthographies (e.g., Arabic and English: Saiegh-Haddad & Geva, 2008; Chinese and English: Cheung, Chung, Wong, McBride-Chang, Penney, & Ho, 2010; McBride-Chang & Ho, 2005; Wang, Perfetti, & Liu, 2005; Wang, Yang, & Cheng, 2009; Korean and English: Cho & McBride-Chang, 2005; Kim, 2009; Wang, Park, & Lee, 2006; Wang, Ko, & Choi, 2009). However, since most of the transfer studies used cross-sectional design, it remains unclear how cross-language transfer of metalinguistic awareness influences reading development over time. A longitudinal design provides an opportunity to identify the possible causal relation between the three lexical constituents and biliteracy acquisition.

In the present 1-year longitudinal study, we examined the development of phonological, orthographic, and morphological skills and their relation to word reading outcome in a group of Chinese-English bilingual children. We were particularly interested in cross-time cross-language and cross-time within-language predictions from the three lexical constituents to reading skills in two typologically distant orthographies.

Contribution of Phonological Awareness to Biliteracy Development

Phonological awareness is defined as the ability to perceive and manipulate the sound units in spoken language (Goswami & Bryant, 1990). According to the Psycholinguistic Grain Size Theory proposed by Ziegler and Goswami (2005), the emergence of phonological awareness follows a continuum in which sensitivity to large phonological units develops first, followed by sensitivity to smaller phonological units. In other words, children first develop sensitivity to syllables, which are the largest phonological units, followed by their sensitivity to onsets and rimes, and finally their sensitivity to phonemes, which are the smallest phonological units.

Research with bilingual children has shown that awareness to each level of the phonological units makes significant contribution to biliteracy development. McBride-Chang and colleagues (2008b) examined reading development in a group of 5-year-old Cantonese children learning to read Chinese characters and English alphabets simultaneously in Hong Kong. The researchers found that syllable awareness in Cantonese accounted for a significant amount of unique variance in both Chinese character and English word recognition after controlling for age, expressive vocabulary, nonverbal IQ, and working memory. In a longitudinal study, Chow, McBride-Chang, and Burgess (2005) found that syllable awareness in Chinese

uniquely predicted both concurrent (when children were tested at the age of 4.88 years) and subsequent (when children were tested nine months later) English reading.

Wang et al. (2009) studied reading development in Chinese-English bilingual children who resided in the United States. Chinese phonological awareness were assessed using an oddity task in which children were presented with three syllables and they had to determine which one of the three syllables differs from the other two in onset, rime, or tone. The researchers found that awareness to Chinese onset, but not rime, was a significant predictor of concurrent English real word and pseudoword reading after controlling for age, oral vocabulary, and morphological awareness in English. Rime awareness did not contribute to English reading probably because the difference in rime structure between the two languages. The rime structure in Chinese contains a vowel (e.g., /da/) or an vowel plus one of the two codas, /n/or /ŋ/ (e.g., /dan/). In comparison, the rime structure in English is more complex and unpredictable because English allows many consonants in coda position. Interestingly, Wang et al. (2009) also found that Chinese tone awareness is a unique predictor of concurrent English real word reading. Lexical tones do not exist in English. However, English uses stress to differentiate meanings between lexical items. Since both tone and stress are prosodic features, it is possible that bilingual children's Chinese prosodic sensitivity was transferred to and facilitated reading development in English.

Sun-Alperin and Wang (2010) examined reading development in Spanish-speaking children learning to read English as a second language. Phonemic awareness was assessed using a phoneme deletion task in which children were presented with a pseudoword and asked to reproduce the word without saying the initial, medial, or final phoneme (e.g., say "mab" without /m/). The researchers observed a bi-directional transfer effect in which Spanish phonemic awareness predicted concurrent English reading and English phonemic awareness predicted Spanish reading. The writing systems of both English and Spanish are alphabetic. Children learning to read English and Spanish simultaneously utilize the same grapheme to phoneme mapping principle.

The Contribution of Morphological Awareness to Biliteracy Development

Morphological awareness is defined as an individual's awareness of the morphemic structures of words and the ability to reflect on and manipulate those structures (Carlisle, 1995). There are three ways in which a monomorphemic word can be changed into a morphologically complex word: inflection (e.g., adding the plural maker *–s* to a noun as in *cats*), derivation (e.g., adding the negation prefix *–un* to an adjective as in *unhappy*), and compounding (e.g., combining two monomorphemic stems as in *bathroom*). Morphological awareness differs from vocabulary knowledge. Morphological awareness emphasizes the awareness of the word internal

structure in terms of meaning units, whereas vocabulary knowledge emphasizes knowledge of the meaning of a word as a whole rather than the individual constituent meaning units. Obviously, understanding of morphemic units within a word facilitates understanding of meaning of the whole word.

It is important to note that there is a close relationship between morphological awareness and phonological awareness. Phonological sensitivity may provide a foundation for morphological learning. Because a cluster of sounds represent each morpheme, children must learn to segment the speech stream and identify those recurring sound units prior to identify the sound units that bear certain meaning function. Because two of the same morphemes can share the same or similar phonology, it is also possible that the observed morphology effect is indeed a sort of phonology effect. Hence, in studying the role of morphological awareness in learning to read, it is necessary to tease apart phonological awareness.

Deacon et al. (2007) is among the very few studies that have examined inflectional awareness in biliteracy development using a longitudinal design. The researchers followed a group of 58 English-speaking children enrolled in a French immersion program over a 3-year period. Each year, children's inflectional awareness was assessed using a sentence analogy task. Children were presented with a pair of example sentences that reflected a tense change, such as "Chris bought a car" and "Chris is buying a car" and they were asked to make the same kind of change to another sentence, such as "Chris ate the noodles" and the correct answer was "Chris is eating the noodles" (e.g., changing the target verb from the past tense to the present tense). English inflectional awareness measured in Grade 1 predicted French reading in Grades 1, 2 and 3 after verbal and nonverbal IQ, phonological awareness and French inflectional awareness had been controlled. French inflectional awareness in Grade 2 also predicted English reading in Grades 2 and 3. These results demonstrated that morphological awareness makes unique contribution to literacy acquisition over and above phonological awareness. In addition, the contribution of morphological awareness is stable and consistent over a long period of time.

Researchers have found that derivational awareness facilitates reading development in bilingual children only if derivation is a productive morphological structure in both languages. For example, in both Korean and English, derivational affixes are frequently used to create new words. Wang, Ko, and Choi (2009) found that awareness to Korean derivational morphology accounts for unique variance in concurrent English word reading after controlling for age, English oral vocabulary, English phonological and morphological awareness and Korean phonological awareness. Compound words are the most universal type of complex words (Dressler, 2006). Contribution of compound awareness to biliteracy development has been consistently reported in Chinese-English bilinguals (Cheung et al., 2010; Wang, Cheng, & Chen, 2006; Wang, Yang, & Cheng, 2009; Zhang, Anderson, Li, Dong, Wu, & Zhang, 2010). Cheung et al. (2010) studied Cantonese speaking children who were learning to read in Chinese and English. Compound awareness was assessed using a morphological construction task in which children were asked to come up with a novel word that follow the compounding rule to label a novel object or concept. For example, children heard the description "Early in the morning the sun comes up, and this

is called *sunrise*. At night, we see the moon come up. What could we call this?" The correct answer was *moonrise*. Overall, compound awareness in Chinese was a significant predictor of English word reading after controlling for age, IQ, English phonological and morphological awareness, and English speech perception. Results from this study demonstrated that contribution of morphological awareness to Chinese-English biliteracy development was above and beyond phonological awareness as well as perceptual sensitivity to speech sounds. Since neither derivation nor inflection is a productive word formation strategy in Chinese and Wang, Cheng, and Chen (2006) did not observe transfer of derivational awareness in their Chinese-English bilingual children, we decided to focus on compound awareness in the present study.

The Contribution of Orthographic Awareness to Biliteracy Development

Orthographic awareness is defined as children's understanding of the conventions used in the writing system of their language (Treiman & Cassar, 1997). The contribution of orthographic awareness to biliteracy development has been consistently reported across language dyads that shared the same writing systems (e.g., Spanish and English: Sun-Alperin & Wang, 2008, 2010; French and English: Deacon, Wade-Woolley, & Kirby, 2009). Spanish, French, and English all use the Roman alphabetic script, although the orthographies of French and Spanish are more transparent which means that the grapheme-phoneme mapping is more consistent in French and Spanish than in English. Given the close connection between orthography and phonology in alphabetic writing systems especially in transparent alphabetic orthographies, it is important to take into consideration phonological awareness when addressing the role of orthographic awareness in learning to read.

Deacon et al. (2009) examined orthographic awareness in 76 native English-speaking children enrolled in a French immersion program in Canada. In the orthographic processing task, children chose between alternative spellings for pseudohomophones (e.g., *brain* and *brane* in English and *livre* and *lyvre* in French). French orthographic awareness was a unique predictor of concurrent English word identification after controlling for IQ, phonological awareness, and English morphological and orthographic awareness. Similarly, English orthographic awareness accounted for unique variance in French word identification. Sun-Alperin and Wang (2010) also found concurrent transfer of orthographic awareness in their study with Spanish-English bilingual children.

Despite the consistent findings of transfer between two alphabetic scripts, the contribution of orthographic awareness to biliteracy development was not observed in Korean-English bilingual (Wang, Park, & Lee, 2006) and Chinese-English bilingual children (Gottardo, Siegel, Yan, & Wade-Woolley, 2001; Wang et al., 2005, 2009). The Korean writing system, Hangul, is alphasyllabary in which each Hangul character maps onto a syllable but each grapheme within a Hangul character maps

onto a phoneme. The Chinese writing system is logographic in which each character maps onto a syllable and a morpheme. The writing systems of Korean and Chinese are typologically distant from that of English, as both Chinese and Korean have a non-linear visual configuration. Therefore, children's understanding of the writing conventions in English is less likely to be applied when reading Chinese or Korean. We included orthographic awareness as one of the predictors in the current study to examine the potential long-term effects of orthographic processing on reading development.

The Current Study

The current study was the extension of Wang et al. (2009). We followed the same group of children for 1 year and tested them again in Grade 2 using the same measures. This longitudinal design allowed us to examine the possible cross-time transfer of the three lexical components in long-term reading development. Most of the studies reviewed previously only examined one or two of the lexical components at one time. The current study would make a novel contribution by concurrently investigating all three significant lexical factors in biliteracy development. Incorporating both cross-language and cross-time comparisons in a longitudinal design may offer an opportunity to test the potential causal relationship between phonology, orthography, morphology and reading in biliteracy development.

Method

Participants

The participants were Chinese immigrant children from the greater Washington, DC area. They were enrolled in American public school during weekdays and Chinese heritage language schools on weekends. There were 78 participants at the beginning of the study (see Wang, Yang, & Cheng, 2009 for details). However, for reasons such as children changing to other Chinese schools, children dropping the Chinese class because of their tight schedules, or family moving to other locations where Chinese school was not available, 28 children dropped out of the study (35.9 % of attrition rate). Results reported subsequently were only for the 50 children (23 girls and 27 boys) who had complete data for both Time 1 (Grade 1) and Time 2 (Grade 2). The mean age in Grade 1 was 6.73 years ($SD = .27$ years), and the mean age in Grade 2 was 7.59 years ($SD = 1.01$). Children who were lost from the original sample ($N = 28$) were not statistically different on all of the Grade 1 measures compared to those who remained, except on the Chinese Onset Oddity task. The remained children had a significantly higher score on this task than those who dropped out ($t(74) = 3.143$, $p = .002$).

At the beginning of the study, all 50 children were enrolled in the first grade in both Chinese heritage language schools and English publish schools. All of the children had typically developing English proficiency based on reports from their English school teachers. Children's parents were asked to fill out a short questionnaire regarding basic demographic information and family language and literacy experiences, both in the first and the second year of the study. The following information on children's background is from the second year (Grade 2). About 92 % of the children were born in the United States while 8 % of them were born in China. About 80 % of the children learned Chinese as their first language, 18 % learned English as the first language, and the remaining 2 % learned the two languages simultaneously. About 92 % of the children spoke both Chinese and English at home, 4 % of them only spoke Chinese and the other 4 % only spoke English at home. About 82 % of the parents spoke both Chinese and English at home, 16 % of the parents only spoke Chinese and 2 % only spoke English at home.

Procedure

Testing at Time 1 took place between February and March 2007 and children were in the second semester of Grade 1. Testing at Time 2 occurred within the same interval a year later and children were in the second semester of Grade 2. English naming and Chinese character naming tasks were administered individually and responses were recorded for further coding. All remaining tasks were administered in small groups in quiet classrooms. English and Chinese tasks were separated into two sessions, each lasting approximately 40 min. The order of the tasks in each language was counterbalanced across children.

English Measures

Phoneme Deletion Task. A nonword was presented via a CD player and children were asked how this nonword should be pronounced without a certain sound. Three choices were presented, which correspond to the numbers of "1", "2", and "3" on children's answer sheet. Children were instructed to circle the number that corresponds to the best answer among the choices. A sample item is "*mab*, how would *mab* sound without */b/*? */ab/*, */mab/*, or */ma/*?" There were four practice items and sixteen test items.

Orthographic Choice Task. The task assessed children's sensitivity to the legality of various orthographic patterns in English. Children were shown a pair of nonwords and asked to judge which one appears more like a real English word by circling that word on their answer sheet. A sample item was "tshe" and "shet." Children with orthographic awareness would choose "shet" as the answer because the consonant cluster "ts" cannot occur word-initially in English. There were three practice items and eighteen test items. Children were given two minutes to complete this task.

Compound Structure Task. In both English and Chinese, a compound word is made up of a modifier and a head, which is always the right constituent. The meaning of a compound word is determined by its head morpheme rather than by its modifier morpheme (Andrews, Miller, & Rayner, 2004). Items were presented visually on children's answer sheet and orally via a CD player at the same time. There were three groups of items. The first two groups included items with two morphemes. Children were presented with a riddle followed by two choices and their task was to circle the best answer to the riddle on the answer sheet. A sample item from the first group was "Which is a better name for a bee that lives in the grass? Grass bee? Or Bee grass?" From the second group, an example item was "Which is a better name for grass where a lot of bees like to hide? Grass bee? Or Bee grass?" Items from the first and second groups differed in terms of which morpheme was the modifier or head noun. There were one practice item and six test items in each of the first two groups. The third group consisted of items with three morphemes. Each item began with a riddle, followed by four choices. The items in the third group were not related to those in the first two groups. A sample item from the third group was "If you found a lid for a dish to keep candies in, what would it be called? Dish lid candy? Candy dish lid? Dish candy lid? Or Candy lid dish?" There were one practice item and four test items in this group.

Oral Vocabulary. The Peabody Picture Vocabulary Test—III (PPVT-III, Dunn & Dunn, 1997) was adapted as a measure of receptive vocabulary. Thirty items appropriate for the age range of the children in the current study were selected.

Real Word Naming. A total of 35 words were adapted from the word recognition subtest of the Wide Range Achievement Test-Revised (WRAT-R) (Jastak & Jastak, 1984). Children were instructed to read aloud each of the words shown in a booklet.

Pseudoword Naming. Forty items from the Word Attack subtest of the Woodcock Reading Mastery Test-Revised (Woodcock, 1987) were selected. The testing format was the same as those of the real word naming test.

Chinese Measures

Onset, Rime and Tone Oddity. This task assessed children's ability to differentiate the phonological units in Chinese syllables (e.g., onset, rime, and tone). In each item, three syllables were presented via a CD player and each syllable corresponded to the numbers "1", "2", and "3" on children's answer sheet. Children were asked to circle the number that represents the syllable that do not share the same onset, rime, or tone as the other two syllables. An example item from the onset oddity task was *dé*, *dà*, and *xiě* (¯ for the high-level tone, ´ for the high-rising tone, ˇ for the falling-rising tone, and `for the high-falling tone) and *xiě* was the odd one. A sample item from the rime oddity task was *suì*, *bù*, and *fù* and the correct answer was *suì*. In the tone oddity task, an example item was *bá*, *dé*, and *chī* and the odd one was *chī*. There were two practice items and ten test items in each of onset, rime, and tone oddity.

Orthographic Choice Task. There were two conditions in this task with twelve items in each condition. One condition measured children's sensitivity to the legality

of the radical position. For example, 对 is the illegally comprised non-character in the pair of 对 and 戏 because the radical cannot be placed on the right side of the character. The other condition measured children's sensitivity to the legality of the radical form. One of the paired stimuli contained a component radical with an illegal form, for example, 欢 is the illegal form in the pair of 欢 and 欢. Illegal radicals, such as 又, were created by adding, deleting, or moving a stroke from one location to another within a legal radical. There were three practice items and 24 test items.

Compound Structure Task. Three subgroups were included: the first two groups were similar riddles but differed in which nouns being the modifier. An example from the first group was "长在树上的花叫什么更好呢?树花还是花树?" (Which is a better name for the flower that grows on a tree? A tree flower? Or a flower tree?). An example from the second group was "只长花的树叫什么更好呢?树花还是花树?" (Which is the better name for the tree that grows flowers? A tree flower? Or a flower tree?). In the third subgroup, the riddle was followed by four three-morpheme compound pseudowords. For example, "这里有一棵树, 上面有一只会吃虫子的鸟, 我们应该叫这棵树什么呢? 鸟虫树? 虫鸟树? 树鸟虫? 还是虫树鸟? (There is a tree with a bird that eats bugs, what would it be called? Bird bug tree? Bug bird tree? Bug bird tree? Tree bird bug? Or bug tree bird?). There were ten items in total in this task.

Oral Vocabulary. Thirty items were selected and translated from PPVT—III (Dunn & Dunn, 1997). There was no overlap between the Chinese and English vocabulary test items.

Chinese Character Naming. Twenty-five single characters and fifteen two-character words were selected from the textbooks used in children's Chinese school. Our screening criterion was based upon children's familiarity as rated by the Chinese teachers on a five-point scale with one being not familiar at all and five being very familiar. To ensure that children know most of the characters, we only selected characters that have two points or higher on the familiarity rating.

Hypotheses

We hypothesized that onset and tone awareness in Grade 1 may predict English reading in Grade 2, similar to the finding within Grade 1 in Wang, Yang, & Cheng (2009). This cross-language cross-time prediction can be considered powerful evidence for cross-language transfer of phonological awareness in biliteracy development. We also predicted that English compound structure awareness in Grade 1 may predict Chinese character reading in Grade 2. We did not expect to see transfer of orthographic awareness subsequently. Since previous longitudinal studies with monolingual English children have shown that phonemic awareness is a predictor of subsequent reading development (e.g., Wagner et al., 1997; Muter, Hulme, Snowling, & Stevenson, 2004), we hypothesized that English phonemic awareness in Grade 1 would predict English reading in Grade 2. Likewise, since previous longitudinal research in monolingual Chinese children has shown that phonological awareness predicted subsequent character recognition (e.g., Huang & Hanley, 1997; Ho &

Bryant, 1997), we expected that Chinese onset, rime, or tone awareness in Grade 1 would uniquely predict Chinese character reading in Grade 2. We also expected that Grade 1 morphological awareness in Chinese and English would uniquely predict Grade 2 reading in their respective languages.

Results

Reliability Alpha values, Means and Standard Deviations are listed in Table 10.1. Reliabilities of all the measures (Cronbach's α) ranged from 0.30 to 0.94. The reliability for the orthographic choice task was relatively low for both grade levels in both languages (Grade 1 Chinese $\alpha = 0.45$, Grade 2 Chinese $\alpha = 0.39$, Grade 1 English $\alpha = 0.59$, and Grade 2 English $\alpha = 0.30$). Results from a series of ANOVAs on different tasks in which the language (Chinese vs. English) was the independent variable are presented in Table 10.1. Children in Grade 2 scored significantly higher accuracy than those in Grade one in all tasks. This indicated that the bilingual children had made positive language and reading development over 1 year, without either of their languages lagging behind.

Correlations Among the Predictors and Reading Variables

Within-time correlations among all of the Chinese and English tasks in Grade 1 and Grade 2 are shown in Table 10.2. Correlations within Grade 1 are below the diagonal and correlations within Grade 2 are above the diagonal. Stability coefficients (correlations of the same task between Grade 1 and Grade 2) are shown along the diagonal. Children's performances on all of the tasks were highly correlated across times, except the English and Chinese orthographic choice tasks, Cross-time correlations among all of the Chinese and English tasks in Grade 1 and Grade 2 are shown in Table 10.3. The upper-right and the lower-left matrixes show the cross-time cross-language correlations. The stability coefficients are inside the character borders on the diagonal.

Grade 2 English real word reading was significantly correlated with Grade 1 English phoneme deletion ($r = .320$, $p = .025$), Grade 2 English compound structure ($r = .314$, $p = .026$), Grade 1 Chinese onset awareness ($r = .290$, $p = .043$), Grade 2 Chinese rime awareness ($r = .300$, $p = .034$) and Grade 2 Chinese oral vocabulary ($r = -.305$, $p = .031$). Grade 2 English pseudoword reading was significantly correlated with Grade 1 English phoneme deletion ($r = .468$, $p = .001$), Grade 2 English phoneme deletion ($r = .452$, $p = .001$), Grade 2 English compound structure ($r = .330$, $p = .019$), Grade 1 Chinese oral vocabulary ($r = -.333$, $p = .018$), Grade 2 Chinese oral vocabulary ($r = .362$, $p = .01$), Grade 2 Chinese onset awareness ($r = .371$, $p = .008$), and Grade 2 Chinese rime awareness ($r = .477$, $p < .001$). There was no significant cross-language correlation with Grade 2 Chinese character reading.

Table 10.1 Reliabilities, mean percentage correct, standard deviations (*SDs*) of all measures in Grades 1 and 2 and F-values of ANOVA (*df* = 1) to compare the performance between Grades 1 and 2

		Reliability (α)	Mean	SD	Mean square	F-value	P
English tasks							
Oral vocabulary	Grade 1	0.65	0.41	0.13	0.688	102.901	.000
	Grade 2	0.70	0.58	0.14			
Phoneme deletion	Grade 1	0.77	0.69	0.22	0.456	21.796	.000
	Grade 2	0.70	0.83	0.16			
Orthographic choice	Grade 1	0.59	0.77	0.13	0.184	18.298	.000
	Grade 2	0.30	0.86	0.08			
Compound structure	Grade 1	0.67	0.60	0.17	0.910	65.888	.000
	Grade 2	0.76	0.79	0.21			
Real word reading	Grade 1	0.82	0.47	0.11	2.080	420.820	.000
	Grade 2	0.65	0.75	0.07			
Pseudoword reading	Grade 1	0.94	0.77	0.17	0.206	19.961	.000
	Grade 2	0.80	0.86	0.08			
Chinese tasks							
Oral vocabulary	Grade 1	0.77	0.58	0.16	0.178	25.683	.000
	Grade 2	0.82	0.67	0.17			
Onset awareness	Grade 1	0.79	0.66	0.27	0.486	11.903	.001
	Grade 2	0.81	0.88	0.20			
Rime awareness	Grade 1	0.83	0.66	0.30	1.188	27.896	.000
	Grade 2	0.75	0.80	0.18			
Tone awareness	Grade 1	0.64	0.50	0.24	0.672	19.182	.000
	Grade 2	0.62	0.66	0.22			
Orthographic choice	Grade 1	0.45	0.69	0.11	0.690	78.683	.000
	Grade 2	0.39	0.85	0.09			
Compound structure	Grade 1	0.38	0.56	0.13	0.121	7.694	.008
	Grade 2	0.55	0.63	0.18			
Character reading	Grade 1	0.81	0.32	0.12	1.437	114.565	.000
	Grade 2	0.91	0.56	0.21			

However, Grade 2 Chinese character reading was significantly correlated with Grade 1 Chinese rime awareness ($r = .318$, $p = .024$), Grade 2 Chinese oral vocabulary ($r = .302$, $p = .033$) and Grade 2 Chinese orthographic choice ($r = .405$, $p = .004$).

Within Grade 1, English real word reading was significantly correlated with English oral vocabulary ($r = .375$, $p = .007$), English compound structure ($r = .302$, $p = .035$), and Chinese phonological awareness ($r = .371$, $p = .009$ for onset awareness; $r = .334$, $p = .018$ for rime awareness; and $r = .392$, $p = .005$ for tone awareness). English pseudoword reading in Grade 1 was highly correlated with English oral vocabulary ($r = .393$, $p = .005$), English phoneme deletion ($r = .337$, $p = .018$), English orthographic choice ($r = .288$, $p = .042$), English compound structure ($r = .411$, $p = .003$), and Chinese onset and rime awareness ($r = .462$, $p = .001$ for onset and $r = .351$, $p = .012$ for rime). Chinese character reading in Grade 1 was significantly correlated with English compound structure ($r = .291$, $p = .045$) and Chinese oral

Table 10.2 Within-time correlations, stability coefficients for all the tasks in Grade1 and Grade2

	Variables in Grades 1 and 2	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Age in Grade 1	----	.217	-.120	-.022	.238	.008	.113	-.330*	.059	.158	.015	-.168	.076	-.314*
							English task								
2	Oral vocabulary	.339*	.633**	.190	-.081	.615**	.173	.135	.076	.303*	.454**	.363**	.297*	.442**	.139
3	Phoneme deletion	.073	.020	.449**	.271	.238	.241	.452**	.002	.369**	.406**	.266	-.013	.176	.201
4	Orthographic choice	-.037	.132	.262	.161	-.050	.144	.158	-.087	.306*	.005	.159	.167	-.020	.078
5	Compound structure	.190	.480**	.222	.212	.631**	.314*	.330*	-.135	.233	.445**	.216	.225	.402**	.168
6	Real word reading	.082	.375**	.255	.258	.302*	.507**	.710**	-.305*	.245	.300*	-.091	.201	-.021	-.024
7	Pseudoword reading	.080	.393**	.337*	.288*	.411**	.743**	.511**	.362**	.371**	.477**	-.031	.106	.071	-.036
				.			*Chinese task*								
8	Oral vocabulary	-.043	.053	.277	.222	-.007	-.251	-.233	.748**	-.113	.049	.073	.126	.257	.302*
9	Onset awareness	.139	.470**	.077	.199	.100	.371**	.462**	.144	.287*	.490**	.143	.083	.074	.045
10	Rime awareness	.079	.384**	.020	.155	.164	.334*	.351*	.192	.729**	.332*	.035	.120	.262	.213
11	Tone awareness	.073	.230	-.141	.274	.052	.392**	.228	-.018	.213	.232	.353*	.165	.217	.252
12	Orthographic choice	.057	-.157	.134	.012	.213	-.036	-.008	.070	-.039	.110	.080	.128	.066	.405**
13	Compound structure	.095	.174	-.038	.120	.240	-.128	-.044	.225	.162	.253	-.103	.038	.394**	.243
14	Character naming	-.182	.142	.068	.133	.291*	.160	.361*	.304*	.244	.263	.130	.261	.272	.680**

Note. Within-time correlations in Grade 1 are shown below the diagonal; within-time correlations in Grade 2 are shown above the diagonal. Stability coefficients are shown with character border on the diagonal. Variables are listed in the same order in Grade 1 and Grade 2
*$p < .05$, **$p < .01$

vocabulary ($r = .304$, $p = .034$). Again, similar to Grade 2 Chinese character reading, there was no significant cross-language correlation between any English measure and Grade 1 Chinese reading.

Hierarchical Regression Analyses

Our primary research question was that whether phonological, orthographic, and morphological awareness could contribute unique variance to reading across time. We first examined cross-language transfer of the three lexical constituents to reading across the grade levels. We were then interested in the within-language prediction of the three lexical components to reading performance from Grade 1 to Grade 2. To preserve more power for the analyses, we did not enter age as a control variable in all regressions because age did not significantly correlate with any variables except Grade 2 Chinese oral vocabulary ($r = -.330$, $p = .019$) and Grade 2 Chinese character reading ($r = -.314$, $p = .026$).

Table 10.3 Cross-time correlations for all the tasks in Grade1 and Grade2

		English Grade 1						Chinese Grade 1						
		1	2	3	4	5	6	7	8	9	10	11	12	13
English Grade 2	1. Oral vocabulary	.633**	-.013	.300*	.407**	.477**	.304*	.123	.418**	.403**	.291*	.111	.195	.112
	2. Phoneme deletion	.123	.449**	.096	.166	.342*	.208	-.120	.133	.270	.036	.003	-.134	-.008
	3. Orthographic choice	-.032	.062	.161	.080	.132	.148	-.154	.076	-.126	.036	-.118	.063	.109
	4. Compound structure	.577**	.231	.131	.631**	.340*	.442**	-.029	.191	.229	.152	.068	.182	.070
	5. Real word reading	.217	.320*	.238	.220	.507**	.493**	-.273	.290*	.027	.256	-.041	-.209	.002
	6. Pseudoword reading	.248	.468**	.250	.155	.497**	.511**	-.333*	.235	131	.244	-.124	-.120	-.110
Chinese Grade 2	7. Oral vocabulary	.053	-.339*	-.300*	-.027	-.265	-.323*	.748**	.090	.135	-.020	-.131	.201	.270
	8. Onset awareness	.188	.274	.297*	.157	.184	.184	-.132	.287*	.089	.102	-.221	-.031	-.032
	9. Rime awareness	.384**	.172	.281*	.192	.298*	.258	-.005	.229	.332*	.295*	-.297*	.113	.003
	10. Tone awareness	.230	.090	.294*	.410**	.315*	.189	.056	.141	.230	.353*	.137	.184	.354*
	11. Orthographic choice	-.157	-.081	.180	.091	.117	.144	.071	.090	.083	.280*	.128	.081	.277
	12. Compound structure	.174	-.005	.148	.538**	.095	.167	.159	.212	.331*	-.006	-.018	.394**	.152
	13. Character naming	.142	-.048	.141	.229	.076	.272	.262	.165	.318*	.166	.083	.127	.680**

Note. Stability coefficients are shown with character border on the diagonal
*p<.05, **p<.01

Table 10.4 Cross-time cross-language hierarchical regression analysis predicting English real word reading in Grade 2 using all tasks in Grade 2 and all Chinese tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 English compound	.334	.111	.111	5.882*	.437**
Step 2	Grade 2 Chinese compound	.428	.183	.072	4.055***	−.317*
Step 3	Grade 1 Chinese onset	516	.266	.083	5.072*	.296*
Step 4	Grade 1 Chinese orthographic	.523	.274	.008	.478	−.073
Step 5	Grade 1 Chinese compound	.541	.293	.019	1.170	−.148

Note. Grade 2 English oral vocabulary, phoneme deletion, and orthographic choice did not survive stepwise in Step 1. Grade 2 Chinese oral vocabulary, onset, rime, and tone, and orthographic choice did not survive stepwise in Step 2. Grade 1 Chinese rime and tone did not survive stepwise in Step 3

Final $F\ (5, 43) = 3.566$, $p < .01$

*$p < .05$, **$p < .01$, *** = .05

Cross-Time Cross-Language Predictions

We explored whether the variance in reading skills in one language in Grade 2 (e.g. Grade 2 English real word reading) could be uniquely accounted for by variables in the other language in Grade 1 (e.g., any of the Chinese lexical constituents in Grade 1) beyond all variables in Grade 2 (e.g., controlling for all English constituent variables). To predict English real word and pseudoword reading, two separate analyses were carried out using the same entry order. First, all Grade 2 English tasks were entered in one block using the stepwise method. In step 2, all Grade 2 Chinese tasks were entered in one block using the stepwise method. We decided to enter both English and Chinese constituent variables in Grade 2 in order to have the most stringent control of all the potential variance explained by these variables. Finally, the Chinese predictors in Grade 1 were entered in the following order: phonological tasks, orthographic choice, and compound structure. Chinese onset, rime, and tone awareness was entered in one block. Similarly, for predicting Chinese character reading in Grade 2, all Chinese tasks in Grade 2 were entered first, followed by all Grade 2 English tasks, and finally all Grade 1 English tasks. There was one significant cross-time cross-language prediction: Grade 1 Chinese onset oddity accounted for 8.3 % of the unique variance ($\beta = .296$, $p = .029$) in Grade 2 English real word reading after controlling for all Grade 2 tasks in both languages (See Table 10.4 for R, R^2, ΔR^2, Δ F, and standardized beta values). Tables 10.5 and 10.6 showed the results for predicting English pseudoword reading and Chinese character reading in which we did not find any significant cross-language and cross-time prediction.

Cross-Time Within-Language Predictions

We examined the within-language predictors that could uniquely contribute to reading in the correspondent language across grade levels. All Grade 2 tasks in the target language were always entered first in one block in the first step. In Step 2, all Grade 2 tasks in the other language were entered in one block. We included the Grade 2

Table 10.5 Cross-time cross-language hierarchical regression analysis predicting English pseudoword reading in Grade 2 using all tasks in Grade 2 and all Chinese tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 English phoneme deletion	.451	.204	.187	12.012***	.301**
	Grade 2 English oral vocabulary	.580	.336	.133	9.182**	−.363**
Step 2	Grade 2 Chinese rime	.674	.452	.116	9.543**	.378**
Step 3	Grade 1 Chinese orthographic choice	.675	.456	.004	.324	−.042
Step 4	Grade 1 Chinese compound structure	.684	.468	.012	.929	−.114

Note. Grade 2 English orthographic choice and compound structure did not survive stepwise in Step 1. Grade 2 Chinese oral vocabulary, onset and tone, orthographic choice, and compound structure did not survive stepwise in step 2. Grade 1 Chinese onset, rime, and tone were entered in one step after Step 2 using the stepwise method, but none of the variables survived
Final $F(5, 43) = 7.558$, $p < .001$
**$p < .01$, ***$p = .001$

Table 10.6 Cross-time cross-language hierarchical regression analysis predicting Chinese character reading in Grade 2 using all tasks in Grade 2 and all English tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 Chinese orthographic choice	.408	.167	.167	9.411**	.376**
Step 2	Grade 1 English phoneme deletion	.409	.167	.000	.012	−.073
Step 3	Grade 1 English orthographic choice	.414	.172	.005	.250	.042
Step 4	Grade 1 English compound structure	.457	.209	.038	2.087	.202

Note: Grade 2 Chinese oral vocabulary, onset, rime, and tone, and compound structure did not survive stepwise in Step1. Grade 2 English oral vocabulary, phoneme deletion, orthographic choice, and compound structure were entered after Step 1 using the stepwise method, but none of the variables survived
Final $F(4, 44) = 2.909$, $p = .032$
**$p < .01$

tasks in the other language in Step 2 in order to provide the most stringent control for all potential contributing variables in Grade 2 when considering the cross-time transfer from the Grade 1 predictors. The Grade 1 predictors were always entered last. For example, in predicting English real word reading in Grade 2, the variables entered in the first step were Grade 2 English oral vocabulary, Grade 2 English phoneme deletion, Grade 2 English orthographic choice, and Grade 2 English compound structure. The variables entered in the second step were Grade 2 Chinese onset, rime, and tone awareness, Grade 2 Chinese orthographic choice, and Grade 2 Chinese compound structure. The variables entered in the final step were Grade 1 English phoneme deletion, Grade 1 English orthographic choice, and Grade 1 English compound structure. The Chinese phonological tasks (onset, rime, and

Table 10.7 Cross-time within-language hierarchical regression analyses predicting English real word in Grade 2 using all tasks in Grade 2 and all English tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 English compound	.354	.125	.125	6.729*	.333**
Step 2	Grade 1 English phoneme	.430	.185	.060	3.386*	.214***
Step 3	Grade 1 English orthographic	.459	.210	.025	1.440	.175
Step 4	Grade 1 English compound	.462	.214	.003	.182	−.075

Note: Grade 2 English oral vocabulary, phoneme deletion, and orthographic choice did not survive stepwise in Step 1. Grade 2 Chinese oral vocabulary, onset, rime, and tone awareness, orthographic choice, and compound structure was entered after Step 1 using the stepwise method, but none of the variables survived
Final F (4, 44) = 2.99, $p < .05$
*$p < .05$, **$p = .062$, ***$p = .072$

Table 10.8 Cross-time within-language hierarchical regression analysis predicting English pseudoword in Grade 2 using all tasks in Grade 2 and all English tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 English phoneme	.442	.196	.196	11.439***	.222*
	Grade 2 English compound	.513	.263	.067	4.199*	.361*
Step 2	Grade 1 English phoneme	.581	.338	.075	5.089*	.287*
Step 3	Grade 1 English orthographic	.598	.357	.019	1.312	.172
Step 4	Grade 1 English compound	.618	.382	.311	1.771	−.210

Note: Grade 2 English oral vocabulary and orthographic choice did not survive stepwise in Step 1. Grade 2 Chinese oral vocabulary, onset, rime, and tone awareness, orthographic choice, and compound structure was entered after Step 1 using the stepwise method, but none of the variables survived
Final F (7, 41) = 5.333, $p < .001$
*$p < .05$, ***$p < .001$

tone awareness) were entered in one block. Results for predicting Grade 2 English real word reading, pseudoword reading, and Chinese character reading were shown in Tables 10.7, 10.8, and 10.9, respectively. Grade 1 English phoneme deletion accounted for a marginally significant 6 % of the unique variance ($\beta = .214$, $p = .072$) in Grade 2 real word reading and a significant 7.5 % of the unique variance ($\beta = .287$, $p = .021$) in Grade 2 English pseudoword reading after controlling for all tasks in Grade 2. Grade 1 Chinese rime oddity accounted for a significant 8.2 % of the unique variance ($\beta = .276$, $p = .031$) in Grade 2 Chinese character reading after controlling for all tasks in Grade 2.

Discussion

The present study set out to examine the unique contribution of phonology, orthography, and morphology in Chinese-English biliteracy development in beginning readers in a 1-year longitudinal design. The potential causal

Table 10.9 Cross-time within-language hierarchical regression analysis predicting Chinese character reading in Grade 2 using all tasks in Grade 2 and all Chinese tasks in Grade 1

	Variables	Mult R	Mult R^2	R^2 Change	F change	β
Step 1	Grade 2 Chinese orthography	.394	.156	.156	8.661**	.376**
Step 2	Grade 1 Chinese rime	.488	.238	.082	4.963*	.276*
Step 3	Grade 1 Chinese orthographic	.488	.238	.000	.006	−.008
Step 4	Grade 1 Chinese compound	.509	.259	.021	1.240	.146

Note: Grade 2 Chinese oral vocabulary, onset, rime, tone, and compound structure did not survive stepwise at Step 1. Grade 2 English oral vocabulary, phoneme deletion, orthographic choice, and compound structure was entered after Step 1 using the stepwise method, but none of the variables survived. Grade 1 Chinese onset and tone did not survive stepwise at Step 3
Final $F(4, 44) = 3.841$, $p < .01$
*$p < .05$, **$p < .01$

relationships between bilingual children's lexical components and reading outcome both within- and cross-language were investigated. We found that Chinese onset awareness was a significant predictor of subsequent English real word reading. Chinese rime awareness predicted subsequent Chinese character recognition. English phonemic awareness accounted for unique variance in subsequent English real and pseudoword reading. Together, these results point to the importance of phonological awareness as a potential universal causal determiner in reading development in bilingual children.

The cross-time cross-language prediction from Chinese onset awareness to English real word reading suggests that the transfer of onset awareness in Chinese-English biliteracy development was robust and stable across time. Chinese and English share many similar initial consonants including *m*, *n*, *l*, *b*, *p*, *d*, *t*, *g*, *k*, *s*, *z*, *r*, *y*, *w*, *f*, and *h*. Since onset is a shared phonological unit between Chinese and English, bilingual children can take advantage of their knowledge of onset in one language and facilitate the development of reading skills in the other language. McBride-Chang et al. (2008b) also found that Chinese onset awareness was a significant predictor of English word recognition longitudinally among Hong Kong children, which suggests that the transfer of onset awareness in Chinese-English biliteracy development may be generalizable across Chinese children in different regions.

Manis, Lindsey, and Bailey (2004) found that Spanish phonological awareness measured by a phoneme deletion task in Kindergarten was a significant predictor for English word reading and English passage comprehension measured in Grade 2. English phonological awareness in Kindergarten also accounted for unique variance in Spanish reading in Grade 2. These results, along with the findings from Chinese-English biliteracy studies, suggest that the contribution of phonological awareness to subsequent reading development is universal, regardless whether the bilingual children are learning to read two typologically similar scripts (e.g., Spanish and English) or two typologically distant scripts (e.g., Chinese and English).

In terms of cross-time within language predictions, we found that Grade 1 English phonemic awareness was a significant unique predictor of English real and

pseudoword reading in Grade 2. These findings suggest that English phonemic awareness is the crucial factor in subsequent English reading acquisition for bilingual children who are learning to read simultaneously in two typologically distant writing systems. These results are consistent with previous research with monolingual English-speaking children (e.g., Hulme, Hatcher, Nation, Brown, Adams, & Stuart, 2002; Wagner et al., 1997; Muter et al., 2004). Reading entails mapping graphic symbols onto the speech sounds they represent (Perfetti, 2003) and reading an alphabetic writing system entails the mapping of graphemes to individual phonemes. For both monolingual and bilingual children alike, a good reader of English must have the metalinguistic awareness to perceive and manipulate the phonemic units. In other words, the phonological constituent is equally important for monolingual and bilingual children learning to read English.

In terms of reading Chinese, we found that rime awareness in Grade 1 was a stronger predictor than onset and tone awareness in accounting for unique variance in Grade 2 Chinese character reading. This result was consistent with previous research on monolingual Cantonese children learning to read Chinese characters (Ho & Bryant, 1997). Rime awareness can, therefore, be considered one of the crucial factors for subsequent reading development in both monolingual and bilingual children learning to read Chinese. Orthographic awareness did not contribute significant amount of unique variance to cross-language longitudinal predictions. This result is not surprising given that the writing systems of Chinese and English form the sharpest contrast; therefore it is much less likely to be utilized in reading across the two systems. However, Tong and McBride-Chang (2010) reported that, in their study with Cantonese children learning to read in Chinese and English, Chinese visual-orthographic skill was a significant predictor of English real word reading. Visual-orthographic skill was measured by a configuration discrimination task in which children were asked to determine whether each radical was a real component of a Chinese character. Our finding is not consistent with that reported in Tong and McBride-Chang (2010), probably due to the difference in task demand. Our orthographic awareness task required children to judge the whole character whereas in Tong and McBride-Chang's study, children only needed to consider the radical. The fact that children in our task had to take into consideration the whole character legality might have made the orthographic skill in Chinese less transferrable to English. The relatively low reliability of the orthographic choice task may also be responsible for the lack of significant contribution of orthographic awareness to reading outcomes in Grade 2.

One important limitation of the current study is the small sample size that may have reduced the power of the regression analyses. Some of the tasks also had a relatively small number of items and low reliabilities. We did not find a significant contribution from compound awareness to subsequent reading both within-language and across languages, which could be a result of low reliability of our compound structure task especially in Chinese language. It may also stem from a small sample size recruited and relatively large number of predictors when considering both within-language and cross-language, concurrent and subsequent predictors. It could be also an indication that cross-language transfer of compound awareness is weak

in nature for young children (Grade 1 to Grade 2) and does not survive in a longitudinal design. Future research could consider using alternative measures for orthographic and morphological awareness. For example, the visual configuration discrimination used in Tong and McBride-Chang (2010) has been shown to be a reliable measure of orthographic awareness. Future research should also consider other types of morphological measures such as the compound morphology task in McBride-Chang et al. (2008a) or the morpheme recognition and discrimination tests in Ku and Anderson (2003). In a future study, the current sample could be followed to a higher grade to examine the contribution of the three lexical constituents to reading fluency and comprehension in more skilled readers.

Conclusion

The current study set out to examine the contribution of phonology, orthography, and morphology in Chinese-English biliteracy development. Chinese onset awareness was a significant predictor for subsequent English reading. Also, we found that English phonemic awareness was crucial for subsequent English reading and Chinese rime awareness contributed unique variance to subsequent Chinese reading. These results highlight the potential causal relationship between awareness of phonological units and subsequent reading development in bilingual children.

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Part IV
Children's Literature in Chinese

Chapter 11
Chinese Children's Literature in North America

Belinda Yun-Ying Louie

Abstract In China, researchers and educators have found evidence to support that the shared-book reading approach improves Chinese children's literacy and language skills. In order to support Chinese language teachers who want to use the shared-book approach in north America, this study is a systematic analysis of Chinese juvenile literature available in north America. In this project, we considered 1,034 titles of Chinese children's literature books that were available to the north American community. These books were published in China, Taiwan, Singapore, Hong Kong, and the United States. After removing the translated book portion of the collection, we analyzed five aspects of the books: genres, readability, aural accessibility, cultural content, and appeal to Chinese language learners. Overall, the books were written for Chinese-speaking children who have the oral language capacity to understand when the stories are read to them. In addition, some of the contemporary realistic fiction titles are laden with strong Chinese sentimentalism that may be foreign to students grew up overseas.

Keywords Children's literature • Genres • Readability • Cultural content • Aural accessibility

Chinese Children's Literature in the United States

Research on the effects of storybook reading among English-speaking children spans several decades and identifies key factors that relate to vocabulary learning in both classroom and home environments (Beck & McKeown, 2007; Elley, 1989;

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_11,

Robbins & Ehri, 1994). When parents share books with early childhood second language learners at home, frequently and accompanied by conversation, the experience helps these young children to develop a robust oral language (Collins, 2010). In China, researchers and educators have also found evidence to support that the shared-book reading approach improves Chinese children's literacy and language skills (Anderson et al., 2002; Chow, McBride-Chang, Cheung, & Chow, 2008). However, books for young children are not as available as books for advanced readers. Understanding that appropriate reading materials are pertinent to the success of the shared-book experience, Anderson and his colleagues (2002) spent an enormous amount of time designing and constructing appropriate and enjoyable stories when they launched the shared-book reading program in China. Teachers who use the shared-book approach read a text together with their students, using various activities to engage children in reading the text (Anderson et al., 2002). If the shared-book approach is to be implemented in the United States to facilitate Chinese learning, what books are available to teachers and parents? How appropriate are these books in terms of language and content? How appealing are these books to the North American learners? This chapter reports the results of a content analysis of Chinese children's literature available in the North America.

In my previous study on Chinese children's literature (Louie & Louie, 2002), I focused on how various genres of children's literature published in China helped teachers to fulfill the central Chinese government's literacy directives. The impetus for the current study came from teachers' desire to use literature to enhance Chinese language learning in North America. Hence, this project only considered books that were accessible to the North American community. This study is the first systematic analysis of Chinese juvenile literature available in North America, aimed at providing support for Chinese language educators. The knowledge gained from this study can also help other language teachers when they consider using children's literature to enhance language development.

In order to understand how these books may enhance Chinese language development of both heritage (with Chinese as the language spoken at home) and non-heritage learners, I analyzed five aspects of the collection: genres, readability, aural accessibility, cultural content, and appeal to Chinese language learners. In order to study the books' appeal to language learners, I collected information from 12 heritage learners, ages 4–16 years old, on their responses from 9 to 20 books in various genres. Likewise, I collected responses from 20 non-heritage learners, ages 4–14 years, after reading 9–20 books across genres. Genre study is important because discourse structures vary with genres. Genre analysis provides information on whether language learners are exposed to a balanced set of textual structures. In order to investigate whether the collection facilitates Chinese language development, I analyzed the books through two language-oriented lenses: the readability lenses and the aural accessibility lenses. Readability evaluation establishes reading levels of the texts so that teachers can select texts to match their students' reading abilities. The aural accessibility evaluation is important because of the large number of beginners who are still learning the oral language. Teachers need to know the aural levels of the texts so that they can ensure that the books

selected for reading aloud are accessible to the beginning learners. Understanding the cultural content of the books can alert teachers to spend time on background information and classroom discussion when presenting certain books to the students. Educators advocate for the importance of introducing literature with authentic cultural content (Bishop, 2003). However, the cultural content may hinder students' comprehension of the stories, depending on students' familiarity with the norms and values, social interactions and living conditions, and the literary allusions used (Louie, 2005). Finally, it is important to find out whether these texts appeal to language learners in the United States. Most of the Chinese books chosen for this study were originally published in Asian countries for the first language learners. Will the stories have the same appeal to the overseas Chinese language learners?

Method

Book Sources

I obtained 1,034 titles of children's literature from five major sources: China Sprout, Asia for Kids, China Books, Chinese Childbooks, and Amazon. These books were published in China, Taiwan, Singapore, Hong Kong, and the United States. I also analyzed electronic books that were available through a Taiwanese Council for Cultural Affairs Web site, which provides free access to numerous children's literature titles in Chinese (http://children.cca.gov.tw/home.php). The books included original tales authored or retold by native authors and translated books first published in languages other than Chinese, such as Japanese, Korean, Dutch, French, and English. I excluded original and translated books with advanced readability, such as the Harry Potter series, because higher-level language learners perform more like first language readers; thus, the books are beyond the scope of this paper.

Genres

Simply put, "a genre is a kind or type of literature that has a common set of characteristics" (Lukens, 2006, p. 15). I analyzed the collection of books based on some of Lukens' categories, such as realism, traditional tales, fantasy, rhyme to poetry, and nonfiction. In children's literature, books are classified into different genres based on their character, text structure, and setting. Although genres overlap and variations exist within any given genre, genre classification helps teachers to be aware that there are more types of literature for children than those with which we are familiar, such as folk tales or nursery rhymes (Lukens, 2006). Teachers should be sensitive to the broad and rich variety of literature available so that they can help students to appreciate a diverse set of reading materials.

Table 11.1 High frequency words in the 12-leveled text

Grade level	Volume	Words that students can recognize		Words that students can write	
1	1	400	950	100	350
	2	550		250	
2	3	450	850	350	650
	4	400		300	
3	5	200	400	300	600
	6	200		300	
4	7	200	400	200	400
	8	200		200	
5	9	200	400	150	300
	10	200		150	
6	11			120	200
	12			80	
Total		3000		2500	

Readability Evaluation

I worked with two experienced Chinese language teachers to determine the readability levels of the 1,034 stories based on the 2008 character frequency list provided by the People's Education Press in China, which was included in each of the 12-leveled reading texts adopted by the majority of elementary classrooms China (see Table 11.1). For our collection, we focused on the first grade and second grade character lists. The first grade list consists of 950 characters, with 850 additional characters in the second-grade list. The two Chinese teachers classified the books into 4 levels: "pre-1 level" for books with fewer than 50 % of the characters that are in the first grade list, "1st grade level" for books with 50–80 % of the characters in the first grade list, "2nd grade level" for books with more than 80 % of the characters are in second grade list, and "above 2nd grade level" for books with less than 80 % of the book's characters in the second grade list, meaning that many new characters were present. It is important to evaluate the books according to frequency lists based on graded text to provide some comparison with the Chinese students in China.

Aural Accessibility Evaluation

We determined the stories' aural accessibility by matching the books to the levels in the Center for Applied Linguistics' (CAL) Oral Proficiency Exam and Student Oral Proficiency Assessment Rating Scale (COPE/SOPA-RS) (Center for Applied Linguistics, 2003). There are 9 levels in the scale, ranging from Jr. Novice-low to Jr. Advanced-high in four categories: Oral fluency, grammar (speaking), vocabulary (speaking), and listening comprehension. The first three categories are geared toward the learners' language production, while the last category focuses on their language perception. While oral fluency and speaking grammar were not suitable for text

evaluation, the categories of speaking vocabulary and listening comprehension provided a highly workable scale, with benchmarks for assessing a text's aural accessibility. When teachers are cognizant of the aural level of the books, they will be less likely to choose read-aloud books which are beyond the listening comprehension of the Chinese language learners. (See Table 11.2)

Cultural Content Analysis

I also analyzed the cultural authenticity of the books in terms of richness in cultural details, values, taken-for-granted information possessed by the community, motivation to tell the stories, and lexical choice (Bishop, 2003; Yokota, 1993). For example, in *Paper Horse* (Xiong & Xiong, 2008), the author portrayed a little girl, who lived with her grandmother, waiting for the girl's parents to come back during the Chinese New Year. It is still a common practice for parents in China to leave their only child with the grandparents while both parents work in other cities. In *Lantern Festival* (Bao, 2009), the setting was the Chinese Lantern Festival. The characters were a young boy and his balloon-vendor parents. The Chinese communities around the world have the shared knowledge that families will go to town to view all kinds of beautiful lanterns. The Lantern Festival is an important and joyous time for many Chinese families, rich and poor.

Appeal to North American Learners

Twelve heritage learners (ages 4–16 years) and 20 non-heritage (ages 4–14 years) learners, who were enrolled in a Chinese language enrichment program in a Saturday Chinese heritage language program, responded to a collection of books. The students read individual stories and rated the stories' appeal using a 4-point Likert-type scale. Books were selected by the teachers based on their estimate of children's reading and listening abilities as well as their interest levels. For the first grade and under groups, teachers selected all the language-based books because other texts were too difficult for this level. Our heritage learners in this group were American-born children who came from Cantonese-speaking homes. Similar to the non-heritage learners, they struggled as they learned Mandarin. We included texts from other genres for older and more advanced students. Although the elementary age students enjoyed traditional stories, they only enjoyed the stories which were written in English. The traditional tales in Chinese were far beyond their reading levels. Teachers read the stories aloud to students who had not yet developed the literacy skills to read the stories. We interviewed the students and asked them to write or tell us their comments for each of the stories presented. The selected stories represented all the genres in the collection. Students with high Chinese language proficiency read the stories on their own. Children enjoyed reading the books with a setting similar to their own cultural context. Understanding to what extent Chinese books appeal to English-speaking children living in the United States will help teachers to select books for their students (Fig. 11.1).

Table 11.2 Aural accessibility evaluation chart based on the oral proficiency exam and student oral proficiency assessment rating scale (COPE/SOPA-RS)

1	2	3	4	5	6	7	8	9
-Includes words in very specific topic areas in predictable contexts	-Includes specific words in limited number of topic areas, high-frequency expressions, and other memorized expressions	-Includes vocabulary centering on basic objects, places, and common kinship terms	-Includes basic vocabulary in statements and questions to satisfy basic social and academic needs	-Includes basic vocabulary of a personal nature and limited academic topics	-Includes a broad enough vocabulary for discussing simple social and academic topics in generalities, but lacks detail	-Includes vocabulary for discussing concrete or factual topics of a personal nature, topics of general interest, and academic subjects	-Includes vocabulary for details about concrete or factual topics of a personal nature, topics of general interest, and academic subjects	-Includes precise vocabulary for a wide variety of topics related to everyday social and academic situations
-Includes a few memorized, high-frequency expressions	-Includes predictable questions, statements, and commands in familiar topic areas	-Includes simple questions, statements, and commands in familiar topic areas	-Includes familiar and new sentence-level questions and commands in a limited number of content areas	-Includes sentence-level statements in new contexts	-Includes longer stretches of discourse on a number of topics	-Includes more details in discourse on some academic topics and on some familiar topics	-Includes details in connected speech on a variety of topics	-Includes complex academic discourse and highly idiomatic speech
							-Includes a few	

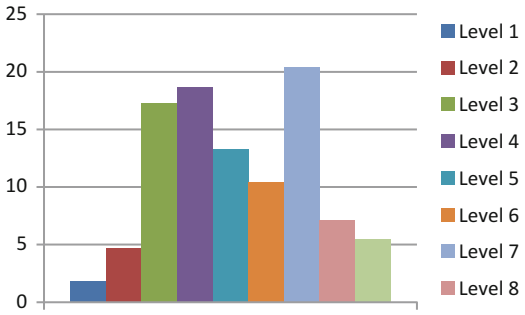

Fig. 11.1 Aural accessibility level

Results and Discussion

In the context of international children's literature, most of the translated international books available in the United States were first published in the European countries such as Holland, Germany, and France (Lehman, Freeman, & Scharer, 2010). Unlike the books published in the United States, translated books tend to present various facets of life—sickness, suffering, and even death—in a more stark manner (Louie & Louie, 1999).

Among the 1,034 literature titles, 354 of them were translated books and 680 were written by Chinese authors. More than one third of the collection consisted of translated books. Translated literature is a unique phenomenon in Chinese children's literature. Translated books have difficulty entering the children's publishing world in many countries because of marketing and economic concerns (Louie & Louie, 1999). However, it is not the case in the Chinese-speaking communities. Children's literature began its slow emergence as a result of the May Fourth movement (1919–1936) to educate the masses using the vernacular language instead of the highly-literate classical language (Farquhar, 1999).

The progressive education reform looked to the western world for inspiration and information. Intellectuals expanded their horizons beyond the classic Confucian texts to explore western perspectives. Western classics, popular works, and later children's literature gradually established a strong foothold in the Chinese publishing industry, only to be interrupted by the Cultural Revolution in the late 1960s and 1970s (Farquhar, 1999) when Chairman Mao banned anything that was not aligned with the political thoughts of the central government of the time. Since the May Fourth movement, translated children's literature started with established western classics, such as Daniel Defoe's *Robinson Crusoe*. Now, the translated children's literature includes most of the award-winning books from the United Kingdom, the United States, Canada, France, Germany, Korea, and Japan. Many children in North America have already read the stories that were first published in the United States and Canada, such as the *Spot* series, which focuses on a little dog (Need to add to the reference list at the end). These children are familiar with the story grammar and the general context of many series of stories, facilitating speaking vocabulary and listening comprehension.

Genres

The focus of this study was the Chinese-authored texts, which cover six genres: realism (57 %), language (19 %), non-fiction (10 %), traditional tales (12 %), rhyme to poetry (1 %), and graphic novels (1 %). Most realistic stories carry few culturally-specific details. They portray children, or animal characters acting like human beings and engaging in daily activities such as playing with friends, chasing balloons, eating breakfast, and shopping. A few of the characters are shown in culturally authentic settings. I will discuss these culturally-specific books in the content analysis section of this chapter. Because of the universal experience in activities of daily living, readers with sufficient literacy or aural proficiency should have no problem comprehending the texts in the realism genre.

The language books aim at teaching first-language and second-language learners Chinese words and phrases. Their format is very similar to the concept books for preschoolers learning the names of colors, shapes, and other familiar items in their lives. These books always come with bright and appealing photographs or pictures to accompany the Chinese characters, pinyin or *zhuyinfuhao* (Chinese sound notation systems in China and Taiwan respectively), or English words. Children have no problem with literacy or aural proficiency in language books because vocabulary-building is inherent to the purpose of the texts.

The non-fiction books cover a wide range of topics about the Chinese culture, land, language, and people. For example, books explain the nature of the Chinese characters to increase readers' knowledge in the Chinese written language. Many books provide information on various Chinese festivals to stimulate readers' interest in discovering the Chinese culture. There are also books on nature for young children, appealing to their interest in insects, plants, and animals. Chinese language learners enjoy looking at the pictures when the text is too difficult for them to read on their own.

Traditional tales include both the beloved tales deeply rooted in the Chinese culture as well as universal tales shared by other cultures. Legends, fables, fairy tales, folk tales, and tales on historical figures introduce the colorful stories which contribute to the Chinese heritage. Legends explain creation. According to the Chinese legends, Pangu pushed the sky from the earth to create the space in between them (Dong, 2009). Then, Nuwa flicked wet mud all over to give birth to the people who inhabited in the land (Liu, 2010). Houyi shot down nine hot suns to preserve the last sun that we have today to save the world from draught (Dong, 2010). In contrast, fables are didactic tales that provide timeless wisdom to the young readers. Persistence allowed a "foolish" old man to move the mountain to make it easier for folks to travel from his town to others (Cai & Zhang, 2006). The struggle between the selfish crane and the equally selfish clam only benefited the third-party fisherman who walked by to catch both for his dinner table (Yu, 2010). Many of these fables are *chengyuguxi,* providing the background stories to hundreds of four-character Chinese idioms that are commonly found in writing and oral repertoire. Chinese fairy tales put heavenly and human beings together providing entertaining

drama to common folks for generations, for example, the famous adventures of the Monkey King and his entourage who disturbed the heavenly court, the earthly demons, and the human villages (Xu, 2008). The story of the heavenly weaver and the lowly cowherd was the tale behind the Double Seven Festival, the day that the couple enjoyed their annual reunion. The kitchen god, the door god, the match-maker old man, and the wealth god also appear in the fairy tales, with the narrator explaining how the gods (like kitchen fairies) interacted with folks in their lives (Xiong & Xiong, 2008; Gan, 2011a, 2011b). In the Chinese tales, heavenly and earthly beings often interacted in daily lives. Heavenly beings could easily take on the human forms to live among villagers. Tales of historical figures have been preserved to guide children in their character development. Kong Rong, the youngest of three brothers, chose the smallest pear from the basket to show respect to his older siblings (Louie, 2007). Cao Chong proposed an ingenious way to weigh an elephant (Su, 2007). The universal tales are stories that either have their origins in other cultures or share many common elements with other cultures. Stories such as the mouse maiden looking for a bridegroom and the blind man encountering an elephant can be found in other language versions.

Rhyme and Poetry

The rhymes and poetries celebrate the nature, the seasons or childhood play. In *Mid-Autumn Moon, Very Pretty* (Hung, 2001), the rhymes describe the changing colors in the fall, the snacks children love to eat during the fall season, and the activities that they enjoy playing at this time of the year.

Graphic Novels

It is an emerging trend that Chinese artists present classic teaching and stories using the graphic novel format. We identified 4 books in this study. Tsai (2001) retold and illustrated a collection of Confucius' sayings, helping young learners to understand and to appreciate the teaching of the sage. In *Shaolin Temple*, Tsai (2006) used fun drawings and bilingual texts to make Chinese martial arts accessible to today's children who want to learn more about the Chinese culture.

Readability Evaluation

After excluding the translated books, two experienced Chinese language teachers used the 2008 character frequency list of the People's Education Press in China to categorize the readability levels of the 676 Chinese stories in this collection into

4 levels after excluding the translated stories. In Pre-level 1, the remaining books included fewer than 50 % of the Chinese characters that readers are expected to recognize in Level 1 (first grade). In Level 1, books included 50–80 % of the 950 Chinese characters that children are expected to recognize in first grade in China. In Level 2, books included over 80 % of the 850 additional characters that children are supposed to recognize in second grade in China. In Level 2+, books included less than 80 % of the Chinese characters in the first grade and second grade list, with new characters at a more advanced readability level.

Among the 676 books in this collection, 35 books (5.8 %) belonged to the Pre-level 1 category. Children in China should be able to read these books before they enter first grade. In Level 1, there were 295 books (43.6 %); 232 books (34.3 %) in Level 2, and 114 books (16.3 %) above Level 2. In order to read 50 % of these books, books at Pre-level 1 and Level 1, Chinese language learners in the United States have to be able to recognize approximately 760 Chinese characters. Recognizing the large number of Chinese characters is an extremely daunting task for these beginning learners.

Very few elementary schools in the United States offer Chinese language classes. Children often learn the Chinese language by attending weekend Chinese heritage language classes or short-term enrichment classes at school. The once or twice a week lessons make Chinese learning a very slow process for the young learners. It takes many years (definitely more than one) of such infrequent classes before these students can recognize 760 characters. In addition, teachers teach the English-speaking children to read by decoding the alphabetic script. Sight word approach, which relies on strong visual differentiation, is not an effective means to learn the English language. Students are expected to recognize only 220 sight words from the Dolch list by third grade. The number is far below the 950 characters that native Chinese children are expected to recognize just in first grade. Therefore, the instructional experience of the English-speaking learners does not enhance their character recognition in Chinese.

Aural Accessibility Evaluation

Two Chinese language teachers classified the 676 Chinese tales based on the 9 levels of speaking vocabulary and listening comprehension identified in the COPE/SOPA Rating scale. (See Table 11.3). About 80 % of the books are at Level 3 and below according the audibility evaluation. At Level 3, texts include simple questions, statements and commands in familiar topic areas. There is a pattern of repetition. The vocabulary centers on basic objects, places, and common kinship terms. Between Level 4 and 6 are 46 % of the books. At Level 6, the texts include longer stretches of connected speech on a number of topics. The vocabulary is broadened to include simple topics with general but not detailed description. About 34 % of the books are between Level 7 and 9. At Level 9, the texts include complex discourse and idiomatic expressions. The vocabulary becomes more precise on a wide variety of topics related to everyday social situations.

Table 11.3 Texts selected across genres for students to respond

Level	Heritage students	Non-heritage students	Realistic stories	Traditional stories	Language-based texts	Non-fiction	Total number of books
1st grade & under	3	5			9		9
2nd to 3rd grade			3		6		9
4th to 6th grade	1	9	3		8	1	12
7th to 9th grade	4		14	5		1	20

Books at Pre-level l (5.8 % of the collection) in readability level, ranged from level 1 to 3 in their aural accessibility level. For books at the first grade readability level, about 48.8 % of the books, their aural accessibility levels range from 3 to 6. For books at second grade readability (38.3 % of the collection), their aural levels range from 5 to 9. The easy-to-read books still require relatively high listening comprehension ability, making it difficult for non-native, non-heritage Chinese language learners to understand the texts even when the teacher reads the books aloud to them.

Cultural Content Analysis

Many contemporary realistic stories portray animal or child characters in their daily routines. These books contain only limited amount of culturally specific elements. In *Panda Loves to Play* (Yao, 2009), Panda plays among the trees in the summer. Panda plays in the snowy mountain during winter. In *Scarf* (Yan, 2001), the little boy shows his love to grandmother by wrapping his scarf around grandmother's neck. In *Just Like an Elephant* (Lin & Hsu, 2001), the children had fun mimicking different animals. Books with universal themes are easy for young Chinese language learners to identify with. Subsequently, learners encounter no difficulty in understanding the content of the texts.

We have identified three cultural elements in the collection that may require teachers' instructional support to facilitate comprehension if they use the books in Chinese language classes. First, some Chinese children's literature is filled with didactic lessons that teachers and parents want children to learn. Chinese adults want children to learn the morals when they read stories, not just to improve their reading skills, and definitely not just to be entertained (Louie, 1996). However, some of the sentiments expressed in the stories are laden with Chinese values that Chinese language learners in the United States may find difficult to comprehend. In *Little Black Lamb* (Su, 2008), the little lamb walked away from his siblings when the mother took them out for a walk. He played with the birds and rolled around in the flowers. When the sun went down, he could not find his way home. At the end, the author wrote, "Poor Little Blackie, he never saw his mother again!" It is not unusual for Chinese adults to use scare-tactics to make sure that children behave.

In *Mother and Son* (Liu, Chiu, & Wang, 2009), the mother stopped going out with her friends, never ate out, and never traveled after her teenage son ran away from home. At the end, the son missed his mother and returned home, only to find his mother very sick in the hospital. This book has low readability and appropriate aural demand. However, the detailed description of the lack-of-life in the mother's world creates a strong sense of guilt for the son that may not appeal to readers in the United States. Teachers may want to discuss with their students that Chinese parents love their children. Parents want to build their children's characters through stories. Part of the character building is to ensure that children understand the importance of obedience to parents, which is a virtue in Chinese society.

The second Chinese cultural element that teachers may pay attention to is the traditional tale. Many Chinese language learners in the United States, heritage and non-heritage, have limited knowledge of the authentic Chinese traditional tale. The heavenly beings in the tale, the Monkey King's fight with various types of demons, and the young gentleman's wife turning out to be a snake demon may seem odd to students when they encounter the stories for the first time. Teachers may want to give a synopsis of the stories and a brief explanation about the characters before the books are introduced to students. When students know what to expect, resistance as a reaction to the unfamiliar tales is less likely for the western learners.

Lastly, language learners may have problem understanding the Chinese sentiment and the Chinese way of life in some contemporary realistic stories. Chinese picture books were used to transmit "the rules of life," teaching children that some values such as bravery and honesty are essential in life (Qi, 2011). Many authors embrace the didactic role of literature that is to shape children's moral values, to help children experience other's feelings, and to mold their characters (Louie, 1996). Sentimentality occurs when authors overuse feelings or emotions to make readers feel uncomfortable when readers "are asked for an emotional response in excess of what the situation requires" (Lukens, 2003, p. 121). For example, the *Love of China* picture book series published by the Chungqing Publishing House, aims at portraying the lives of children in modern day China. The stories tell about the life of children in the city and countryside. Sentimentalism prevails in the whole series. In *Lotus Lanterns and the Sound of Flute* (Bao, 2009), Ling missed her older sister, Xiaoyu. Xiaoyu was in a school bus with her classmates traveling on a narrow mountain road during a heavy rain. The rain caused a landslide which hit the bus and knocked it over a cliff. All the children were killed in that accident. It is unnecessary for the author to use such an intense and tragic event as the backdrop of Ling's sadness. The emotional impact of the accident was out of proportion with the gentle flute music and flowing river in the rest of the picture book. In *Lantern Festival* (Bao, 2009), a boy stayed next to his father in bitter cold waiting for him to finish selling the balloons so that they could watch the new year's lanterns. The overuse of emotion occurs when the author described how the boy braved the bitter cold and encouraged his father, "Baba, I am not cold. We will finish soon. There are only two more balloons. Mama told me that she would look for us at the end of the day. We will sell the balloons and go the lantern festival together." The author furthered the sentimentality by ending the story with a handicapped girl buying the last two balloons and offering one to the boy. She also gave the boy the lantern festival tickets that the family could

not afford. The dramatic occurrence of a handicapped girl bringing happiness to the boy's family is a tear-jerker that creates excessive emotional intensity.

In *A New Year's Reunion* (Yu, 2008), the father came home to spend a week with his family once a year during the new year time. The little girl had a great time visiting friends, watching her father fix their house, and eating special dishes with both parents. At the end of the story, she waved good-bye as her father left by bus, wondering how she could spend another year waiting for his return. Learners in the United States may find it hard to accept the sadness and the fact that fathers or mothers can leave their families for extended period of time because of their work. Teachers need to discuss this reality with the language learners so that they will understand that parents still love their children even though they take jobs far away from their homes.

Appeal to North American Learners

We gathered responses from 12 heritage learners (ages 4–16 years) and 20 non-heritage (ages 4–14 years) learners, who were enrolled in a Chinese language enrichment program in a Saturday Chinese heritage language program. The oral proficiency levels of the 10 non-heritage learners were at junior novice-mid level (corresponding to Level 2 of the aural accessibility scale) and 10 were at junior novice-high level (corresponding to Level 3 of the aural accessibility scale) according to the COPE/SOPA rating scale (CAL, 2003). Three heritage learners were at junior novice-mid level (corresponding to Level 2 of the aural accessibility scale), 3 were at junior novice-high level, 1 was at junior intermediate-low level (corresponding to Level 3 of the aural accessibility scale) and 4 were at junior advanced-high level (corresponding to Level 9 of the aural accessibility scale). Teachers read the stories aloud to students who had not yet developed the literacy skills to read the stories themselves. We interviewed the students and asked them to write down or tell us their comments for each of the selected stories.

Students with low oral proficiency could hardly understand the books, even when teachers read the books to them. Students with low oral proficiency responded mainly to the pictures and the limited texts that they understood, missing the cultural nuances of the stories. Students with high proficiency (all of them were heritage learners) did not like to read contemporary realistic stories with cultural authentic sentiment and setting. Two heritage learners (14 years old and 16 years old) experienced no difficulty reading the Chinese Breeze Graded Reader Series. However, they responded negatively to the ways relationships were portrayed in the books. They found the relationship among the man and two ladies in *Whom Do You Like More?* (Liu, Chu, & Wen, 2008) "very weird," and "scandalous." They did not like *Mother and Son* because the story was "*too sad*" and "*boring*." These two heritage learners were born in the United States and speak Mandarin at home. Fully immersed in the American culture, they demonstrate resistance towards strong sentiments expressed by Chinese characters in the stories.

Conclusion

The Chinese children's literature in the United States is increasingly available to parents, teachers and students. The collection covers a variety of genres. Many of the books were intended for Chinese language learners. However, with most of the books published in Chinese-speaking countries, the readability of the books appears to be too high for English-speaking learners in the United States. For the same reason, the books are more appropriate for learners who have the oral language to understand the texts. Many heritage and non-heritage learners who are beginning to learn Chinese have low aural capacity. They hardly understand the stories even when teachers read the stories aloud to them. Instead of reading the whole text, teachers may guide students to learn new words from the text and pictures, very similar to shared reading with young children learning to read in their first language. Frequent reading using this approach will still enhance vocabulary growth (Collins, 2010). For the more advanced learners who can read the texts on their own, teachers should initiate a rich discussion to help these students understand the values and contexts of the stories.

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Chapter 12
China and Chinese as Mirrored in Multicultural Youth Literature: A Study of Award-Winning Picture Books from 1993 to 2009

Minjie Chen and Qiuying Wang

Abstract This chapter is a critical overview of notable picture books that portray China, Chinese, and Chinese culture. Following up Mingshui Cai's 1994 study, "Images of Chinese and Chinese Americans Mirrored in Picture Books," this project examined 46 titles of award-winning picture book stories published from 1993 through 2009, tracing changes, progresses, and persistent flaws in how the culture and experience of ethnic Chinese had been portrayed in publications for American young readers. It analyzed the diversity of genres and subject matter in these books, and evaluated the accuracy of cultural representation in textual and visual contents, with attention paid to the relationship between cultural authenticity and authors' cultural backgrounds. The project highlighted high-quality titles considered satisfactory sources for learning about Chinese culture, and made suggestions to publishers on ways to raise the standards of multicultural youth literature.

Keywords Multicultural youth literature • Children's literature • Picture books • Book awards • Cultural authenticity • China • Chinese • Chinese diasporas • Content analysis

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X. Chen et al. (eds.), *Reading Development and Difficulties in Monolingual and Bilingual Chinese Children*, Literacy Studies 8, DOI 10.1007/978-94-007-7380-6_12,

Vignette: Ben's Storytime

Ben, a 3-year-old son of a Chinese couple, picked an orange-colored hardback from the piles of picture books lying on the floor of my living room, and I began "reading" the story to him. The book Ben had chosen was not of an appropriate language level even for a more fluent English speaker of his age—much less for Ben, who grew up in a complex language environment: a salad bowl of Mandarin Chinese, English, and the dialect spoken by grandparents from a village in Central China. *Once Upon a Full Moon* by Elizabeth Quan, though richly illustrated, runs 48 pages and contains passages of text too long for a toddler's attention span. However, Ben showed unwavering concentration and interest throughout my abridged retelling of the story in Chinese. Two days later when he visited me again, he requested the same book.

Once Upon a Full Moon is a memoir of a Chinese family's journey from North America to the home of the author's grandmother in a village in China. What kept Ben engaged, in addition to Quan's bright and warm watercolor illustrations, was the many connections the boy could readily make between the world he knew and the setting, characters, and plot of the story. Many cultural elements in the story were relatable to Ben, including the transnational experience of the family, their strong tie to China, and the children's close intergenerational relationships with their grandmother. Even the food that Papa orders in the story—winter-melon soup, greens, and white rice—were familiar to Ben's family. At the end of our second reading, Ben asked if his father's home village in China looked like what was in the book. To the boy's great satisfaction, his dad gave a firm "yes" for answer.

Ben's positive interaction with *Once Upon a Full Moon* does not make the book ideal reading for average 3-year-olds. The case nonetheless shows how the cultural relevancy of a children's book helped a story transcend barriers in language and reading level, and captivate a toddler with its authentic details in text and images. Although my (one of the authors) bowdlerized retelling of the story had no immediate impact upon Ben's English vocabulary, this successful shared reading session rewarded an emergent reader with a respect for his free reading choice; one-on-one attention from an adult; aesthetic experience with child-centered artwork and an appealing story; an affirmation of his personal and ethnic identity; and a pleasant association of literacy activities with emotional security. All these benefits would contribute to Ben's continual growth into a motivated reader and confident learner.

This chapter is a critical overview of award-winning and notable picture books that portray China, Chinese, and Chinese culture. Focusing on titles published since Mingshui Cai finished his study "Images of Chinese and Chinese Americans Mirrored in Picture Books" in 1994, this project seeks to renew understanding of the quality of multicultural youth literature about China and Chinese. We will analyze the patterns of genre and subject matter of these books; discuss how accurately and authentically the history, culture, and experience of Chinese people have been represented in them; and critique how American children's literature has portrayed a changing contemporary Chinese society. On an immediately practical level, this

study will highlight, for the benefit of teachers, librarians, and parents, picture book titles that are considered excellent sources for learning about Chinese culture.

Multicultural Youth Literature: Definition and Significance

In spite of much debate over the definition and connotation of multicultural youth literature[1] (Cai, 2003), there has been a consensus on the importance of using multicultural youth literature for the education of both white children and young readers from historically marginalized racial, ethnic, and cultural groups. In terms of definition, this article embraces a broad view as expressed by Ambika Gopalakrishnan: multicultural youth literature validates all socio-cultural experiences, including those occurring because of language, race, gender, class, ethnicity, ability, and sexual orientation (Gopalakrishnan, 2011). Scholars have elaborated extensively on the value and necessity of incorporating multicultural youth literature into the school curriculum of a diverse American society (e.g., Bishop, 1997; Cai, 2002; Gopalakrishnan, 2011; Norton, 2009; Rochman, 1995). Those values, alternatively articulated as functions and goals of using multicultural literature with young learners, can be distilled into three keywords at two levels: (1) acting as *mirrors* and *windows* to inform young readers, and (2) empowering readers to achieve *social change*.

As Cullinan (1989) and Bishop (1990) stated in frequently quoted metaphorical terms, children from both mainstream and marginalized social groups need to see their own lives and experiences reflected in literature (the mirror) as a means of self-affirmation; they also need the books as windows onto reality for building cross-cultural understanding, respect, and a more balanced view of U.S. society and the world. It must be clarified that books about a certain cultural group can be the "window" for children from that group as well. Print literature, along with oral sources and other media, is part of the socialization tools that help a younger generation expand beyond daily experiential knowledge and understand its own cultural heritage—be it about Greek mythology, Bible stories, or a Chinese legend of the goddess on the moon.

For a higher purpose, which Cai (2002, 2003) compellingly argues, the ultimate goals for using multicultural literature are to decentralize the power of the mainstream culture, challenge the dominant ideologies, develop sensitivity to social inequalities, and promote social justice. The "empowering" promise of multicultural literature is firmly corroborated by critical race theory, which asserts that storytelling and counter-storytelling help members of the dominant racial group grasp what it is like to be nonwhite; cast doubt on the validity of accepted premises or myths that marginalize people or conceal their humanity; and give voice to victims of racial discrimination (Delgado & Stefancic, 2001).

[1] We consider "multicultural *youth* literature" a term more precise than "multicultural *children's* literature" to refer to children's and young adult literature, although the latter is often found in scholarly writing to be inclusive of trade books published for both age groups.

Significance to Language-Minority Children

According to the National Center for Education Statistics, the number of school-age children (ages 5–17) who spoke a language other than English at home rose from 4.7 to 11.2 million between 1980 and 2009, or from 10 % to 21 % of the population in this age range (Aud et al., 2011). In the 2009–2010 academic year, an estimated 4.7 million students, or 10 % of US public school enrollment, were English language learners (ELLs) with limited English proficiency (Aud et al., 2012). The Census Bureau's 2009 American Community Survey suggested that Spanish, Chinese and Vietnamese were the top three languages most frequently spoken in ELL students' homes (Batalova & McHugh, 2010).

For bilingual children from minority groups, the effective use of well-chosen multicultural literature facilitates literacy acquisition, and contributes to their overall academic achievement in the long run. Hadaway and Young (2011) reviewed studies on key factors that promote the academic success of English learners, and pointed out that language-minority students' achievement is often greater when they are reading stories and books that are familiar or culturally relevant.

The contribution of multicultural literature in the school curriculum goes beyond mere content familiarity. Only in a non-discriminatory and non-demeaning learning environment can every student thrive. As "windows" to a mosaic American society, and as empowering instructional materials for the cause of social justice, multicultural education helps all children—nonwhite and white, queer and straight, female and male—build self-esteem and mutual respect.

Research Questions

In his critical overview, Cai (1994) examined 73 picture story books that feature Chinese characters, available in his local libraries in a small Midwest community. Focusing on the ways in which Chinese, Chinese Americans, and Chinese culture are portrayed in these books, Cai found the following patterns: a "disproportionately high ratio" of folktales (about 70 % of the total 73 books); scarcity of stories about contemporary Chinese and China; images of ethnic Chinese that were quite positive, but flawed by inauthentic cultural representations in both the texts and illustrations; and a tendency of all books to focus on Chinese past cultural tradition rather than capturing a changing contemporary reality. Specifically, he cited ignorance and poor research on the part of children's book illustrators as the main contributing factor for visual misrepresentation of Chinese culture.

The major questions that have driven our inquiry are: what changes have taken place in picture books about Chinese since Cai's investigation? What problems remain? Which titles can we recommend to teachers and parents with confidence and satisfaction? Based on the current pattern and quality of picture books on Chinese topics, what suggestions can we offer to publishers—traditional gatekeepers of reading materials for the delight and instruction of young children?

Scope

We searched for award-winning picture books published during the past two decades and found 46 titles[2] that feature Chinese or China. Although Cai's study was released in 1994, we started from the year 1992 until the present (June 2011), in order to accommodate titles that might otherwise fall through the gap due to the long-term academic publishing process. The resulting 46 titles were published either in the United States or Canada, dated within a span of 17 years from 1993 through 2009, averaging 2–3 titles from each year. All actual copies were obtained from the two authors' university and local public libraries.

The majority of the titles (40) were found in the Database of Award-Winning Children's Literature (DAWCL), which contains over 8,700 book records from 102 awards across six English-speaking countries and supports searching by the ethnicity or nationality of protagonists (Bartle, 2011). Some of the "awards" indexed in the database are lists of notable books compiled by professional associations, and our study honors this broad definition of children's book awards. Most of the books (31 titles) have been listed in either Notable Social Studies Trade Books for Young People (22 titles), which are selected by the National Council for the Social Studies, or ALA Notable Books for Children (13 titles), or both. Examples of less frequently-won awards include Amelia Frances Howard-Gibbon Illustrator's Award (3 titles), Orbis Pictus Honor (2 titles), and Caldecott Honor (1 title). Another six titles were added from the lists of two other awards, not indexed by DAWCL, but pertinent to this study: Asian Pacific American Award for Literature and Chinese American Librarians Association Best Book Award, both established by professional groups affiliated with the American Library Association.

In focusing upon award-winning titles, the scope of our study is narrower than Cai's conducted in 1994. The research findings will contribute to an understanding of the highest-quality picture books, which have received approval from children's literature experts and subsequently are more likely than average works to be noticed by professionals. It must be pointed out once more that the scope of "awards" is not rigid. Another powerful search tool, Children's Literature Comprehensive Database (CLCD), is estimated to have indexed at least twice as many children's book awards as DAWCL, including many that are lesser known, non-U.S., or at the regional level ("Links," n.d.). CLCD's search mechanism yielded at least 100 "award winners" of picture books on Chinese topics, including those that made the finalists and shortlists. Although this study is based on the analysis of a smaller set of 46 titles, we are aware of titles outside this range and will offer brief discussions when relevant.

[2] One picture book, *The Master Swordsman and the Magic Doorway* by Alice Provensen (2001) contains two different stories and is coded as two titles; otherwise the total number of books is 45.

Criteria

The perceived values and goals of multicultural youth literature have informed scholars what criteria to consider for evaluating this body of publications. Multicultural literature is first of all subjected to the same multitude of standards for youth literature in general. For example, the content of a multicultural book should be appealing to hold a child's interest. The literary and artistic quality of the texts and images should be conducive to an aesthetic reading experience. We chose not to make these standards the focus of this study, because award-winning titles have been under the scrutiny of book reviewers and awards committees who are familiar with basic criteria for youth literature.

Sociopolitical concerns for the informative and empowering roles of multicultural literature demand an examination of other dimensions in individual titles as well as in multicultural books taken as a whole. Bishop (1997) has reminded us that there is no quick and easy checklist to be applied to such literature, but she brought attention to a number of issues and suggested major criteria to be considered for an assessment, including thematic variety, ideological messages, cultural authenticity, and authorship (Bishop, 1991, 1997). This study, an overview of recent picture books that feature Chinese people, is guided by those widely adopted criteria for multicultural youth literature. Although the scope of the study does not permit an in-depth critique of every dimension in every single title, we intend to uncover patterns and trends at a broad level.

Method

We chose content analysis as our methodology for the study. For each title we coded the following fields: race or ethnicity of authors and illustrators; subject and themes; genre; setting; main character's identity by gender, ethnicity, nationality, occupation, etc.; accuracy of information and cultural authenticity. It was essential to document these dimensions for making a full comparison between publications from the past two decades and Cai's findings from 1994. The two researchers divided up the titles and coded independently. One author who had access to all the titles verified the other one's coding and could find no disagreement, owing to the fact that the bare bones of these picture books were straightforward to adult readers. Both authors, who grew up in China and were bilingual in Chinese and English, then collectively researched all the questionable cultural issues noted in the coding. The comments presented in this essay were their consensus.

We coded the cultural background of creators to attend to persistent concerns over authenticity and authorship in multicultural youth literature. Scholars generally do not rule out the possibility that "cultural outsiders" could create accurate and realistic depictions of people from other groups, on the condition of adequate preparation to bridge the cultural gaps; there is also the consensus that

no one can be fully representative of an entire culture, and both white and nonwhite authors do research about their own history and culture (Bishop, 1997; Gopalakrishnan, 2011; Oswald & Smolen, 2011). "Cultural insiders" are not exempted from factual errors, cultural misrepresentations, and even racial stereotypes they have internalized from the dominant culture (Perkins, 2009; Ruan, 2002). However, studies continue to confirm a strong correlation between culturally authentic youth literature and creators who write or illustrate from their own culture (or closely related subcultures) (e.g., Cai, 1994; Naidoo, 2008). Conversely, criticisms and controversies often swirl around titles created by "cultural outsiders" (Bishop, 1991, p. 34). This study carries on the dialogue on the "cultural insider/outsider" dichotomy, a politically charged issue that has been contested since the late 1960s.

China, Chinese, and Chinese Americans

It would be a haphazard attempt to evaluate books featuring Chinese without a basic idea of the "real people"—Chinese, Chinese immigrants, and Chinese (North) Americans; who they were; and where they came from. Keeping abreast of the history and current status of Chinese and Chinese Diasporas is crucial for us to measure the gap between what is reality and what information about Chinese people and their experiences is available in children's books.

According to current understanding by archaeologists and historians, the initial appearance of the tool-making *Homo erectus* in China extends back at least 750–800 thousand years; the written history of China can be traced back to the Shang dynasty (ca. 1766–1122 B.C.) (Michaels, Possehl, Higham, Rhee, & Sinopoli, 1996). The more than 3,000 years from Shang through the last imperial Qing government (1644–1912) saw dozens of dynastic changes, drastic territorial expansions and contractions, and pendulum shifts between unification and separated, warring states.

The year 1840, when the First Opium War between Britain and the Qing government broke out, marks the start of modern China. The political, military, and economic history of the late Qing dynasty (1840–1912) had a direct impact upon Chinese Diasporas. As Roger Daniels (1988) explained, when the once mighty Qing empire was approaching its final collapse, an ever-increasing Chinese population, a crumbling internal administration, repeated military defeats and humiliations at the hands of the Western powers, and the deterioration of the standard of living all combined to create classic "push" conditions that encouraged emigration (p. 12). A significant migration of Chinese labor to the continental United States began with the California gold rush of 1849, and over 100,000 Chinese arrived within the first 20 years (Daniels, 1988; U.S. Department of State Office of the Historian, n.d.). The earliest immigrants from Asia, Chinese have had a history of residing in this country for over 160 years.

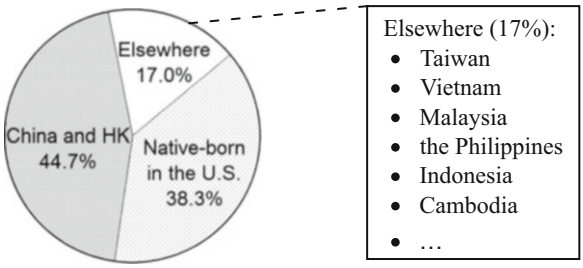

Fig. 12.1 Nativity of Chinese population in the United States, 2008 (Source: Terrazas & Batalova, 2010)

America in 1849 was a nation endemic with racism and nativism. A series of discriminatory legislations—the Naturalization Act passed in 1870, the Page Law enacted in 1875, and the infamous Chinese Exclusion Act of 1882—created enormous barriers for ethnic Chinese to becoming American citizens, to forming families in the U.S., to getting equal payment as European immigrant workers, and, until the Exclusion laws were repealed in 1943, to entering the U.S. as laborers. Major increases in Chinese population in America occurred after the Immigration Act of 1965, which opened a wider door to Asian immigrants. The end of the Cultural Revolution (1966–1976) in mainland China gave Chinese who survived the Communist political turmoil yet another impetus to emigrate.

Asian people in the U.S. are 4.5 times more likely than the U.S. general population to be foreign born (56.3 % vs. 12.5 %) (U.S. Census Bureau, 2012). Chinese population is consistent with this pattern. Of the 3.2 million Chinese people residing in the U.S. in 2008 (Fig. 12.1), about 38.3 % are native born U.S. citizens, and the rest are from a wide variety of geographical locations in East Asia and Southeast Asia. Today, foreign born Chinese comprise the fourth largest immigrant group in the U.S., after Mexican, Filipino, and Asian Indian immigrants (Terrazas & Batalova, 2010). In addition, China is the top source country of transnational adoption by U.S. citizens. From 1999 through 2010, a total of 64,043 young children from Chinese orphanages have been adopted into American families (U.S. Department of State Bureau of Consular Affairs, n.d.).

For people identified as from "elsewhere" in the chart, it means that moving to the U.S. is at least the second international migration for their families—like author Amy Chua's[3] father, a scientist who grew up as ethnic Chinese in the Philippines under the reign of Japan during the Pacific War, before migrating to the U.S. to receive graduate education. Given today's technological development in transportation and communication, it is more affordable than ever for immigrants to maintain ties with their country of origin, making the experience of Chinese in America an increasingly transnational and globalized one.

[3] Chua, a Yale Law School professor, published a controversial memoir, *Battle Hymn of the Tiger Mother*, in 2011.

Analysis

Genre

The dominance of Chinese folktales in the picture books examined by Cai (1994) is not found in this body of award-winning titles from 1993 through 2009, suggesting an increased diversity of genres. Researchers have both confirmed the effectiveness of folktales in transmitting the culture and philosophy of a people, and pointed out the inevitable limitations of over-relying upon the genre (Norton, 2009; Chen, 2009; Cai, 1994). Admittedly, our study does not survey all picture books on Chinese topics at large as Cai's (1994) did. Given the notability of titles of interest, a numerical balance of multiple genres is nonetheless good news (Table 12.1).

Time Setting

Researchers have long noticed the lack of fictional books portraying the contemporary lives of Asian Americans and ethnic Chinese people (Bishop, 1997; Cai, 1994). Table 12.2 shows an improvement on this shortage. (Four titles span from the past

Table 12.1 Genre of award-winning picture books on Chinese topics (1993–2009)

Genre	No. of titles	Percentage (%)
Historic fiction	11	24
Contemporary realistic fiction	11	24
Folktale, legend	8	17
Biography, memoir	7	15
Informational	5	11
Fantasy, fairy tales	4	9
Poetry, free verse	3	7
Total	49 (>46)	107

Note: Two cases of overlapping genres compound the total count. One is a work of historical fantasy, two other titles are fiction written in free verse

Table 12.2 Time setting of award-winning picture books on Chinese topics (1993–2009)

	Time period	No. of titles	
Ancient China	Ancient, unspecified time period	11	17
	Ancient, with specific time period:	6	
Modern History	Late Qing dynasty (1840–1912)	3	31
	Twentieth century, first half	9	
	Twentieth century, second half	3	
	Contemporary	16	
	N.A.	2	2
	Total	50 (>46)	50

to the contemporary period, thus compounding the total count.) Of the 16 titles which at least partially reflect a contemporary time, either expressed verbally or suggested visually, the majority (13) are works of fiction.

As pointed out earlier, the aftermath of the Opium War (1840–1842) ushered in the beginning of Chinese mass migration to America. Post-1949 China ruled by the Communist Party was also a tumultuous historical period, which renewed immigration from China and elsewhere. Our search for award-winning picture book about those two time periods located three titles for each, published from a span of nearly two decades. That was a rather limited choice.

Among the 17 titles about ancient China, there is a tendency to portray a remote, unidentifiable past (11), as opposed to a specific historical period (6). On the one hand, what makes Chinese civilization unique in world history is its continuity through thousands of years to the present century (Shinn & Worden, 1988). A story with temporal distance and vagueness, if it has remained a tenacious fabric of Chinese cultural heritage and shared knowledge, could be informative of an old, unbroken civilization. On the other hand, Chinese politics, culture and identity are anything but static and monolithic as the civilization has endured war and peace, prosperity and recessions, multi-ethnic assimilations and clashes for thousands of years. We also need stories with a specific historical setting to capture distinct Chinese culture, history and experience from different time periods and sociopolitical contexts. One implication for publishers and authors is that, even as we recognize the peril of letting ancient stories dominate children's reading about Chinese, we have not nearly exhausted a rich, continuous and shifting Chinese civilization as a source of knowledge about China in the past and Chinese today.

Geographical Setting and Identity

The geographical setting of a book is highly correlated with the national and ethnic identity of protagonists or biographees. Tabulations of the two fields (Tables 12.3 and 12.4) show a fairly balanced coverage of ethnic Chinese from both China and North America. Geographical locations that are significant for China-U.S. migration experiences appear in a higher proportion of titles. For example, the Guangdong Province (3 titles) of south China was the major area of origin for a massive number of Chinese laborers who left for California from 1849 until 1882. The provincial capital Guangzhou (known historically as Canton) also hosts the U.S. Consulate General's Adopted Children's Immigrant Visa Unit, making the city an important stop for transnational adoptive families.

A comparison between the previous overview of Chinese population and Table 12.4 shows that these picture books have begun to reflect diverse and complex Chinese identities. *Shanghai Messenger* (2005) by Andrea Cheng features a young contemporary Eurasian American girl, Xiao Mei, who is worried that, as "half Chinese," she may not be completely accepted by relatives in Shanghai, China. Amelia Lau Carling's autobiographical fiction *Mama and Papa Have a Store* (1998) contributes a unique story about the robust global experience of Chinese Diasporas

Table 12.3 Geographical setting of award-winning picture books on Chinese topics (1993–2009)

Geographical area	No. of titles
China	29
Titles with more detailed location information:	
Guangdong province	(3)
Tibet	(3)
Shandong province	(2)
Beijing	(2)
Shanghai	(1)
Sichuan province	(1)
Xi'an, Shaanxi province	(1)
Canada or North America unspecified	3
United States	20
Titles with more detailed location information:	
California (San Francisco, Angel Island, Los Angeles)	(6)
Chinatown (in named or unnamed cities)	(6)
New York City	(3)
Oregon	(1)
Ohio	(1)
Indiana	(1)
Guatemala	1
Japan	1
N.A.	1
Total	55 (>46)

since the 1840s. In 1938, Carling's parents fled the Japanese invasion in Guangdong and made Guatemala City their home. Rich with visual details and nuanced text, the book celebrates a peaceful fusion of Chinese lifestyle into a multi-racial, multilingual Guatemalan community. Incidentally, the Guatemala-born author Amelia Lau Carling would add to the U.S. census count of Chinese people from "elsewhere" (Fig. 12.1), because she eventually settled in New York City (Pereira, 2006).

Only one title portrays a Tibetan Chinese as the protagonist. Tibetans are one of 55 officially recognized ethnic minority groups (in addition to unrecognized ones) in China.[4] Many ethnic groups have preserved distinct cultures, including 19 of them which have developed their own written language systems (China Education & Research Network, 2001). Minority groups also differ widely in their relationship with the majority Han Chinese historically and in contemporary society. The illusion of a Han-only Chinese society is not an accurate literary representation of China, any more than a body of "white-only" picture books would be of American society.

[4] Although small in proportion, the total population of officially recognized minority groups in the People's Republic of China is 113.8 million according to the 2010 census data (National Bureau of Statistics of China, 2011). This is a size significantly larger than the non-white population in the U.S. (85.2 millions in 2010).

Table 12.4 National and ethnic identity of central characters of award-winning picture books on Chinese topics (1993–2009)

Identity	No. of titles
Chinese (non-immigrants or before immigration)	21
Specific sub-categories of interest:	
Tibetan	(1)
Chinese Americans/Canadians	18
Specific sub-categories of interest:	
Chinese American adoptees	(2)
Biracial Eurasian American/"hapa"	(1)
Chinese immigrants (to the U.S.)	6
from mainland China	(4)
from Hong Kong	(1)
from Taiwan	(1)
Chinese Guatemalans	1
Japanese, Japanese Canadian	2
Non-Asian	4
N.A.	2
Total	54 (>46)

Note: The categories "Chinese," "Chinese immigrants" and "Chinese Americans" can overlap, depending on what complex immigration stages are portrayed in the stories. One autobiography, *Dancing to Freedom* (2008), subtly captures the biographee Cunxin Li's entire identity shifts from Chinese to a naturalized U.S. citizen

Subject and Themes

The subject variety and thematic sophistication of picture books featuring Chinese have grown substantially. Applying a classification scheme resembling Cai's (1994) study, this section divides all titles into three groups, and gives an overview of the prominent subject matter and themes in each. In half (23) of the titles, which include folktales and other genres, Chinese characters are located within China. The other half (23), to be discussed last, concern Chinese transnational history.

Folktales, legends, and fantasy stories: 11 titles. This group contains Chinese folktales, legends, and imaginary fantasy stories about a "timeless" ancient China. We have put orally based traditional tales and fantasy created by contemporary authors in one category, a choice made necessary by a continuum of authors' practice in retelling, adapting, creating and recreating these stories as well as in documenting the origin of their inspirations. Hearne's (1993a) critique of "source acknowledgement practices" (pp. 24–25) in picture-book folklore is most helpful for us in determining the relationship between these 11 stories and Chinese culture. Two titles (*Dragon Soup* [1996]; *The Paper Dragon* [1997]) appear to be original fantasy stories created by non-Chinese authors in North America, both employing the Chinese cultural motif, the dragon. The two tales share the themes of bravery, self-sacrifice, and wisdom. Another title is surprisingly a tall tale-type story from Japan,

thus not of Chinese origin. A humorous account of a challenge between two giant warriors, one from Japan and the other from China, *The Two Bullies* (1997) conveys a message about humility. Noted as being "translated from an original Japanese story" (title page) without further authorship information, it is unclear whether *The Two Bullies* is a Japanese literary work or folktale.

Of eight other orally based folktales and legends, four titles—*The Dragon's Pearl* (1993), *Lord of the Cranes* (2000), and the two separate stories contained in *The Master Swordsman and the Magic Doorway* (2001)—claim to be retold from China but contain no source note, creating great difficulty for us to ascertain the folkloric and cultural origin of the stories. Four other titles—*The Dragon New Year: A Chinese Legend* (1999), *The Hunter: A Chinese Folktale* (2000), *Monkey King* (2001), and *All the Way to Lhasa: A Tale from Tibet* (2002)—provide enough information to reveal how Chinese folktales are transformed into American children's literature. A cross between retelling and creative writing, *The Dragon New Year* takes generous liberties in mixing multiple motifs and elements from Chinese rituals, folk beliefs, and religion into a pourquoi tale about why Chinese set off fireworks to celebrate the New Year. The "moral messages" that can be inferred from these stories include self-sacrifice, wisdom, generosity, perseverance, and humility.

In American multicultural education, literature based upon traditional oral culture, including myths, legends, and folktales, is treated as an important source for learning about the belief and value systems of a people (Norton, 2009). However, a disclosure of the complex cultural origins of the above 11 stories suggests that, in practice, it is far less straightforward to ascertain which titles are truly faithful to and representative of a culture. A faithful retelling can be undesirable for many reasons, one being that gatekeepers may perceive the ideology embedded in a story as a threat to the American value systems and thus reject the book. Two controversial Chinese folktales illustrated by Ed Young, *The Voice of the Great Bell* (1989) and *Red Thread* (1993), both out of print, are examples of that (Hearne, 1993b). Major revisions may have to be made because, according to the dominant view of childhood in America, a child reader should be shielded from the horror, cruelty, and vulgarity found in the original folktales recorded from oral culture. The question of "faithfulness" is also complicated by the fact that a living and dynamic civilization undergoes a slow process of metabolism, gradually adopting new values and retiring the old. Our analysis of cultural accuracy and authenticity in the next section will demonstrate the challenge further.

There is no quick resolution to the conflict. Here we emphasize an alternative role that traditional literature serves: stories that are well-known among a people—regardless of their origin from oral or print culture—constitute the cultural frame of reference for that people. Even when outdated values are no longer taken seriously by a contemporary society, these stories have become part of cultural heritage and shared knowledge. The story of *Red Thread* (1993), for instance, portrays problematic gender roles and a dubious distribution of justice, but also exposes readers to the idea of "red thread" in Chinese culture. Traditionally referring to the destined tie in a marriage relationship, the term "red thread," with a renewed meaning for the destined tie in an adoptive family, provides a poetic underpinning for *The Red Thread: An Adoption Fairy Tale* (2007) by the Taiwanese American illustrator Grace Lin.

Re-examining the eight folktales and legends, we found two that best serve the role of introducing Chinese cultural references to young American readers. *The Hunter* (2000) and *Monkey King* (2001) originate from oral culture and remain widely familiar to Chinese through a continual presence in print, media, and the K-12 school curriculum in China. In particular, *Monkey King* has been circulated in oral and print culture among Chinese speakers for "almost a millennium" (Yu, 2006, p. x), and can be found in numerous adaptations, fractured retellings, and media renditions. Characters, plot, and humor elements from *Monkey King* are a stable part of ordinary Chinese vocabulary and reference systems.

We argue that picture-book folktales should continue bridging the inter-cultural gap in knowledge, code, and reference systems, by introducing more widely-known stories from minority cultures, even as writers have to gingerly negotiate the quagmire of cultural conflict. Cross-cultural communication and understanding are eased, and cultural barriers reduced, when people share a common vocabulary. Despite ideological criticism of Disney's 1998 animated adaptation of the Chinese folktale "Hua Mulan," it is gratifying to mention the single word "Mulan" in daily conversation and be able to communicate the meaning of that name—without having to retell, to an American listener, the entire back story of a Chinese cross-dressing woman warrior.

China and Chinese (non-immigrants): 12 titles. Ten of the titles (7 nonfiction and 3 fiction) in this group cover a range of topics about China and Chinese, including the hieroglyphically based Chinese characters (*Voices of the Heart* [1997]; *Beyond the Great Mountains* [2005]), poems written in the Tang dynasty but read aloud in Chinese classrooms in the twenty-first century (*Maples in the Mist* [1996]), influential historical figures who are still quoted by Chinese (*Confucius* [2002]; *Su Dongpo* [2006]), the construction of famous heritage sites that have weathered natural and manmade disasters to this day (*Emperor's Silent Army* [2002]; *Forbidden City* [2006]), family relationships (*Always Come Home to Me* [2007]), and a story about a young peasant girl's secret resistance against Communist China's disastrous policy of the late 1950s (*Sparrow girl* [2009]). Many of the topics are what we consider building blocks for shared knowledge across racial and ethnic groups and for the cultural competency of members in a multicultural society.

In two other titles that are geographically set in China, Chinese history and experiences are peripheral to the story. *Tibet: Through the Red Box* (1998) and *Far Beyond the Garden Gate: Alexandra David-Neel's Journey to Lhasa* (2002) are works of nonfiction about European people's adventures in Tibet. *Tibet* by Peter Sis is based on his father's journey to the area as a filmmaker in the mid-1950s, after the Chinese Communist government had annexed Tibet and was constructing a road to the area. Sis pieced together a mysterious Tibet from his father's fragmentary and ambiguous memory, and his own dreamy imagination. Handwritten texts suggest entries from the filmmaker's diary kept in Tibet. At times revealing the voice of a confused survivor caught in a strange land and harsh weather, the entries leave the reader wondering which part of his account of Tibet to trust. In Sis' book, what truly happened in Tibet is of less importance than the role an imaginary Tibet—symbolic of distance, tension, possibilities and spirituality—plays in strengthening the father-son bond.

Table 12.2 has confirmed the increase in stories set in contemporary time. However, the hidden gap is that there are few substantial works featuring contemporary Chinese in China, in contrast to at least 12 featuring contemporary Chinese in North America. The high percentage of foreign born Chinese in the U.S., as well as their continuous ties with where they are from, reminds us of the interconnectedness of a people in global migration. Using national borders to determine whether a story is a legitimate "multicultural" account of Chinese American experience, or rather a book about "foreigners," is to lose sight of an increasingly globalized way of being. One exception is the aforementioned *Shanghai Messenger* (2005),[5] the only title that is intent on exposing readers to contemporary Shanghai and ordinary people's life through the fresh, observant eye of a Chinese American girl. Eleven-year-old Xiao Mei travels from Ohio to Shanghai for the summer and narrates a unique story of seeing China not only as a site of tourist attractions, but also as a place where she experiences mundane day-to-day life with fellow Shanghai residents. Cheng's gentle free verse captures the city at the intersection of age-old traditions and rapid modern development under heavy Western influences.

Chinese Diasporas: 23 titles. These 23 titles, reflecting the global existence of ethnic Chinese outside China, comprise contemporary realistic fiction (11), historical fiction (8), biographies (3) and an informational book. It is worth reporting the various occupations and professions of central figures and some secondary characters in this body of picture books: Chinese are seen as grocery store keepers and merchants (4 titles), restaurant owners and workers (4 titles), railroad construction workers (2 titles), peasants, laundry workers, janitor, seamstress, postman, aviator, actress, and ballet dancer. Much of this list reflects the history of Chinese immigrants being employed in menial, dangerous, and poorly-paid jobs. What the list does not show to young readers is the increase of Chinese with professional jobs after the Immigration Act of 1965. Half of Chinese in the U.S. have obtained a bachelor's degree or higher ("White House," n.d.). First-generation Chinese immigrants are still heavily employed in services, management, business, and finance, but a good percentage also find professional jobs in sciences and engineering, information technology, education and media (Terrazas & Batalova, 2010). Jin Wang's parents in *American Born Chinese* (2006), the Printz Award-winning graphic novel by Gene Luen Yang, both go to graduate school and are not unusual for a new generation of Chinese immigrants.

There is a mixture of familiar topics with new ones that are not found in Cai's (1994) study. Prominent subject matter and themes include Chinese cultural traditions; the livelihood and experience of first-generation immigrants; racial antagonism and racism; interracial friendship and harmony; Chinese American experience during the Pacific War; the proud dual identity of being both ethnic Chinese and American; and finally, transnational adoption. In terms of thematic variety, these books constitute tremendous progress in the publishing of picture books featuring Chinese people in North America.

[5] The title is actually taken from books featuring "Chinese Diasporas," because the central figure is a Chinese American.

Five titles on cultural traditions reflect major Chinese holidays, rituals, and practices that many Chinese Diasporas still observe. For a young boy from Hong Kong, portrayed in *My Chinatown: One Year in Poems* (2002) by Kam Mak, these familiar rituals and lifestyles found in the Chinese American community are a source of comfort, cushioning him against the shock of landing in a new place and a new language environment.

Two titles on adoption (*Mommy Far, Mommy Near* [2000]; *The White Swan Express* [2002]) serve relatively clear agendas for a special targeted audience. First, they give visibility to all members in a transnational, transracial, and multi-ethnic adoptive family, and normalize their identity. Second, they seek to help a young adoptee reader make sense of her experience as the dual subject of abandonment (for whatever reason) and adoption. *Mommy Far*, carrying a therapeutic overtone, and *White Swan*, jubilant and celebratory, are among a growing body of children's literature responding to the steady increase of transnational adoptions.

At least a dozen other titles shed light on the sociopolitical dimensions of Chinese experience in North America. The treatment of weighty topics in the picture-book format raises typical challenges for creators. What is the appropriate age for exposing a child to the history of racial discrimination, oppression, and exploitation? Can a book confront all the cruelty and darkness of that history, at the risk of repelling a child reader? Or can a book leave out traumatic facts to accommodate the sensibility of a child audience, at the risk of whitewashing history? There is also the question of narrative tones. How is a child's interpretation of suffering and plight affected, if everything is deliberately narrated in a light and even upbeat tone, leaving no room for the character's anger, frustration, and moments of weakness?

One title that effectively makes the format fit the content is *Shining Star: The Anna May Wong Story* (2009). As a picture book, it chooses to accompany the images with a text of medium length appropriate for the middle grades, allowing enough narrative space for the biographee's experience, feelings, and some brief information on the social context. The book invites the reader's empathy with Anna May Wong and also offers information to explain the "why" of her struggle as an actress of color in Hollywood during the 1930s. Another title, *Landed* (2006), is fairly well-executed, but for one caveat. Narrated credibly in a child's innocent and uninformed voice, this is an account of an immigrant's experience of being detained and interrogated at Angel Island during the early twentieth century. *Landed*, too, successfully invites empathy but is short on aids to understanding. Without checking out the author's note at the end, young readers will be as uninformed as the 12-year old character Sun as to why he is humiliated and restricted.

Three titles, *Nim and the War Effort* (1997), *Mei Ling in China City* (2008), and *Sky High: The True Story of Maggie Gee* (2009), should be highlighted for filling an important gap in subject matter about ethnic Chinese. Cold War played a significant role in the long-term suppression of Chinese experience during the Second World War in American popular culture and youth literature (Chen, 2009). We are witnessing a modest growth of youth literature that taps into this rich history about Chinese people. The three picture books each feature a spunky Chinese American girl, all

contributing to the Pacific War effort in their own way—by winning the school paper drive (Nim), collecting donations for the war relief (Mei Ling), and joining the Women Airforce Service Pilots (WASP) (Maggie Gee).

Cultural Accuracy and Authenticity

Two major patterns that emerged from these award-winning picture books are: negatively, cultural errors, inaccuracies, and problematic representations still occur at a high frequency, appearing in about one third of the titles; positively, the cultural background of the creators remains a good predictor for the reliability of the cultural accuracy of a book. Non-Chinese creators were responsible for nearly all of the jarring misrepresentations, revealing unfamiliarity with Chinese history, folk culture, and way of life. Chinese writers and illustrators are not, and will never be, error-proof, but they tend to avoid egregious errors of authenticity. A total of 22 authors with ethnic Chinese background, including both first-generation immigrants and native-born Chinese Americans, are involved in the independent or collaborative creation of 26 titles, or 57 % of the award-winning picture-book stories.

One persistent challenge for an accurate and authentic cultural representation of China and Chinese derives from the length of a civilization that is in its fourth millennium. The complexity of cultural continuity and transformations over dynastic changes, territorial expansions, and ethnic assimilations is beyond any single person's grasp. However, people acquainted with Chinese culture are able to verify, based on previous knowledge and information gathering, the credibility of cultural details. Before we give examples of the errors and problems we found, here is a suggestion for publishers: exercise quality control and have a book manuscript reviewed by knowledgeable cultural insiders prior to its final publication. *Sky High: The True Story of Maggie Gee* (2009), a biographical story about one of only two Chinese American pilots in the WASP during World War II, acknowledges a subject expert on WASP history for reviewing the book. A similar review process by cultural experts can catch errors before books go into print and pass on misunderstandings to young minds.

The problem of anachronism, found as a common error by Cai (1994), remains serious in what we found. Visual representations of characters' clothes and hairstyles, suggesting features from different dynasties hundreds of years apart, are juxtaposed on the same pages, which are unfortunately not about time travel. *The Paper Dragon* (1997) illustrated by Robert Sabuda, *Master Swordsman and the Magic Doorway* (2001) by Alice Provensen, and *Su Dongpo* (2006) by Demi all contributed their fair share to the cultural confusion and ambiguity. Otherwise, *The Paper Dragon* is a suspenseful fairy tale about a Chinese artist outsmarting a dragon, illustrated in magnificent paper cutting, except that it appears to be a Western winged dragon. *Dragon Soup* (1996), also an engaging fairy tale about outsmarting dragons, is set in an unnamed Asian country and is visually uncommitted to any single culture. Like its title, the illustrations of the book are a soup of cultural elements temporally and spatially far apart, combining an adult man with

a long queue characteristic of the Qing Dynasty, a girl of modern dress and haircut, and winged dragons from the West.

Other errors in cultural details abound. In *Confucius* (2002) illustrated by Frédéric Clément, the Chinese mythical creature, Qilin, takes the shape of a unicorn from Western folklore.[6] In *Sparrow Girl* (2009) illustrated by Yoko Tanaka, a story set in China in 1958, the Chinese peasants seem to have borrowed from Japanese farmers' wardrobes, and even converted to sleeping on futon beddings on the floor. Seemingly innocuous errors, such as an indiscriminate treatment of Chinese and Japanese culture in youth literature, are a symptom of one of the most arrogant assumptions about East Asian people—that their cultures are related and thus worthing no effort of distinguishing. *Sparrow Girl* is only one of the children's books that, with no qualm, blend Chinese and Japanese culture for young American readers, following earlier misguided examples like *Tikki Tikki Tembo* (1968) by Blair Lent (Chen, 2009).

Ed Young, the prolific China-born illustrator who is deeply knowledgeable of traditional Chinese art and culture, is not exempt either. The problem stems less from insufficient cultural expertise than from a casual consideration for the criteria of children's literature. His *Beyond the Great Mountains* (2005) explains the meaning of Chinese characters based on their visual shapes, which is a routine game for beginning learners of the ancient hieroglyphic language, but his interpretation of the characters "jade" and "kingdom" is not accurate by etymological standards.[7] Though of potential mnemonic value, the artistic liberty he took with the characters is not clarified anywhere in the book. (In another similar title on Chinese characters, *Voices of the Heart* [1997], Young made a disclaimer, indicating that the visual interpretations were freely his own.)

Conclusion

This study examined 46 titles of award-winning picture-book stories featuring China and Chinese, and published in the U.S. and Canada from 1993 through 2009. A comparison between the patterns of this body of literature and those of titles prior to 1993, as outlined in Cai's, 1994 study, found both significant improvement and persistent problems. This is a richer and more diverse body of picture books, reflecting Chinese culture, history and experiences in a good variety of genres, covering different time periods, geographical locations, and thematic concerns.

[6] Qilin does not have a strict uniform look across textual descriptions, visual representations, and sculptures in Chinese culture. Despite the flexibility of its shape in folk imagination, the mythical animal is often depicted with the horn(s) of a deer and a scaled body, and is unlikely to be confused with a white horned horse.

[7] Traditional Chinese character 國 (kingdom, nation) is commonly seen as being composed of two parts, meaning weapons for defense and territorial boundaries respectively. In his book Young supplied a less belligerent explanation of the meaning of "nation" based on 国, a younger, variant form composed of "jade" and "boundaries."

In Ed Young's Caldecott Honor book *Seven Blind Mice* (1992), each mouse explores one part of an unknown beast and finds out what it is by putting together all the clues. In multicultural literature, no single title can fully accomplish the task of representing a people's culture and experience. Through each title a young reader learns a part of that culture like a blind mouse learns about a giant elephant. The best bet for an accurate and comprehensive literary representation of a minority culture is an abundance of heterogeneous works, capturing a small piece of truth in each effort, allowing room for both the prevalent patterns and diverging idiosyncrasies of that culture. The ultimate approach for combating cultural stereotyping is a choice so rich and diverse that no simplified, unbalanced, and prejudiced portrayal of a people can dominate knowledge about that cultural group.

In addition to the many topical and thematic gaps we have discussed, there is an absolute absence of LGBTQ Chinese in all of these picture books. Religious diversity is limited. Titles that give visibility to and thus normalize "non-traditional" families such as those with step-relations are also scarce. Publishers have endless opportunities to produce a truly rich body of multicultural youth literature that, revisiting the definition we used, validates a range of socio-cultural experiences, including those of language, race, gender, class, ethnicity, ability, and sexual orientation (Gopalakrishnan, 2011).

It must be pointed out that high-quality works addressing some of those "missing" topics are available, though not necessarily winning the awards indexed by DAWCL. For example, *D is for Doufu* (Shen's Books, 1997) gives visual exposure to non-Han Chinese. *The Cricket's Cage* (Hyperion Books, 1997) adds to stories set in specific historical periods of ancient China. *A Little Tiger in the Chinese Night* (Tundra Books, 1993), *Red Land, Yellow River* (Groundwood Books, 2004), and *Mao and Me* (Enchanted Lion Books, 2008), all autobiographical stories about life in Communist China, are valuable memoirs reflecting China's political history. *A Young Painter: The Life and Paintings of Wang Yani* (Scholastic, 1991) and *Share the Sky* (Annick Press, 1999) are rare titles portraying contemporary Chinese from China. A number of recent titles, winning recognition after our data collection work, were also left out of this review. Most remarkable of all are Ed Young's fresh foray into personal storytelling through *The House Baba Built: An Artist's Childhood in China* (2011) and Liqiong Yu and Chengliang Zhu's *A New Year's Reunion* (2011), a rare critical success of children's literature imported from Mainland China to the American market. The limitations of this study call for continual analytical attention to new picture books and other types such as board books, chapter books, and young adult fiction, in order to establish a comprehensive appraisal and raise the quality of information about China and Chinese in American youth literature.

Given so many conspicuous cultural misrepresentations we found even among award-winning titles, we advocate for introducing into the publishing cycle a review process by cultural experts. When Ben, the boy in the opening snippet, is learning to read, he deserves as much as his white toddler friends to see his people and culture reflected in children's books, and he is just as entitled to read appealing, aesthetic and authentic books that are the product of inspired imagination, genuine empathy, and solid research.

Acknowledgment Betsy Hearne, Professor Emeritus of Library and Information Science at the University of Illinois, Urbana-Champaign graciously read the first draft of this essay and provided much-needed criticism and exhortation.

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