

Comprehension Monitoring in Chinese Reading among Chinese Adolescent Readers

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Abstract—English and Chinese reading place different requirements in terms of lower-order processing. Research has consistently found evidence that word recognition in English and Chinese reading requires different cognitive processes. However, whether English reading differs from Chinese reading with regard to higher-order processing receives little attention. This study investigated comprehension monitoring, an important higher-order skill, among 126 Chinese adolescent readers using two kinds of information errors (i.e., external and internal information errors), in order to compare results from studies on comprehension monitoring in English. The results showed that the detection of external errors was significantly higher than the detection of internal errors. Proficient Chinese readers performed significantly higher on overall comprehension monitoring task, on monitoring of external errors, and on monitoring of internal errors compared to poor Chinese readers. There was also significant correlation between comprehension monitoring and Chinese reading proficiency. **Conclusions and Recommendations:** The results of the study suggest that Chinese readers' comprehension monitoring was similar to comprehension monitoring of native English speakers in English reading, and this may provide some evidence that Chinese and English reading may have similar higher-order processes even though reading in the two languages place different requirements in terms of lower-order processing skills.

Index Terms—comprehension monitoring, Chinese reading, logographic language, metacognitive processes

I. INTRODUCTION

Reading is well-known as complicated multi-level processes, which can be further divided into lower-order and higher-order processes (Grabe & Stoller, 2011; Pressley, 2002; Yamashita, 2013). Lower-order processes commonly refer to linguistic processes, including word recognition, syntactic parsing, and semantic proposition encoding (Grabe, 2009; Yamashita, 2013). On the other hand, higher-order processes consist of the comprehension building processes and strategic processing, in which a variety of strategies are orchestrated to resolve comprehension problems (Koda, 2005; Stevenson, Schoonen, & Gloppe, 2007). In competent reading, lower-order processes are fast and unconscious automatic processes, which can be carried out simultaneously with conscious processes without any interference; whereas higher-order processes tend to be controlled processes (Segalowitz, 2000).

Among a variety of higher-order processes, comprehension monitoring is an important one, as it alerts readers when smooth comprehension is broken down and it enables readers to track what they are reading and to check whether it makes sense or not (Alexander & Jetton, 2000; Author, 2008; Zinar, 2000). Comprehension monitoring has been widely researched among English reading of native English speakers (Author, 2012). However, less is known about comprehension monitoring in reading in different orthographies, such as Chinese – a logographic language. It is important to examine comprehension monitoring, one of important higher-order processes, in Chinese reading, and to compare the results with the research findings from studies which examined comprehension monitoring in English – an alphabetic language, to see whether the higher-order processes in reading in a logographic language is similar to or different from higher-order processes in reading in an alphabetic language.

II. LITERATURE REVIEW

Lower-order reading processes in different orthographies

Taylor and Taylor (1995) argue that the higher-order reading processes may remain similar among readers from various orthographic backgrounds, even though the lower-order reading processes, such as word recognition, are affected by different orthographies across languages. In different orthographies, the basic linguistic units are also different (Cook & Bassetti, 2005; Yamashita, 2013). In alphabetic languages, such as English, French, and Dutch, the basic units are phonemes; in syllabary languages, such as Japanese kana, the basic units are syllables; and morphemes are the smallest representational units in logographic languages, such as Chinese and Japanese Kanji (Coltheart, 1984; Cook & Bassetti, 2005; Perfetti, 2003; Yamashita, 2013; Ziegler & Goswami, 2005, 2006).

Research has consistently shown that that word recognition in reading different orthographies makes different demands on cognitive processes (Cook & Bassetti, 2005). Reading in alphabetic languages requires readers to segment phonemes and to conduct intra-word analysis; whereas reading in a logographic language places fewer demands on intra-word segmentation abilities. Rather, reading in a logographic language relies much less on phonological

information but more on holistic visual information (Author, 2015; Yamashita, 2013).

Comprehension monitoring

Being one of the important higher-order processes in reading, comprehension monitoring is an essential skill for competent reading (Oakhill, Hartt, & Samols, 2005; Wray, 1994). Comprehension monitoring has been defined as: “a metacognitive process...essential for competent reading” (Wagoner, 1983, p. 328). It has also been explained as a process that “an individual evaluates the state of his/her understanding of information” (Oakhill et al., 2005, p. 658). Comprehension monitoring can be broadly divided into three main steps: involving evaluation, planning and regulation (Otero, 1998). In the evaluation stage, readers normally assess their concurrent understanding of what they have processed and this allows them to decide whether there is a need to take further actions. If there is a comprehension breakdown, or if they think their minds have gone away, in the planning stage, they then try to deploy different kinds of strategies relevant to the comprehension problem from their strategic repertoire. In the last regulatory stage, readers start to take actions by implementing the selected strategies to fix up comprehension problems (Wray, 1994). These actions may include, for example, re-allocating attention, slowing down the speed of reading, re-interpreting certain parts in the text, re-evaluating the mental representation they have made, and moving backward or looking ahead in the text in order to solve ambiguities (Otero, 1998).

Essentially, comprehension monitoring can be thought of being part of metacognition, which is referred to as a person's cognition about cognition, thinking about thinking, and knowing about knowing (Flavell, Miller, & Miller, 2002; Paris, Wasik, & Turner, 1991; Phakiti, 2003a, 2003b, 2006; Weinert, 1987). Metacognition is consisted of metacognitive knowledge and metacognitive control. Metacognitive knowledge located in the long-term memory is what a person knows about his/her own cognitive process. Metacognitive control, which functions in individuals' working memory, is one's ability to use metacognitive knowledge to achieve certain goals through various cognitive activities, such as planning and monitoring comprehension (Alexander, Schallert, & Hare, 1991; Baker & Brown, 1984; Brown, 1987; Westby, 2004). Having metacognitive knowledge does not ensure readers will use it to execute metacognitive control during reading (Flavell, 1981, 1987; Flavell, Miller, & Miller, 2002; Westby, 2004). For instance, a reader may know that if he/she loses concentration, they should go back to re-read part of the text (i.e., knowledge about comprehension monitoring). However, in reading practice, some readers do not constantly check whether their reading stays in the track and fail to monitor their comprehension (i.e., failure in comprehension monitoring control). To examine the level of comprehension monitoring knowledge a reader has, researchers normally use questionnaires (Phakiti, 2006), whereas to examine performance of comprehension monitoring control, there are generally three methodological approaches, which will be explained in the following section.

Approaches to study comprehension monitoring control

The three common approaches to study comprehension monitoring control are the introspective approach, the calibration approach, and the error detection approach (Morrison, 2004; Westby, 2004). The introspective approach, also known as the think-aloud method, requires readers to report their mental activities during reading. This method is normally used to investigate readers' concurrent processing. However, when comprehension is occurring smoothly, comprehension monitoring is an automatic process without much conscious attention (Oakhill, 1996). As a result, it might be difficult for learners to report their comprehension monitoring. In addition, there are also some drawbacks to this methodology. For instance, verbalisation while reading can interfere with the natural process of reading; it also makes higher demands on participants' verbal ability; and it may add a burden to readers (Tang, 1997).

The method of calibration examines readers' comprehension monitoring by comparison of readers' prediction of their comprehension and their actual performance on comprehension tasks. Under this paradigm, it is assumed that the higher the correlation between readers' predicting and their actual performance, the better their comprehension monitoring. This method cannot tell us much about the difference between good and poor performance of comprehension monitoring since readers might either overestimate or underestimate their performance (Morrison, 2004).

The error detection approach is the most commonly used one when examining comprehension monitoring (Author, 2012). In this approach, texts are premodified and inconsistent information is embedded to trigger readers' conscious attention so that controlled processing can be activated (Otero, 2002). Due to the advantages of error detection approach over the other two approaches, we also employed an error detection approach to study comprehension monitoring in Chinese reading.

Studies in comprehension monitoring with native English speakers

There are a great number of studies on comprehension monitoring with native English speakers. These studies normally required readers to detect the errors or inconsistencies embedded in a text (Author, 2012). Previous studies examined comprehension monitoring with children and adult readers; comparing good and poor readers; using different text types, such as narratives and expositions; and manipulating and creating different types of errors, including lexical errors (nonsense words), external errors (information that contradicts general world knowledge; and internal errors (the text contains contradictory information) (Oakhill et al., 2005).

The results of these studies indicate that comprehension monitoring develops over time (Kolić-Vehovec & Bajšanski, 2006). Younger and poorer readers do not monitor their comprehension successfully (Zabucky & Ranter, 1992). There was a general trend that younger and less skilled readers noticed more lexical errors than the other types since they tended to evaluate their comprehension on a lexical level (Westby, 2004). Poorer readers had particular difficulty in the

detection of internal errors (Ehrlich, Remond, & Tardieu, 1999), and this could be attributed to the increased difficulty of detecting internal errors rather than external errors, as detection of internal errors require readers to compare the incoming information with a recently constructed representation of the text, which is less stable than readers' general knowledge about world (Oakhill et al., 2005).

Some studies also examined readers' detection of internal errors in different location. It was found that readers reported more errors when contradictory information was located closer together in the passage than when it was located further apart (Zabrucky & Ranter, 1992). In addition, good readers appeared to be better at identifying errors located further apart than poor readers were, whereas there tended to be a smaller difference between good and poor readers in the detection of errors located close together (Oakhill et al., 2005). These findings suggest that good readers might have a greater ability to maintain and hold text information than poor readers do.

Studies of comprehension monitoring in English reading examined the contribution of comprehension monitoring to reading comprehension. For instance, Zinar (2000) conducted a study on 96 fourth-grade English-speaking children to examine the contributions of both word identification skill and comprehension monitoring to reading comprehension. Participants were asked to read passages with inconsistencies and without inconsistencies. The passages were presented sentence by sentence on a computer. Participants were required to identify inconsistencies as they read and provide explanations afterwards. After they had finished reading, they were also asked to answer some comprehension questions regarding the passages as well as to rate the level of difficulty of the text. Comprehension monitoring was measured both on-line (e.g. amount of time spent on target sentences with or without inconsistencies; numbers of target lookbacks) and off-line (e.g. numbers of reported target inconsistencies; scores of reading comprehension questions). The results showed that children who actively used the strategy of looking back to prior sentences after encountering an inconsistency achieved higher scores in reading comprehension tests. The hierarchical regression indicated that word recognition made a larger contribution than comprehension monitoring, which made a small but significant contribution to the prediction of reading comprehension, accounting for 2.9%.

The present study

While studies with English speakers have indicated that comprehension monitoring performance differ for different kinds of information errors (i.e., external and internal), and differ between more and less proficient readers (e.g. Oakhill et al., 2005), there is a lack of research on comprehension monitoring performance in Chinese reading. The present study will examine whether Chinese readers perform differently or similarly on comprehension monitoring of external and internal errors from English readers. In addition, the study will investigate comprehension monitoring performance by Chinese readers with different levels of reading proficiency. Thirdly, the study will also examine the contribution of comprehension monitoring to Chinese reading proficiency.

The study addresses the following research questions:

1. Is there any difference between comprehension monitoring of external errors and internal errors in Chinese reading?
2. How does comprehension monitoring performance in Chinese reading differ among readers with different levels of Chinese reading proficiency?
3. What is the contribution of Chinese comprehension monitoring performance to Chinese reading proficiency?

III. METHOD

Setting and participants

The study was conducted among 126 Chinese adolescents, whose ages ranged from 15-19 years old (Mean (M) = 16.92, Standard Deviation (SD) = 0.88). Among 126 students, 10 were males and 116 were females. The participants' Chinese reading proficiency was measured by reading comprehension of two Chinese texts. Students were required to complete comprehension questions, in multiple-choice and short-answer formats after reading each text. The total scores of the reading proficiency test was 100, and participants' scores ranged from 53 to 93 (M = 73.40, SD = 7.94).

The comprehension monitoring task

The participants' comprehension monitoring in Chinese reading was measured by using an error detection task, which required the participants to read two Chinese narratives and to underline information errors embedded in them. The error detection task was a customarily designed task. The reason for choosing narratives was because understanding narratives requires less domain-specific knowledge compared to reading expositions. The text type of narrative was also considered to be a familiar text type as indicated by the participants' Chinese teachers. The two narratives were *An Old Father and His Three Sons* and *A Young Pretty Girl and Her Lover* (Chen, 2007), which were Chinese translation of Aesop's fables. Using Aesop's fables rather than using Chinese folktales could prevent students from being too familiar with the content of the texts, thus, understanding of the texts represented students' genuine reading abilities. *An Old Father and His Three Sons* had 704 characters, and *A Young Pretty Girl and Her Lover* had 674 words.

Based on previous comprehension monitoring research (Ehrlich et al., 1999; Oakhill et al., 2005), two kinds of errors were embedded in the texts, namely external errors and internal errors. External errors contain information that violates general knowledge (e.g., My daughter eats water), whereas internal errors refer to information that is contradictory within the text itself (e.g., The TV in my home was broken. My daughter is watching TV in our living room). Ten errors were embedded in each text, 5 of which were external errors and 5 of which were internal errors. There were altogether

10 external and 10 internal errors, and these errors were distributed evenly throughout the texts. Participants were required to read the texts and to underline the sentences that did not make sense. The reliability analysis showed that the task was quite reliable, with the Cronbach's alpha coefficient .79.

Data analysis

Data analysis was performed with SPSS 20.0. To answer the first research question, a repeated one-way ANOVA was used. To answer the second research question, the participants were first classified into proficient and poor Chinese readers according to their Chinese reading proficiency test results. Then a one-way ANOVA was conducted. For the last research question, Pearson product moment correlation analysis was used.

IV. RESULTS

Descriptive statistics

Table 1 displays the descriptive statistics for participants' overall scores for Chinese reading proficiency, overall scores of Chinese comprehension monitoring task, scores for comprehension monitoring of external and internal errors. The table includes *Ms*, *SDs*, minimum (Min.) and maximum (Max.) scores, and highest achievable scores.

TABLE 1.
DESCRIPTIVE STATISTICS

Variables	<i>M</i>	<i>SD</i>	Min.	Max.	Highest achievable scores
Chinese reading proficiency	73.40	7.94	53	93	100
overall comprehension monitoring performance	14.95	3.35	4	19	20
comprehension monitoring of external errors	7.69	2.01	1	10	10
comprehension monitoring of internal errors	7.26	1.73	1	10	10

Results for research question 1

The results from one-way repeated measure ANOVA showed that the detection of external errors was significantly higher than the detection of internal errors, even though the value of eta-squared indicates that the effect size was small: $F(1, 125) = 6.57, p < .01, \eta^2 = .05$. This result suggests that the performance of comprehension monitoring of external and internal errors among readers of Chinese – a logographic language – was similar to that of readers of an alphabetic language, such as English.

Results for research question 2

In order to answer the second research question, participants were first divided into proficient and poor Chinese readers according to their Chinese reading proficiency. We first calculated the *Mean* score of the Chinese reading proficiency ($Mean = 73.40$). Students who scored below the *Mean* score were classified as poor Chinese readers, whereas students whose scores were above the *Mean* score were categorized as proficient Chinese readers. As a result, 65 students were in the group of poor Chinese readers, accounting for 51.60%; and the rest of 61 students were in the group of proficient Chinese readers, accounting for 48.40%. The distribution of the participants, descriptive statistics of Chinese reading proficiency, performance of overall Chinese comprehension monitoring task, and scores of comprehension monitoring of external and internal errors, by levels of Chinese reading proficiency, are presented in Table 2. Table 2 also displayed the results of one-way ANOVA and the effect size.

TABLE 2.
DESCRIPTIVE STATISTICS OF COMPREHENSION MONITORING SCORES BY CHINESE READING PROFICIENCY

Variables	groups	<i>M</i>	<i>SD</i>	<i>F</i>	η^2
overall comprehension monitoring performance	poor (65)	14.31	3.70	6.89	.05
	proficient (61)	15.85	2.82		
comprehension monitoring of external errors	poor (65)	7.34	2.20	4.83	.04
	proficient (61)	8.11	1.71		
comprehension monitoring of internal errors	poor (65)	6.97	1.89	6.48	.05
	proficient (61)	7.74	1.46		

The results showed that there were statistically significant differences not only on overall Chinese comprehension monitoring task: $F(1, 124) = 6.89, p < .01, \eta^2 = .05$, but also on comprehension monitoring of external errors: $F(1, 124) = 4.83, p < .05, \eta^2 = .04$, and comprehension monitoring of internal errors: $F(1, 124) = 6.48, p < .05, \eta^2 = .05$. From Table 2, we can see that proficient Chinese readers performed significantly higher on overall comprehension monitoring task ($M = 15.85, SD = 2.82$), on monitoring of external errors ($M = 8.11, SD = 1.71$), and on monitoring of internal errors ($M = 7.74, SD = 1.46$) compared to their counterparts, who were less proficient in Chinese reading ($M = 14.31, SD = 3.70$ for overall comprehension monitoring task, $M = 7.34, SD = 2.20$ for monitoring of external errors, and $M = 6.97, SD = 1.89$ for monitoring of internal errors).

Results for research question 3

The contribution of participants' comprehension monitoring to Chinese reading proficiency was examined by a series of one-tailed Pearson product moment correlation analyses, because of predictable directions of the association. The correlation results are presented in table 3.

TABLE 3
RESULTS OF CORRELATION ANALYSES

Variables	Chinese reading
overall comprehension monitoring	.19*
external error detection	.17*
internal error detection	.17*

* $p < .05$, (1-tailed).

Referring to Table 3, there was a significant positive correlation between students' overall comprehension monitoring and Chinese reading ($r = .19$, $p < .05$), indicating that overall comprehension monitoring made significant and positive contribution to Chinese reading proficiency, explaining about 38% of variance. The association between students' comprehension monitoring of external errors and Chinese reading ($r = .17$, $p < .05$) and was comprehension monitoring of internal errors and Chinese reading were also significant ($r = .17$, $p < .05$), and comprehension monitoring of external errors made exactly the same contribution as comprehension monitoring of internal errors to Chinese reading proficiency, each explained 34% of variance. These results indicate that better comprehension monitoring performance could positively predict Chinese reading proficiency.

V. DISCUSSION AND CONCLUSION

The primary aim of the current study was to examine whether readers of a logographic language – Chinese – have similar or different higher-order processes in reading as readers of alphabetic languages by studying comprehension monitoring among Chinese adolescent readers. Using comprehension monitoring of two kinds of information errors, namely external and internal errors, of the same readers, we found that Chinese adolescent readers' comprehension monitoring in Chinese reading exhibited the similar pattern as that of English reading among native English speakers. The result that monitoring external errors was better than monitoring internal errors may be explained by relatively less cognitive demand being placed on the detection of external errors than detection of internal errors (Rubman & Waters, 2000). The similar pattern that monitoring of external errors was better than monitoring of internal errors between Chinese readers and readers of English appears to support the argument made by Taylor and Taylor (1995) that the higher-order reading processes tend not to be affected by different orthographies. Likewise, the current study also found that Chinese reading proficiency affected readers' comprehension monitoring performance as the results shown with English readers, as more proficient Chinese readers performed significantly better than their counterparts with poor Chinese reading proficiency. Using correlation analyses, we found that comprehension monitoring performance could explain a large amount of percentage as high as 38% in Chinese reading proficiency.

These research results have significant implications for literacy acquisition for learners of English language or Chinese language as a foreign language. Because we found that the comprehension monitoring – an important higher-order reading process, is similar among readers from different orthographies (i.e., Chinese vs. English), thus, when starting to learn to read in a foreign language which has a different orthography, readers may need to concentrate more on lower-order processes, such as skills of word recognition and syntactic parsing. For Chinese learners of English as foreign language, they may need to hone their skills in conducting intra-word analysis in order to segment phonemes efficiently; whereas for learners of Chinese as a foreign language, they may need to train their word recognition abilities based on visual cues.

Due to the small scope of the study, there are a number of limitations which warrants further investigation. First, the present study only investigate one of higher-order processes in Chinese reading, future studies may explore other higher-order processes in Chinese reading, such as making inferences, in order to compare and contrast the processes with reading in alphabetic languages. Secondly, the present study only used a single text type – narratives, thus, it is difficult for us to generalize the findings into reading other text types, as reading different text types tends to rely on different reading strategies and skills (Horiba, 2000). Future studies may wish to use multiple text types to examine higher-order of reading processes across different orthographies.

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