

Reading Strategies Revealed in Chinese Children's Oral Reading

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ABSTRACT

The purpose of this study was to examine the character identification strategies of Chinese children during their oral reading of a continuous text. Eighteen second graders' oral reading of a story, as well as an interview about their decoding strategies, were audiotaped and transcribed. The results generally converged with those of previous oral reading research in alphabetic languages. Children, even poor readers, consistently used information available within characters and information from context to identify unfamiliar characters. This study suggests that Chinese children as young as second grade can apply appropriate strategies to decode their logographic writing system. In the interview after reading, children were able to describe their thinking processes while decoding unfamiliar characters. Their descriptions were usually consistent with behavior observed during oral reading, which indicates a high level of metalinguistic awareness.

Oral reading is an active language process that provides a window for observing children's reading strategies. So far, there has been extensive research on children's oral reading behavior and the various strategies children apply in reading alphabetic scripts like English; however, there's little similar research with other kinds of language systems. The current study broadens this research to Chinese, a logographic script. The purpose of this study is to examine the oral reading behavior and decoding strategies employed by young Chinese children; the role of metalinguistic awareness in reading Chinese characters; and differences among good, average, and poor readers in these aspects of reading. Second-grade children read a story individually. Their reading process was analyzed in terms of reading errors and other aspects of reading behavior. Immediately after children finished reading the story, they were interviewed about their reading strategies. Children's reflections on how they read unfamiliar characters provided another angle to look at children's strategic language processes during reading. Among numerous oral reading studies in alphabetic language systems and a very few in nonalphabetic language systems, this study is the first one to integrate children's own explanations with oral reading analysis.

The framing assumption underlying most reading research is that reading can be reduced to a set of component skills. This assumption is problematic because reading of continuous text is best conceived as a "partially decomposable system" (Simon, 1980). The reduction of reading to a set of component skills leaves out or de-emphasizes strategic orchestration of components, interaction among components, and moment-by-moment dynamics. Most studies of word identification are outside the context of reading continuous text, where decoding strategies are limited and not necessarily the same as the ones that come into play in natural reading settings.

PREVIOUS RESEARCH

One of the features of primary school literacy teaching is the significant amount of time spent on oral reading. Thus for children, oral reading of a continuous text is a natural reading situation that ought to enable insight into the reading processes involving visual perception, strategy selection, verbal production, and aural verification. Goodman (1969, 1970) initiated systematic research on beginning readers' oral reading. Oral reading errors, which Goodman termed 'miscues,' reveal the underlying reading process that simultaneously entails competence in comprehending the print and production of its oral representation by means of mapping speech onto print. Oral reading errors provide insight into 'slips of the tongue,' 'slips of the eye,' and even 'slips of the mind,' from which a more comprehensive view of the reading process is possible.

Research with children acquiring alphabetic languages reveals several consistent error patterns during oral reading (see Wixson, 1979 for a review).

Children produce more contextually (i.e., syntactically and semantically) acceptable errors than graphophonologically similar errors. Clay (1968) investigated the oral reading errors of 100 five-year-old children and reported that 72% of errors were grammatically acceptable, whereas only 41% of errors were graphophonologically similar to the target words. Weber's (1970b) study produced a similar result; approximately 90% of the oral reading errors of first graders were grammatically acceptable.

Another finding is that good readers tend to make a larger proportion of semantically acceptable errors (e.g., read *home* for house) whereas poor readers tend to make a larger proportion of errors that are graphophonologically similar to the target word (e.g., read *horse* or *hoose* for house) (Danielsson, 2001; Fleisher, 1988; Goodman, 1969). Within each error category, good readers make more errors that are semantically and syntactically acceptable and that are graphophonologically similar (e.g., Weber 1970a, 1970b). Chin, Waggoner, Anderson, Schommer, and Wilkinson (1993) reported that poor readers made many more errors than good readers and many more high meaning change and high graphophonological change errors than good readers in Grade 2, indicating a greater sensitivity to phonological and contextual information on the part of good readers. However, this sensitivity seems to exert more influence in early reading development, because the difference between good and poor readers was reduced by third grade. Although whether, how, and to what extent implicit knowledge of semantics, syntax, phonology can be applied to reading is not very clear, there's no doubt that active readers are able to use 'graphophonic' [Goodman's term; we will use *graphophonological*], syntactic, and semantic cue sources during oral reading (Goodman, 1967; Goodman & Burke, 1973; Tunmer & Chapman, 1998).

While findings from research on errors during oral reading point to one set of conclusions about the relative importance of phonological and contextual information for good and poor readers, research using other paradigms points to different conclusions, and the controversy about decoding strategies of children of different reading levels continues. McGuinness (1997) proposed four decoding strategies that children were hypothesized to use when encountering an unfamiliar word, namely, *part-word decoding*, *whole-word decoding*, *phonological recoding*, and *analogical decoding*. Part-word decoding and whole-word decoding strategies are less effective because of the reliance on a global visual impression and use of context, if available.

Phonological recoding involves converting the print into pronunciations with the application of grapheme-phoneme correspondence rules (Ehri, 1996). However, the effective application of this strategy depends on the regularity of letter-sound correspondences and is problematic with long words. Rather than letter-sound matching, analogical decoding involves using orthographic patterns from known words to pronounce unfamiliar words. According to proponents of

stage models of reading development, analogical decoding is a late-developing strategy (e.g., Ehri, 2005; Manis, Szeszowski, Howell, & Horn, 1986; Zinna, Liberman, & Shankweiler, 1986). However, other research suggests that even beginning readers are capable of reading unfamiliar words by making analogies. Goswami (1986) found that first graders and kindergartners could use analogy to read unfamiliar words correctly, suggesting that analogical decoding could play a role in early reading acquisition. Brown and Deavers (1999) replicated Goswami's finding that the use of analogy was independent of reading ability by having first-, second-, and third-grade children read both regular and irregular nonwords.

Another important but controversial strategy is the use of contextual information. Goodman (e.g., 1965) argued for the importance of contextual information in word identification based on the observation that good readers' errors are more constrained by context than the errors of poor readers. This is inconsistent with other researchers who propose a more important role for phonological recoding in word recognition, because these researchers have found that good readers are more sensitive to graphophonological information than poor readers. For instance, Perfetti, Goldman, and Hogaboam (1979) reported that poor readers tended to rely more on contextual information than good readers because of their deficits in word analysis.

In his longitudinal study of first-grade students' oral reading, Biemiller (1970) concluded that conjoint use of phonological and contextual information is the most advanced and effective approach to word identification among beginning readers. This idea was elaborated by Stanovich (1980), who proposed an interactive-compensatory model of reading. Acknowledging that children use several kinds of information during reading, Stanovich argued, however, that they compensate for a deficit in ability to use one type of information by relying more on another. Tunmer and Chapman (1998) confirmed that two general strategies—phonological recoding and use of context—are employed by beginning readers to decode and learn unfamiliar words in meaningful text. They concluded that the ability to use both strategies is of great importance in early reading development and that there is a reciprocal facilitating relationship between the two strategies.

Children's behavior during oral reading provides another angle to assess monitoring and regulation of the reading process. Self-corrections have attracted particular interest because these are an indication of self-monitoring and a reflection of strategic reading (Clay, 1985). Some types of errors are corrected more often than others. The more semantically and syntactically acceptable an error, the less likely children are to correct it and vice versa (Clay, 1967; Goodman & Burke, 1973). Research has shown that good readers have higher self-correction rates than poor readers (Clay, 1969; Hoffman & Clements, 1984; Hoffman, et al., 1984; Weber, 1970a). However, the difference between good and poor readers in rate of self-correction may be confounded with text

difficulty. Good and poor readers have similar self-correction rates if text difficulty is matched with their reading levels (Share, 1990; Thompson, 1984).

Children's independent reading, in which they rely on different sources of information and integrate different strategies for word identification, requires metalinguistic awareness (Nagy & Anderson, 1999). Metalinguistic awareness enables one to employ "control processes" to extract meaning from print and to reflect on and manipulate the properties of language structure (Tunmer, Herriman, & Nesdale, 1988). According to Tunmer and colleagues, there are four general types of metalinguistic awareness that may play a role in beginning reading: phonological, word, syntactic, and pragmatic awareness.

Among these four categories, phonological awareness has attracted the greatest attention. Its importance to early reading of alphabetic languages is evident in reading research (e.g., Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1991; Lundberg, Frost, & Petersen, 1988; Lyster, 2002). Phonological awareness refers to children's ability to attend to and analyze the sound structure of words. Children have to develop an understanding of the mapping between units of the spoken language and the corresponding units of the writing system. In this sense, word awareness is implied by and accompanied by phonological awareness.

Syntactic awareness refers to sensitivity to the structural representation of sentences and interword relationships, which enables readers to use local contextual information as a source for word decoding. Tunmer and colleagues (Tunmer & Chapman, 1998; Tunmer, Herriman, & Nesdale, 1988) argue that syntactic awareness facilitates the acquisition of word recognition skill because phonological recoding alone is often insufficient to identify words. Phonological awareness and syntactic awareness are found to play more important roles in the early stages of reading development than pragmatic awareness, because these two categories of metalinguistic awareness facilitate children's word recognition, whereas pragmatic awareness—sensitivity at the intersentential level—is higher-order metalinguistic awareness required for later stages of reading development.

CHINESE WRITING SYSTEM AND LEARNING TO READ CHINESE

Chinese has a logographic writing system in which each character represents a morpheme, or minimal unit of meaning, and corresponds to one syllable. A Chinese syllable consists of an optional initial consonant, or onset, followed by a final part, or rime. Chinese is a tonal language with four basic tones, or pitch contours—high, rising, low then rising, or falling. Thus, a Chinese syllable is made up of three constituents: onset, rime, and tone.

The most common type of Chinese character is the semantic-phonetic compound, which consists of two parts: a semantic component, also called the radical, that provides a clue to the meaning of the character, and a phonetic

component, also called the phonetic, that provides a clue to the pronunciation of the character (Hoosain, 1991; Shu, Chen, Anderson, Wu, & Xuan, 2003; Taylor & Taylor, 1995; Zhou, 1978). For example, in the semantic-phonetic compound character 蜻 (dragonfly), the left part 虫 is the radical, meaning insect, whereas the right part 青, pronounced /qing1/, is the phonetic which provides the pronunciation of the whole character 蜻/qing1/.¹

Unlike learning to read English, learning to read Chinese does not require knowledge of grapheme-phoneme correspondences but, instead, requires knowledge of phonetic-syllable correspondences. Chinese phonological awareness consists of tone, onset, and rime awareness and the insight that the phonetic part of a character represents the pronunciation of that character. Experimental findings indicate that phonological awareness is important for learning to read Chinese and that children are able to use phonetic cues to read unfamiliar Chinese characters (e.g., Ho & Bryant, 1997; Shu, Anderson, & Wu, 2000; So & Siegel, 1997). Ho and Bryant found that measures of Chinese children's phonological awareness significantly predicted their reading performance in Chinese 2 and 3 years later, even after controlling for the effects of age, IQ, and socioeconomic background.

About 72% of the characters Chinese children learn in elementary school are semantic-phonetic compound characters, among which only 23% contain a phonetic that provides full information about pronunciation in the sense that the whole character has exactly the same pronunciation as its phonetic part, as illustrated above with the character 蜻 (Shu et al., 2003). An even smaller percentage of the semantic-phonetic compounds taught in lower grades are fully regular. Importantly, children as young as second graders can make use of the information provided by the phonetic part to learn to read less-than-fully regular characters (Anderson, Li, Ku, Shu, & Wu, 2003; He, Wang, & Anderson, 2005).

The fact that phonetic cues are not completely reliable means children need other strategies when the phonetic cue is insufficient to directly decode a character. Ho, Wong, and Chan (1999) taught first graders and third graders to read clue characters and tested them on other unknown characters. They reported that not only the third graders, but even the first graders, could make phonological analogies based on the phonetic component from the clue character as well as semantic analogies based on the radical from the clue character. This suggests that young Chinese children are able to make orthographic analogies in learning to read a logographic script just as young English-speaking children make analogies in learning to read an alphabetic script. However, whether children will use analogy in the real reading situation cannot be answered from their study.

¹ Pronunciations are enclosed in backslashes and written in pinyin, the alphabetic script used in the People's Republic of China for representing the pronunciations of characters. The numbers represent the four tones of Mandarin Chinese.

Children's awareness of the structure of characters was studied by Pine, Huang, and Huang (2003). They interviewed 15 first-, second-, and third-grade students about strategies they used to recognize characters. The children were shown several familiar characters containing deliberate distortions. They were asked to identify the mistakes and tell how they recognized the characters. Pine and her colleagues reported that children divided characters into structural components and individual strokes. The children could talk explicitly about the details of the structure of characters. Some children volunteered which components in characters serve as clues for meaning or pronunciation. This study shows that young children are aware of the major components in characters and of the function of these components. In an experimental study with first, second, and fourth graders, Anderson et al. (2004) established that children are able to perceive and use the components in Chinese characters and that the ability to use components increases with age. Even first graders had begun to perceive the major components in characters, while second and fourth graders were better at perceiving the major components and were even able to use sub-components that do not represent semantic or phonological information.

Only one previous study of Chinese children's oral reading was located. Chang, Hung, and Tzeng (1992) compared the oral reading performance of 32 third- and fourth-grade disabled and normal readers. They reported that all of the students, even the disabled students, could use various cue sources in their oral reading. An interesting finding was that students sometimes had difficulty figuring out word boundaries, depending upon whether or not vocabulary was familiar from oral language, and reflecting the fact that Chinese is written without spaces between words. In a study to investigate the reading strategies of Hong Kong first-, third-, and fifth-grade children's processing of two-character words, Chu and Leung (2005) found that although children as young as first graders could use both character-level and word-level information to read unfamiliar characters, at lower grade levels children relied more on component characters while at higher grade levels they relied more on words as a whole meaningful unit. This study was limited to reading unrelated words. The strategies used with continuous text probably go beyond the character and word level, and intersentential and intrasentential level processing is likely to take place.

To recapitulate, the present study probed the strategic decoding skills of Chinese children and their processing of unfamiliar Chinese characters in a natural independent oral reading situation. Specifically, the study examined the 1) oral reading error patterns and oral reading behavior displayed by young Chinese readers, 2) decoding strategies of Chinese children of different reading levels, and 3) level of metalinguistic awareness exhibited by Chinese children. Through examining oral reading errors and character decoding strategies, this study aimed to determine whether the pattern of Chinese children's oral reading behavior is comparable to that of English-speaking children. Children's

own account of their thinking process, combined with analysis of their oral reading, was intended to provide a rich picture of children's linguistic and metalinguistic processes during reading. Because converging evidence was obtained from children's oral reading and interviews with them about their reading strategies, it was hoped the study would furnish new insights into the sources of information used by good and poor readers. It was hoped the study would illuminate the universal as well as the language dependent aspects of children's development of reading, word decoding, and metalinguistic knowledge.

METHOD

Participants

A total of 18 second-grade students from two classes in a public elementary school in Shanghai, China participated in this study. According to the principal, 90% of the parents had attended college, which is above average in China. The study was conducted late in the first semester of the school year. Students were divided into high, average, and low reading proficiency levels, with six students at each level, based upon their teachers' rating of their reading proficiency. Research shows that teachers are a valid and reliable source of information about student reading proficiency (Chen, et al., 2004; Hoge & Coladarci, 1989), as teachers have a comprehensive view of student reading based on daily observation of oral reading, answers to questions, participation in discussions, and performance on tests and exercises.

Procedures

This study was composed of two parts. First, students read aloud the story, *I don't know the time* (see Appendix). The story was selected from the supplementary reading textbook and, according to the teachers, had not been assigned to the students prior to the study. Immediately following oral reading, students were interviewed about their strategies for decoding Chinese characters.

Students were told before they started reading that some of the characters would be difficult, not to worry too much about right or wrong pronunciations, and to make a guess at characters they were not sure about. During oral reading, the researcher did not give any help to the students. If a student paused for 20 seconds, the researcher offered encouragement and, if that didn't work, urged the student go on reading. The interview focused on the students' self-report of their processing of new and difficult characters in the story. The researcher prompted the children to talk about how they read difficult characters, what they were thinking, and why they pronounced the characters as they did. For example:

- Researcher: What about this one (referring to the irregular character 贴/tie1/, meaning paste or stick)?
- Student: This one, tie1 zai4 che1 chuang1 shang4 (he's reading the whole sentence from the text, 贴在车窗上, stick it on the car window, not the individual character 贴/tie1/).
- Researcher: Yes, right, tie1. Have you learned it before?
- Student: No.
- Researcher: Then how do you know its pronunciation?
- Student: I don't know how to read it, so I made a guess.
- Researcher: What did you base your guess on?
- Student: I think if the sentence here is coherent, I will say that this is tie1.

This is a segment from a typical interview. Each student was asked about 3–11 characters, 6 characters on average, depending on their response time. The whole procedure for each student took about 20 minutes. All of the oral reading and interviews were audiotaped, transcribed, and translated into English.

Coding features of oral reading

Students' oral reading was assessed in terms of reading errors and attempts that signaled difficulty in reading. The major categories of reading errors distinguished in this study were substitutions, insertions, and omissions. After reading errors had been identified and coded, they were further analyzed in terms of visual, phonological, syntactic, and semantic dimensions.

A visually similar error was defined as a response that had at least one major component the same as one major component in the target character and the other component similar in appearance (e.g., 问 was coded as a visual confusion with 问). Phonological errors were defined as mistakes of either onset, rime, or tone. Any error that involved reading one major component of the character as the pronunciation of the whole character was also coded as a phonological error. For example, /gao1/ would be coded as a phonological error for the target character 敲/qiao1/ because the phonetic component 高/gao1/ was used to read this character 敲/qiao1/. Syntactically acceptable errors were syntactically appropriate either for the whole sentence or up to and including the uttered character or word, but not appropriate after the uttered character or word (e.g., 一个汽车公司把车开到路边 a car company pulled in along the side of the road, instead of 一个汽车司机把车开到路边 a car driver pulled in along the side of the road). Semantically acceptable errors were semantically appropriate to the intended meaning of the text.

Students' reading attempts indicating some difficulty were classified into four categories: self-corrections, repetitions, pauses, and partials. Self-corrections occurred when a student corrected a wrong response to the target character.

Repetitions occurred when a student reread a character, a word, or went back to the beginning of a clause or sentence to make another attempt to figure out the character. Pauses refer to intervals of silence before characters. Partial pronunciations refer to a partial pronunciation of a character (usually the onset) often followed by a complete and correct pronunciation of the character, with or without pauses. A student sometimes made more than one partial attempt before a complete and correct pronunciation was uttered. For example, to read 睡/shuì4/, the student might make the following attempts: /sh-, shu-, shuì4/.

Coding interview responses

The interview focused on students' own account of reading errors and attempts to read unfamiliar characters. Since reading errors varied from student to student, the number and kind of characters asked about also varied from student to student. Examples of typical questions asked about a character were: How do you read this character? Have you learned it before? How do you know its pronunciation? Why did you read it so? All of the questions were asked in an attempt to elicit students' thinking processes while decoding a new or difficult character.

Student reports of how they approached difficult characters were analyzed in terms of character identification strategies—the cues employed by a student in order to read a new character. Character identification strategies based on three types of cues were distinguished: phonetic, analogical, and contextual cues. Use of a phonetic cue involved basing the pronunciation of a character on its phonetic part, for example, saying 钟/zhong1/ because its phonetic 中 on the right side of the character is also pronounced /zhong1/. In this case, 钟 was an unfamiliar character and 中 a familiar character. Use of a phonetic cue was coded even when the onset, rime, or tone of the phonetic part was changed. Use of an analogical cue refers to deriving the pronunciation of a new character from another compound character with one component in common and only when it is not possible to pronounce a character just by naming the phonetic. For example, a student may read 怙/song1/, a new character, by making an analogy to 松/song1/, a familiar character. These two characters differ only in their radicals (one is 忄, the other is 木), which do not give any clue to pronunciation. If a student read 怙/song1/ as /gong1/, this would be regarded as using a phonological cue because the student relied on the phonetic 公/gong1/, for reading the character. Use of a contextual cue means the pronunciation of a character was derived in part from the meaning of the sentence. Diagnostic of whether context was an influence was whether, when reading a difficult character, the student read the whole word, clause, or sentence containing that character instead of merely reading the individual character.

RESULTS

Features of children's oral reading performance are summarized in Table 1. Individual reading speed varied greatly from 30.8 to 154.2 characters per minute. Good readers and average readers read at almost the same rate, but poor readers read many fewer characters per minute. In terms of accuracy, good readers had the lowest error rate and the poor readers had the highest error rate. Poor readers read very slowly and made almost twice as many errors as good readers. It seems that poor readers spent more time trying to figure out the unfamiliar characters, but ended up making errors anyway. A further analysis using Tukey's HSD to evaluate differences in reading speed shows that poor readers read significantly more slowly than good readers ($p < .01$). However, there were no significant differences in error rate among students of the three reading levels.

Analysis of the types of errors made by good, average, and poor readers showed that substitutions were the most frequently produced errors at all three reading levels, accounting for 60% of total errors (see Table 2). Poor readers made a larger proportion of substitution errors (71%) than either good (42%) or average readers (57%). This indicates that poor readers encountered more difficulty in figuring out unfamiliar characters. However, instead of simply skipping unfamiliar characters, poor readers tried to figure them out even though this often led to an error.

Table 1. Means (Standard Deviations) of the Rate of Characters Read Per Minute and Rate of Errors Per 100 Characters at Three Reading Levels

Reading Level	Reading Speed	Error Rate
High	120.1 (18.4)	4.2 (1.8)
Average	125.2 (23.3)	4.5 (2.4)
Low	68.5 (33.9)	8.0 (5.0)
Total	104.6 (35.9)	5.5 (3.7)

Table 2. Total Number (Percentage) of Types of Reading Errors Among Children at Three Reading Levels

Reading Level	Substitutions	Insertions	Omissions	Total
High	17 (41.5)	14 (35.9)	10 (25.6)	41
Average	25 (56.8)	13 (29.5)	6 (13.6)	44
Low	56 (70.9)	10 (12.7)	13 (16.5)	79
Total	98 (59.8)	37 (22.6)	29 (17.7)	164

To better understand the dynamics of reading errors, errors were further classified into four categories: visually similar, phonological, semantically and/or syntactically acceptable, and other errors (any errors that do not fall into the other three categories). As can be seen from Table 3, a total of 87 errors, accounting for 53% of all errors, were included in the semantically and/or syntactically acceptable category, among which 16% were semantically inappropriate but syntactically appropriate. Phonological errors were the second-most frequently made errors with a total number of 41, accounting for 25% of all reading errors. Of the errors made by good readers, 73% were semantically and/or syntactically acceptable. This figure dropped to 50% for average readers and 32% for poor readers. Phonological errors accounted for about 33% of the errors made by the poor readers, but only 15% of the errors of good readers and 20% of the errors of average readers. To summarize, Table 3 indicates that good readers made more semantically and/or syntactically acceptable substitutions whereas poor readers made more phonological substitutions. Good readers made no visually similar or other errors, whereas about 22% and 27%, respectively, of the errors made by average and poor readers were of these two kinds. Poor readers were more likely to ignore a character if it was too difficult to decode; 92% of their omissions occurred when they encountered an unfamiliar character.

Table 3. Total Number (Percentage) of Errors That Were Due to Visual, Phonological, Semantic and Syntactic, and Other Problems Among Children at Three Reading Levels

Error Type	Reading Level	V	PH	SS	Other	Total
Substitution	High	0	6 (35.3)	11 (64.7)	0	17
	Average	3 (12.0)	9 (36.0)	8 (32.0)	5 (20.0)	25
	Low	4 (7.1)	26 (46.4)	15 (26.8)	11 (19.6)	56
Insertion	High	—	—	13 (92.9)	1 (7.1)	14
	Average	—	—	10 (76.9)	3 (23.1)	13
	Low	—	—	9 (90.0)	1 (10.0)	10
Omission	High	—	—	6 (60.0)	4 (40.0)	10
	Average	—	—	4 (66.7)	2 (33.3)	6
	Low	—	—	1 (7.7)	12 (92.3)	13

V = Visual
 PH = Phonological
 SS - Semantic and Syntactic

Table 4. Total Number (Percentage) of Self-Corrections, Repetitions, Pauses, and Partial Made Among Children at Three Reading Levels

Reading Level	Self-Correction	Repetition	Pause	Partial	Total
High	8 (18.6)	9 (20.9)	22 (51.2)	4 (9.3)	43
Average	11 (22.0)	15 (30.0)	20 (40.0)	4 (8.0)	50
Low	11 (9.5)	20 (17.2)	76 (65.5)	9 (7.8)	116
Total	30 (14.4)	44 (21.0)	118 (56.5)	17 (8.1)	209

When we compared the reading performance (total number of errors, number of phonological errors, number of semantically and/or syntactically acceptable errors, and number of visual errors across all error types) among the three groups, we found just one significant difference, namely in the number of phonological errors [$F(2,15) = 7.12, p < .01$]. Tukey's HSD pairwise comparisons showed that poor readers made significantly more phonological errors than good readers and average readers ($p < .05$ for both comparisons). It seems that the major difference between poor readers and good/average readers is in phonological processing.

Next we examined the reading attempts that were signs of difficulty in reading. A total of 209 reading attempts were made. Table 4 gives the overall distribution of self-corrections, repetitions, pauses, and partials among children at the three reading levels. Reading attempts are reflections of readers' self-monitoring. Except for self-corrections (which always result in the correct response), repetitions, pauses, and partials may lead to errors. Attempts were analyzed in terms of a reading episode, a sequence of attempts initiated by a reading difficulty, usually an encounter with an unfamiliar character. More than half of the attempts were initiated by an unfamiliar character. Each type of reading attempt made in a reading episode was counted only once. A combination of several types of attempts could be initiated by one unfamiliar character, but each type was coded separately. To get one character right, for example, the student might go back to the beginning of the sentence and pause several times during rereading. Only one repetition and one pause would be coded here.

Table 5 summarizes the percentage of repetitions, pauses and partials that led to the expected response among the three reading levels. It is clear that in most cases attempts led to successful reading. Even poor readers were successful about 66% of the time after repeating, pausing, or making a partial attempt. Good and average readers had a similar likelihood of pronouncing a difficult character following rereading or pausing, whereas poor readers had a better

Table 5. Percentages of Reading Attempts (Repetition, Pause, Partial) That Led to Correct Responses Among Children at Three Reading Levels

Reading Level	Successful Repetition	Successful Pause	Successful Partial	Total Successful Attempts
High	77.8	77.3	100.0	80.0
Average	86.7	85.0	100.0	87.2
Low	75.0	61.8	77.8	65.7
Total	79.5	68.6	88.2	73.2

chance after repetitions. Good and average readers could always get the right pronunciation after making partial attempts whereas poor readers were successful 78% of the time. Partial attempts were often associated with phonological errors. Interestingly, however, partial attempts reflected a phonological process, as students tried to figure out the pronunciation through onset, rime, and tone analysis, as illustrated in sequences like /sh, shui, shui⁴/. An examination of unsuccessful reading attempts, which is shown in Table 6, indicates that good and average readers made a larger proportion of unsuccessful attempts initiated by semantically and syntactically appropriate errors than poor readers. Students evidently ignored, or failed to notice, errors that fit contextual constraints.

Spontaneous self-correction rates were 22.3%, 29.8%, and 25.1% for the good, average, and poor readers, respectively. A further look at the nature of the error corrected revealed that only 1 out of 8 self-corrected errors of good readers were neither semantically nor syntactically acceptable, whereas 7 out of 11 and 3 out of 11 for average and poor readers, respectively, were neither seman-

Table 6. Percentages of Unsuccessful Reading Attempts When Semantically and Syntactically Acceptable Errors Were Made

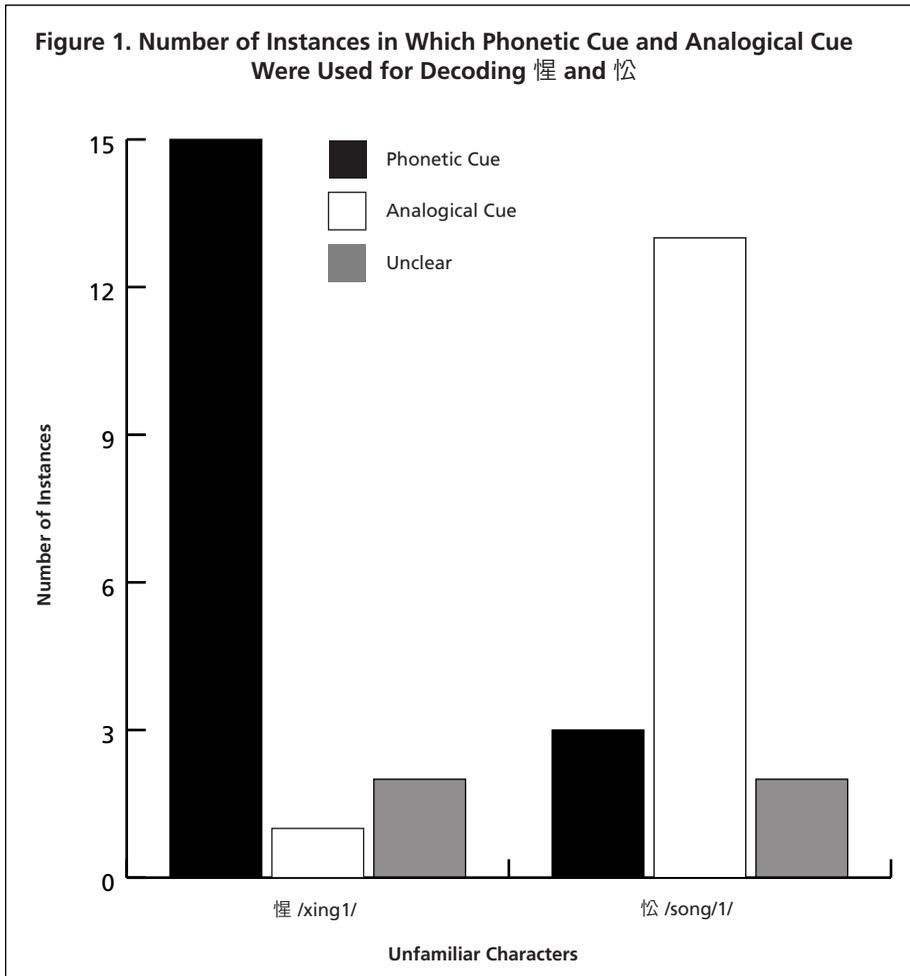
Reading Level	Unsuccessful Repetition	Unsuccessful Pause	Unsuccessful Partial	Total Unsuccessful Attempts
High	50.0	40.0	—	42.9
Average	50.0	66.7	—	60.0
Low	0.0	24.1	50.0	22.2
Total	22.2	29.7	50.0	29.2

tically nor syntactically acceptable. Phonological errors accounted for 3 out of 8, 3 out of 11, and 6 out of 11 self-corrected errors made by the good, average, and poor readers, respectively. Most of the errors that good readers made were both semantically and syntactically acceptable, which are not easy for readers to detect during oral reading, while average and poor readers made more high-meaning-change errors, which are comparatively easy to detect. Again, we didn't find any significant differences in reading attempts, including self-corrections, repetitions, pauses, partials, and successful attempts, between poor readers and good or average readers.

Turning now to the interview, the major questions were how children decode unfamiliar or difficult characters and what kinds of cues they use—contextual, phonetic, or analogical. Questions were asked during the interview if a reading error or a difficulty in reading had appeared during a student's oral reading. This resulted in variation in the number and type of characters individual students were questioned about. Altogether, 109 student responses were made during the interviews to a total of 21 different characters.

Every student was asked about two characters—惺忪, pronounced /xing1 song1/. Figure 1 shows the number of uses of phonetic and analogical cues for decoding these two characters. The contextual cue was not included in this table because 惺 and 忪 are bound characters that are only meaningful when combined with each other, because the two characters are beyond the elementary school reading level, and because the context provides little information that would be helpful in decoding the characters. A total of 83% of the students used the phonetic cue to read 惺/xing1/, reporting that they got the pronunciation from its right part 星/xing1/, a familiar simple character. Of this total, one third changed either the onset or the tone of 星/xing1/ because they thought the pronunciation would change if the radical 亻 was added to it. One poor reader got the pronunciation from the character 猩/xing1/, meaning chimpanzee, which differs from 惺 in the radical 犳 (a radical representing the animal category). A total of 72% of the students used the analogical cue to read 忪/song1/, reporting that they got the pronunciation from 松/song1/, a familiar compound character meaning pine. These two characters differ only in the radical, with 亻 for 忪 and 木 for 松. One good reader and two average readers used the phonetic cue to decode this character, reading it as /gong1/, which is the pronunciation of 公/gong1/, the right part of the character 忪/song1/. Two poor readers failed to give an interpretable response, but one of them said that 忪 should have a different pronunciation from 松 because they have different radicals. Two students seemed to have used a contextual cue, in addition to a phonetic or analogical cue, since they read the phrase or sentence instead of just the individual characters. It is evident that young Chinese readers, even poor readers, have strategies that enable them to pronounce unfamiliar characters.

Apart from 惺/xing1/忪/song1/, children described the strategies they employed to decode a number of other difficult characters. Contextual cues



were described in 12% of the responses from good readers, 35.7% from average readers, and 33.3% from poor readers. One third of the responses from poor readers were about using phonetic cues. Most of the other interview responses indicated that students already knew a character from reading outside of school assignments. However, if a character was not familiar, students tended to rely on context cues and phonetic cues to get the pronunciation.

A comparison of responses during oral reading and during the interview revealed that students of every reading level often pronounced a character correctly in the interview that they had pronounced incorrectly during oral reading. Students were especially likely to correct onset, tone, and word order errors when asked about a character again in the interview. Considering 惺忪, only six students read both of the characters right during oral reading and again during the interview and also reported using the phonetic cue for 惺 and the analogical cue for 忪. Another five students gave no response to these two char-

acters during oral reading, but when asked about the characters individually in the interview, four of them could give a response and all of them could tell the reason for their choice of pronunciation. The rest of the children either didn't pronounce the characters right or gave different responses while reading and in the interview. Still, all of them could give an intelligible reason for their choice of pronunciation. Most of the children based their choice of pronunciation on 星/xing1/, the phonetic of 惺, and 松/song1/, the known clue character for analogy to 忪/song1/, but some said they changed the tone, onset, or rime because of the difference in the radical. One student read /xing1 xing1 song1/ during oral reading and this repetition seemed to show her uncertainty in reading the character 忪/song1/. This uncertainty was consistent with her response to this character in the interview. When asked to read the character again in the interview, she read it as /gong1/ because the right part of the character is pronounced /gong1/ when it is an independent character. But she also pointed out that she was not sure about the pronunciation because during oral reading she had read it as /song1/ since she thought it was analogous to 松/song1/.

DISCUSSION

This study was concerned with three questions. First, what are the oral reading error patterns and reading behaviors displayed by Chinese children? Second, what are the decoding strategies employed by Chinese children for character identification and do they differ according to the reading level of the child? And third, what level of metalinguistic awareness is exhibited by Chinese children?

The results indicate that the error patterns and other features of oral reading of Chinese second graders and young English-speaking children are very similar. Just as in most studies with English-speaking children, good readers in the present study made a larger proportion of semantically and syntactically acceptable errors whereas poor readers made a significantly larger proportion of phonological errors. Although more contextually appropriate errors does not necessarily show a stronger reliance on context, more errors of a phonological nature does reflect lack of control of phonological information on the part of poor readers and better control on the part of good readers. Good readers made no visually similar (to the target character) errors whereas both average and poor readers did so. This indicates that good readers are more sensitive to the visual structure of characters. Substitutions, accounting for 60% of total errors, were the most frequently made error among children of all reading levels. This finding is in line with Weber's (1970a) study of 6-year-old American children's oral reading errors, which found that substitutions were the most frequent errors and accounted for 80% of the total errors made by children. In terms of percentage or total number of instances, good readers did much better than poor readers in every aspect of reading we examined. However, except for phonological errors, differences among groups were not significant. This may

indicate that for young readers, phonological processing is of crucial importance, even with Chinese—a nonalphabetic language. It should also be noted, however, that since our sample size was small, there was limited power to reject the null hypothesis.

In the present study, poor readers made many more reading errors and read less fluently and expressively than average and good readers. Although the number of reading errors did not differ significantly among the groups, there was a significant reading ability effect on reading speed. Poor readers read slowly, but their reading processes were similar to good and average readers. Expressiveness is one clue to the extent to which comprehension is involved during reading. When children are reading with comprehension, contextual cues are more available to them. If a child pauses too long, he is likely to lose the connection between the character being read and the context provided by the sentence and the story. So the child may repeat, pause, or engage in a partial process. The more a child is comprehending the easier it is for her to follow the plot of the story, thus producing more semantically and syntactically acceptable errors.

English words, even exception words, always provide some information about pronunciation (Ehri, 1996). However, because of variation in the regularity of English, phonological recoding ability is not sufficient for vocabulary development (Tunmer & Chapman, 1998). Chinese is even less regular in pronunciation than English. When characters were irregular, and no phonological information was available, students in this study relied more on context. This is illustrated by children's reading of the unfamiliar irregular character 闭/bi4/, meaning close, which contains no clue to pronunciation. It is surprising that all the students, except one poor reader, got the pronunciation right. Every student who was asked about this character later in the interview reported using contextual information to read the character. One poor reader first read the character as /cai2/, then he repeated the previous character and while rereading, he read 闭 correctly as /bi4/. He also reported using contextual information in the interview. In his initial response, this child seemed to use a phonetic cue to read the character because he used one component of the character (才/cai2/, the inner part of 闭/bi4/) as the clue for pronunciation. However, the strategy of using the phonetic was not effective here because the character is irregular. He was aware of that immediately and turned to another strategy—using the contextual cue. This example is consistent with research with English readers demonstrating that, while phonological recoding is primary, word identification is affected by contextual constraints (Perfetti et al., 1979).

In a book popular with teachers, Routman (1988) maintained that readers make use of the three cueing systems proposed by Goodman (1969)—namely, phonological, syntactic, and semantic cues—in equal proportion. Our study does not support this idea. We are not saying that any one cue is always more important than another. We are saying that one cue may be more appropriate and useful depending on the moment-by-moment situation. Students may think about all the available cues at the same time but tend to rely most on

one kind of information. Only when this one kind of information is uncertain will other kinds of information come fully into play. Interview answers about 惺忪/xing1 song1/ illustrate this point, as most students reported using only one kind of information.

Contrary to Goodman's (e.g., 1965) emphasis on context, we found in this study that, although both good and poor readers are able to use contextual information for character processing, they depend on context only when phonological information is insufficient. Contextual information is not always informative because to get an unfamiliar word right, you have to use the surrounding words to help you (Ehri, 1996). However, if the surrounding words are also unfamiliar, children's strategies break down and reading deteriorates. In the phrase 便来敲门问他/bian4 lai2 qiao1 chuang1 wen4 ta1/ (so knocked on the window to ask him), there are three unfamiliar characters 便/bian4/, 敲/qiao1/, and 窗/chuang1/, and they are all irregular. A poor reader read this as /zou3 lai2 gao4 su4 ta1 wen4/ (walked up to tell him and ask). He used a contextual cue for the character 便/bian4/, but a phonetic cue for the character 敲/qiao1/. He read the following three characters in a way to make them consistent with the character 敲/qiao1/, which he read as /gao4/. Although the sentence he produced is sensible by itself, it does not fit the meaning of the whole story and he correctly read only one of the six characters. This episode illustrates that if one character is read wrong, the following character may be read to be consistent with the previous one, which may result in a cascade of errors. Thus, reading can go way off track as a result of students' misreading of some characters and lack of discipline in integrating what they are reading with the meaning of the whole selection.

Text difficulty also plays a role in the use of contextual information. The story employed in this study was at about the same level of difficulty as classroom reading selections. Since it was not too difficult, both good and poor readers could get contextual clues from the story. However, poor readers were not as proficient as good readers at triangulating different information sources to figure out the most appropriate pronunciation of unfamiliar characters.

Sometimes students read a character incorrectly during oral reading but were able to read the same character correctly in the interview. Most of the students could read characters free of context while some poor readers needed to go back to the story in order to read unfamiliar characters. This is consistent with Nicholson and Hill's (1985) finding that English-speaking children who are good readers are better able to decode words independently of context than poor readers.

Although good readers in this study had a lower self-correction rate than poor readers, good readers were more likely to correct errors that did not fit the context. This is consistent with Weber (1970b) who reported a similar result, suggesting good readers have superior comprehension strategies (Stanovich, 1980). Good readers seem to pay more attention to the character itself because only one ungrammatical error was corrected. On the other hand, good read-

ers' self-correction rate is low because most of their errors are syntactically and semantically acceptable, which implies that contextual information is also important for good readers. Biemiller (1970) argued that, in learning to read English, readers at different stages of development do not focus on the same cues, but at the most advanced stage of beginning reading are able to use both graphophonological and contextual information in word identification. This seems to be the same for young Chinese readers.

In stage models of alphabetic reading, analogical decoding is the last stage of reading development (see McGuinness, 1997; Ehri, 2005). The present study shows that Chinese children as young as first-semester second graders are able to use analogy to read unfamiliar characters. However, it seems that reading unfamiliar characters using phonetic cues is more frequent than reading by analogy. This is in line with English children's development of word identification strategies. In order for Chinese children to use the analogical decoding strategy, they need to know another compound character that contains the same phonetic as the target character. But, because of limited reading vocabulary, the young child may not know an analogue character and may not be able to employ this strategy.

It is interesting that children could choose the right strategy to read unfamiliar characters. Notably, they chose the phonetic cue for reading 惺/xing1/ and analogical cue for reading the very next character, 忪/song1/. However, it is not clear whether there is generally an equal opportunity for children to use phonetic cues and analogical cues. It is likely that, because of small vocabulary size, young children have limited chances to use analogy for pronouncing characters thus leading to a tendency to rely more on phonetic cues. But this study leaves no doubt that children are able to use analogy when they know an analogue character. Level of phonological awareness may affect whether a young reader employs strategies effectively. A child with low phonological awareness tends to make more phonological errors and tends not to make good use of available phonological information.

Both the study by Pine et al. (2003) and the present study show that young Chinese children can talk intelligibly about the structure of characters. Children in the present study could talk about their strategies for decoding specific unfamiliar characters in the story. However, Pine and her colleagues' conclusion that character decoding is basically a visual process rather than a phonological process was not supported by the present study. Children in the Pine et al. study did not read connected text. Instead, they were shown distorted characters and asked to explain what was wrong. It is not surprising that in this situation the children talked about the detailed graphic structure of the characters instead of phonological information. The present study probed children's strategic decoding during oral reading. In this situation, children's own account of their thinking, combined with analysis of their oral reading, showed that attention to phonological information was paramount.

In the present study, children were able to describe their thinking process during reading. Even the poor readers could do this. Children's descriptions of thought processes were detailed and usually consistent with the behavior observed during oral reading, which reflects a high level of metalinguistic awareness. Metalinguistic awareness enables children to control the process of decoding characters and then verify the decoding using morphological, syntactic, and contextual information. When children in this study encountered an unfamiliar character, they first tried to use the phonetic cue. If the pronunciation didn't sound right, they next used syntactic and pragmatic cues available from the context. The use of context was limited, however, in the sense that, although children looked at the current sentence, they often neglected the broader context and so did not evaluate pronunciations in terms of the previous or following sentence or the whole story. Although demonstrating a high level of three of the four types of metalinguistic awareness proposed by Tunmer and colleagues (1988), young Chinese readers showed a low level of pragmatic awareness, which is expected to appear in later stages of reading development.

The poor readers in this study were somewhat worse than average and good readers in several aspects of reading behavior. However, just two differences were statistically significant: Poor readers made more phonological errors and they read more slowly than average or good readers. On the other hand, in some respects, the poor readers were similar to other readers. Poor readers were able to choose and use appropriate reading strategies. They were able to talk intelligibly about their thinking process while trying to identify unfamiliar characters. They behaved in similar ways to good and average readers while reading the story, although they were slower and reading was more effortful for them. With more interruptions in poor readers' flow of thought while reading, their comprehension sometimes deteriorated.

This study had some limitations. The sample size was small. Students were from an above-average school in one region of China. In future studies, larger and more-representative samples of children would be desirable. Teachers' ratings were employed to identify student reading proficiency. In future studies, other measures of reading proficiency—as well as, perhaps, assessments of phonological, morphological, and graphomorphological awareness, and ability to monitor comprehension—should be included. Students read only one short passage. Passages of various lengths and difficulty levels would be desirable.

Although it had its limitations, this study strongly suggests that, despite the differences between the Chinese and English languages and writing systems—as well as differences in culture, child rearing practices, and the school curriculum and teaching methods—there are striking similarities in the reading processes of Chinese and American children. Thus, the study serves as a bridge to connect literacy learning in a logographic language system with literacy learning in alphabetic languages, and suggests that important aspects of reading are universal.

APPENDIX

我不知道时间

一个汽车司机把车开到路边，想睡一会儿，他刚闭上眼睛，一位行人便来敲窗问他几点了，睡眼惺忪间，他看了看表说：“八点半了。”

过了一会儿，他又被一阵敲窗声惊醒：“先生，你知道几点钟吗？”他只好看手表说：“八点四十五分了。”

司机想，这样下去我无法睡觉了。于是，他写了张纸条，贴在车窗上：“我不知道时间。”

等他安下神来，准备美美睡上一觉时，又有一个行人来敲车窗：“先生，我告诉你，现在九点钟了。”

English Translation

I don't know the time

A driver pulled in along the roadside and wanted to take a nap. Hardly had he closed his eyes, when a passerby came and knocked at the window to ask him about the time. He looked at his watch with his sleepy eyes and said: "It's eight thirty."

After a while, he was awakened by another knock on the window. "Sir, could you tell me what time it is now?" He had to look at his watch again. "It's eight forty-five now."

The driver thought that he couldn't sleep if it was going to continue like this. So he stuck on the window a piece of paper on which he wrote: "I don't know the time."

After he felt relaxed and was ready to having a good sleep, another passerby came to knock at the window. "Sir, let me tell you, it is nine o'clock now."

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