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The role of tone awareness and pinyin knowledge in Chinese reading

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Abstract

Previous literature has established that tone awareness is significantly related to reading development in young children (age 3–6 years) across Chinese-speaking societies. To date, no study has been conducted to explicitly examine how tone awareness contributes to reading at the intermediate level of primary schooling, or the relationship between tone awareness and pinyin instruction, a demonstrated booster for phonological awareness in Chinese children. The present study aimed to fill this gap by investigating the relationship between tone awareness and pinyin proficiency, and the contribution of each construct to Chinese reading among 8- to 9-year-old children in Mainland China. Experiment 1 compared the relative contribution of tone awareness and pinyin proficiency to Chinese reading, and Experiment 2 explored the contribution of tone sensitivity to Chinese reading after controlling for rapid naming. Results showed that tone awareness was the only significant predictor of Chinese sentence reading when entered with onset awareness and pinyin proficiency measures (Experiment 1); and that tone awareness continued to be a unique contributor to Chinese sentence reading after controlling for speed naming measures (Experiment 2). This study provides important empirical evidence for the critical role of tone awareness in Chinese reading in intermediate-level primary school children.
1 The Role of Tone Awareness and Pinyin Knowledge in Chinese Reading

A substantial body of research has shown that phonological awareness plays an important role in learning to read alphabetic languages such as English (Hu and Catts, 1998; Goswami, 1999; Nunes et al., 2003). In Chinese as well, sensitivity to phonology has been found to predict children’s ability to read (Ho and Bryant, 1997; McBride-Chang and Ho, 2000; Soik and Fletcher, 2001; McBride-Chang and Kail, 2002). Although phonological awareness is related to reading in both English and Chinese, there are subtle differences across the two languages shaped by the specific features of each language and writing system. While phonemic awareness is considered particularly important for word recognition in English (e.g. Muter et al., 1997; Goswami, 2002; Anthony and Lonigan, 2004), its role may be smaller in Chinese, due to the fact that Chinese is a morphosyllabic language in which a character maps onto a morpheme and a syllable rather than a phoneme (e.g. Huang and Hanley, 1994; McBride-Chang et al., 2004; Anderson and Li, 2005). In contrast, syllable awareness and onset-rime awareness have been shown to predict Chinese children's reading skills (Ho and Bryant, 1997; So and Siegel, 1997; Hu and Catts, 1998; Soik and Fletcher, 2001; Shu et al., 2008). Another important and rather unique feature of Chinese is that it is a tonal language, in which tones, or pitch differences, are used to distinguish lexical meaning. However, among different aspects of phonological awareness, the contribution of tone awareness to reading is relatively less studied.

In Mainland China, character pronunciation is denoted by an alphabetic coding system called pinyin. For example, 清 is transcribed as qing1 in pinyin. Pinyin can be considered a shallow system phonologically, in the sense that letter-sound correspondence is highly regular. Children typically receive pinyin instruction as soon as they enter Grade 1, before they are taught any Chinese characters. There is evidence that learning pinyin facilitates Chinese children's phonological awareness (e.g. Cheung et al., 2001; Soik and Fletcher, 2001). Tone awareness should be one aspect of phonological awareness that is enhanced by pinyin learning, because in Mandarin Chinese (the standard dialect spoken in Mainland China), each tone is explicitly denoted by a corresponding tone mark in pinyin. It is not clear, however, whether learning pinyin makes a direct contribution to character reading over and above phonological awareness. The goal of the present study is to explore the relationship between tone awareness and pinyin learning, and the contribution of each construct to Chinese reading.

Phonological awareness is the recognition that spoken language is composed of smaller units of sound (see Blachman, 2000, for a review). Tone awareness, then, is the ability to reflect upon and manipulate tones. Mandarin has four tones, high-level, high-rising, falling-rising, and high-falling (indicated as 1, 2, 3, and 4, respectively, in this article). With few exceptions, most Mandarin syllables are marked by one of the four tones. Change in tone affects the meaning of a word. For example, the syllable shi pronounced with the high-level tone shi1 means ‘poem’ (written as 诗), whereas the same syllable pronounced with the high-rising tone shi2 means ‘stone’ (written as 石). Given the fact that a large number of homophonic syllables in Chinese can only be differentiated by tones, tone awareness likely plays an important role in learning to read Chinese.

A relatively small number of studies have shown that tone awareness is significantly related to Chinese children’s reading development (So and Siegel, 1997; Fu and Huang, 2000; Li et al., 2002; Leong et al., 2005; Wang et al., 2005; Shu et al., 2008). For example, Shu et al. (2008) investigated the contribution of several aspects of phonological awareness to reading in Chinese kindergarten children aged 3–6 years. Tone awareness and syllable awareness were both shown to independently explain variability in Chinese character recognition, with age, vocabulary, and rapid naming statistically controlled. The results support the unique association between tone awareness and reading acquisition in Chinese children. However, from a developmental perspective,
one limitation of the study was that the contribution of tone awareness to reading was not examined in children beyond kindergarten. In another study, Leong et al. (2005) found that a speech-sound repetition task that tapped into the ability to perceive tones predicted Chinese children's pseudoword reading in Grades 4 and 5, over and above rime awareness and phonemic awareness. Interestingly, tone perception did not predict English pseudoword reading in the same children, thus supporting the notion that tone awareness is particularly important for reading Chinese.

As previously noted, children in Mainland China learn an alphabetic transcription of Chinese called pinyin in the beginning of the school years. Pinyin was first introduced by the Chinese government in 1958 as a tool to denote the pronunciation of Chinese characters and was established as the official system to transcribe Chinese proper names and relevant phrases by the International Standardization Organization (ISO) in 1981. Pinyin is an alphabetic system consisting of twenty-six Roman alphabet letters, which represent twenty-two onsets and thirty-seven rimes. Four tone marks are used to denote the four Mandarin tones. Before 2001, pinyin was taught intensively in the first 10 weeks of the first grade in Mainland China. Children were given extensive training in combining onsets and rimes to form different meaningful syllables. In recent years, however, the Chinese Ministry of Education adjusted the guidelines for pinyin teaching, lowering the criterion and the intensity of pinyin learning. Now pinyin is being taught in a gradual manner in the first 2 years of primary school (Xiang and Ren, 2010).

The facilitation effect of pinyin knowledge on phonological awareness has been documented in cross-cultural studies comparing Chinese-speaking children and adults from different countries and regions (e.g. Read et al., 1986; Chen and Yuen, 1991; Cheung et al., 2001; Shu et al., 2008). For example, Chen and Yuen (1991) found that children from Mainland China performed better than children from Hong Kong in naming pseudohomophones. Because pinyin is learned in Mainland China but not Hong Kong, such a finding suggests that pinyin training helps readers read unfamiliar words. A similar finding was obtained in Cheung et al.'s (2001) comparison of phonological skills among pre-readers from New Zealand, Hong Kong, and Guang Zhou (Canton). Results showed that Guang Zhou children outperformed their Hong Kong counterparts on onset and coda analysis. It appears that early experience with pinyin enabled Guangzhou children to develop better phonological skills than those of Hong Kong-based children.

There is also evidence that pinyin learning is related to tone awareness. For example, Shu et al. (2008) observed that tone awareness significantly improved in young Chinese children after they received pinyin training. Leong et al. (2005) reported that in Grades 4 and 5, children in Beijing outperformed children in Hong Kong on a speech-repetition task that measured tone perception. Since only the former group received pinyin instruction, the researchers concluded that learning pinyin accounted for Beijing children's superior performance. Soik and Fletcher (2001), in a study including first, second, third, and fifth grade children in Beijing, found that pinyin knowledge measured by Pinyin Syllable Reading was correlated with tone awareness in Grades 3 and 5. Taken together, these findings point to the possibility that receiving pinyin instruction facilitates tone awareness in Chinese children.

In the present study, we explored how sensitivity to lexical tones is related to pinyin proficiency, and the contribution of tone awareness and pinyin proficiency to Chinese reading among 8-to-9-year-old children (at the intermediate level of primary schooling) in Mainland China. Two experiments are reported. In Experiment 1, we compared the relative contribution of tone awareness and pinyin proficiency to Chinese reading. In Experiment 2, we explored the unique contribution of tone sensitivity in explaining variance in Chinese reading after controlling for rapid naming. We added rapid naming as a control variable because it has been shown consistently to predict Chinese reading (e.g. McBride-Chang and Ho, 2000; Ho et al., 2004; Chow et al., 2005). Rapid naming tasks tap a number of complex abilities, including phonological skills and visual skills (e.g. Ho et al., 2002; Ho et al., 2004). In such tasks, children are asked to name as quickly as possible some common symbols
or objects (e.g. digits, pictures, and Chinese syllables) randomly presented on a testing sheet. Both rapid naming and Chinese reading involve automatic mapping of symbols to print. As we hypothesized, tone sensitivity may also play a role in this mapping process, in which the meanings of homophonous syllables/characters need to be distinguished by tones.

2 Experiment 1

2.1 Method

2.1.1 Participants

Eighty-two third graders (first semester) with an average age of 8 years and 9 months from a public school in a working-class neighborhood in Beijing participated in the experiment. They were all native Mandarin Chinese speakers and the formal language of instruction used in the school was Mandarin. There were thirty-seven girls and forty-five boys in the sample.

2.1.2 Materials and procedure

Six tasks measuring Chinese literacy proficiency, pinyin proficiency, and phonological awareness were administered in the following order over a period of 7 days: Chinese Sentence Reading, Chinese Character Dictation, Pinyin Sentence Reading, Pinyin Syllable Dictation, Tone Judgment, and Onset Judgment. All tasks were administered to the whole class and generous encouragement was provided by the experimenter throughout the tasks. Each task, three practice items/sets were given to make sure every child understood the task properly. The details of the tasks are described below.

In the ‘Chinese Sentence Reading’ task, children saw twenty sentences, each of which was accompanied by five pictures. Children were asked to select the picture (by circling the number under the picture) that best represented the meaning of each sentence. For example, a Chinese sentence is 这个男孩在骑自行车 (The boy is riding a bike). The average length of the sentences contained in this task was eight characters, with all characters involved in the twenty sentences being familiar ones to children according to their Chinese teacher.

In the ‘Chinese Character Dictation’ task, children were asked to write down twenty characters orally presented by the administrator. Characters were presented in the context of a word to constrain the answer to a specific character (because there are many homophones in Chinese). The characters were arranged in a sequence that increased in difficulty, as determined by grade level. For example, the administrator asked students to write ‘分’ in ‘分钟’ (‘minute’).

The ‘Pinyin Sentence Reading’ task was similar to the Chinese Sentence Reading task, except that the sentences were written in pinyin. Children saw twenty sentences in pinyin and were asked to select from the five accompanying pictures, by circling the number under the picture, that best represented the meaning of the sentence. The average length of pinyin sentences was nine syllables, for example, 小 hong2 shou3 li3 na2 she yi1 duo3 hua1 (‘Xiao Hong holds a flower in her hand’, 小红手里拿着一朵花).

In the ‘Pinyin Syllable Dictation’ task, children were asked to write down pinyin for one syllable of a two-syllable word orally presented by the administrator. For example, children were asked to write down the pinyin shi2 for the first syllable in the word shi2 jian1 (‘time’, 时 间). The task contained twenty items.

In the ‘Tone Judgment’ task, children listened to a set of three Chinese syllables orally presented by the experimenter, and were asked to judge which was the ‘odd’ one—the syllable that had a different tone from the other two in the set—by circling the number of their choice (1, 2, or 3) on the task sheet. For example, re4 had an ‘odd’ tone in the set re4, fan1, and ben1, and the child was expected to circle the correct answer ‘1’ for this set on the answer sheet. The task contained 12 items. To make sure children understood the task properly, each test set was repeated twice.

In the ‘Onset Judgment’ task, children listened to a set of three Chinese syllables orally presented by the experimenter and were asked to judge which was the ‘odd’ one—the syllable that had a different onset from the other two in the set, by circling the number of their choice (1, 2, or 3) on the task sheet. For example, bin1 had an ‘odd’ onset in the set pan1,
bin1, and pu1, and the child was expected to circle the correct answer ‘2’ for this set on the answer sheet. To avoid interference of tones, all the syllables were read in the same high-level tone. The task contained twelve items. Each test set was repeated twice.

We prepared forty Chinese sentences and forty pinyin sentences for Chinese Sentence Reading and Pinyin Sentence Reading. Half of the sample read the first twenty Chinese sentences and the last twenty pinyin sentences, and the other half of the sample read the last twenty Chinese sentences and the first twenty pinyin sentences. A similar counterbalanced design was used for Chinese Character Dictation and Pinyin Syllable Dictation.

2.2 Results and discussion

Table 1 shows the mean proportion of correct responses on the measures and the intercorrelations among them. All measures had satisfactory reliabilities (>0.75), as shown in the fourth column of Table 1. Chinese Sentence Reading was significantly correlated with Chinese Character Dictation (0.26, p<.050) and Tone Judgment (0.33, p<.010). Tone judgment was significantly correlated with Pinyin Sentence Reading (0.49, p<.010) and Pinyin Syllable Dictation (0.54, p<.010). The significant correlations suggest a close relationship between Chinese reading, tone awareness, and pinyin knowledge.

To explore the contribution of tone awareness and pinyin knowledge to Chinese reading, a hierarchical regression model was performed with Chinese Sentence Reading as the dependent variable. Among the predictor variables, Chinese Character Reading was entered in Step 1, Pinyin Sentence Reading and Pinyin Syllable Dictation were entered together in Step 2, and Onset Judgment and Tone Judgment were entered together in Step 3. As shown in Table 2, onset awareness and tone awareness in combination explained about 8% of the variance in Chinese Sentence Reading after controlling for Chinese Character Dictation and the two pinyin measures. Tone Judgment was the only significant unique predictor of Chinese reading in the model (B=3.31, p<.010). In contrast, the two pinyin measures, entered in Step 2, did not explain a significant amount of variance in Chinese Sentence Reading.

Results from Experiment 1 suggest that tone awareness plays a critical role in Chinese reading. Moreover, tone awareness was significantly

<table>
<thead>
<tr>
<th>Task</th>
<th>M (SD)</th>
<th>α</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chinese Sentence Reading</td>
<td>0.9 (0.13)</td>
<td>0.77</td>
<td>0.15</td>
<td>0.26*</td>
<td>0.41**</td>
<td>0.82 (0.12)</td>
<td>0.88</td>
</tr>
</tbody>
</table>

*p<.050; **p<.010.

Table 2 Summary of multiple regression analysis on Chinese sentence reading in Experiment 1

<table>
<thead>
<tr>
<th>Step</th>
<th>Predictors</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>$\Delta F$</th>
<th>B</th>
<th>$SE_B$</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chinese Character Dictation</td>
<td>0.07</td>
<td>0.07</td>
<td>5.62*</td>
<td>0.28</td>
<td>0.14</td>
<td>1.98</td>
</tr>
<tr>
<td>2</td>
<td>Pinyin Sentence Reading</td>
<td>0.08</td>
<td>0.02</td>
<td>0.75</td>
<td>0.048</td>
<td>0.102</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>Pinyin Syllable Dictation</td>
<td></td>
<td></td>
<td></td>
<td>-0.14</td>
<td>0.08</td>
<td>-1.75</td>
</tr>
<tr>
<td>3</td>
<td>Onset Judgment</td>
<td>0.16</td>
<td>0.08</td>
<td>3.52*</td>
<td>-1.11</td>
<td>1.58</td>
<td>-0.7</td>
</tr>
<tr>
<td></td>
<td>Tone Judgment</td>
<td></td>
<td></td>
<td></td>
<td>3.31**</td>
<td>1.03</td>
<td>3.07**</td>
</tr>
</tbody>
</table>

*p<.050; **p<.010.
correlated with pinyin proficiency. It is likely that learning pinyin, which explicitly denotes the tone of each syllable, enhances tone awareness (e.g. Soik and Fletcher, 2001). However, Experiment 1 did not show whether tone awareness would remain a unique contributor to Chinese reading after taking into consideration rapid naming, an important correlate of Chinese reading ability. Experiment 2 was designed to examine this issue.

3 Experiment 2

3.1 Method

3.1.1 Participants
Seventy-three second graders (second semester) with an average age of 8 years and 6 months from a public school in a working-class neighborhood in Beijing participated in the experiment. All children were native Chinese speakers and the formal language of instruction used in the school was Mandarin. There were thirty-seven girls and thirty-six boys.

3.1.2 Materials and procedure
Six tasks measuring Chinese literacy proficiency, phonological awareness, and rapid naming were administered in the following order over a period of 6 days: Chinese Sentence Judgment, Tone Judgment, Onset Judgment, Rapid Digit Naming (RAN), Chinese Syllable Naming, and Pinyin Syllable Naming. Chinese Sentence Judgment, Tone Judgment, and Onset Judgment were administered to the whole class simultaneously, and the three naming tasks were administered individually. Similar to Experiment 1, three practice items/sets were given in each task to make sure every child understood the task properly. Generous encouragement was provided by the experimenter throughout the tasks. The details of the tasks are described below.

The ‘Chinese Sentence Judgment’ measured Chinese reading proficiency. In this task, children read 20 sentences in Chinese and were asked to judge whether each sentence was true or false. For example, the sentence ‘大海里只有水，没有别的东西’ (There is nothing in the sea but water) was intended to be a false sentence. This task was measured by the rate of correct responses.

‘Tone Judgment’ task and ‘Onset Judgment’ task were the same as those in Experiment 1.

In the ‘Rapid Digit Naming (RAN) in Chinese’ task, the child named twenty-five randomly ordered digits in Chinese as quickly as possible. The amount of time used (in seconds) was recorded.

In the ‘Chinese Character Naming’ task, the child named as quickly and accurately as they could twenty frequently used characters selected from the textbooks of previous grade levels. The amount of time (in minutes) used was recorded.

In the ‘Pinyin Syllable Naming’ task, the child named as quickly and accurately as they could twenty pinyin syllables. The amount of time (in minutes) used was recorded.

Similar to Experiment 1, a counterbalanced design was used for Chinese Character Naming and Pinyin Syllable Naming.

3.2 Results and discussion
Table 3 shows the mean performance on the measures and the correlations among them. The reliability statistics for the first three measures were

<table>
<thead>
<tr>
<th>Task (N=73)</th>
<th>M (SD)</th>
<th>α</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chinese Sentence Judgment</td>
<td>0.71 (0.2)</td>
<td>NA</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2. Chinese Character Naming</td>
<td>0.78 (0.25)</td>
<td>NA</td>
<td>–0.27*</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3. Pinyin Syllable Naming</td>
<td>2.65 (1.19)</td>
<td>NA</td>
<td>–0.18</td>
<td>0.34*</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>4. Tone Judgment</td>
<td>0.86 (0.19)</td>
<td>0.87</td>
<td>0.41*</td>
<td>–0.26*</td>
<td>–0.54**</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>5. Onset Judgment</td>
<td>0.81 (17)</td>
<td>0.8</td>
<td>0.03</td>
<td>0.05</td>
<td>–0.17</td>
<td>0.30*</td>
<td>–</td>
</tr>
<tr>
<td>6. RAN Digits</td>
<td>12.12 (2.51)</td>
<td>0.9</td>
<td>–0.33**</td>
<td>0.32**</td>
<td>0.39**</td>
<td>–0.18</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Notes. NA, not available.
* p<.050; ** p<.010.
not available. The reliabilities for the phonological awareness measures and the ‘RAN’ digits in Chinese were adequate (all greater than 0.80). With respect to correlations, Chinese Sentence Judgment was significantly correlated with Tone Judgment (0.41, \( p < .050 \)), Chinese Character Naming (−0.27, \( p < .050 \)) and ‘RAN’ Digits in Chinese (−0.33, \( p < .010 \)). Tone Judgment was significantly correlated with Chinese Character Naming and Pinyin Syllable Naming (−0.26, \( p < .050 \) and −0.54, \( p < .010 \), respectively).

A hierarchical multiple regression analysis was conducted with Chinese Sentence Judgment as the dependent variable. Among the predictors, ‘RAN’ Digits in Chinese was entered first, followed by Chinese Character Naming and Pinyin Syllable Naming in the next two steps. Onset Judgment was entered in Step 4, and Tone Judgment was entered in the final step. As shown in Table 4, Tone Judgment remained a significant predictor of Chinese Sentence Reading, after controlling for all other variables, including RAN. It explained about 16% of the unique variance in Chinese reading. Experiment 2 reinforced the finding from Experiment 1, showing that tone awareness contributes uniquely to Chinese reading, even after RAN was taken into consideration.

### 4 General Discussion

The present study examined the relationship among tone awareness, pinyin knowledge, and Chinese reading in primary school children in Mainland China. The study yielded several important findings. One finding is that, in both experiments, tone awareness was significantly correlated with measures of pinyin knowledge. In Experiment 1, tone awareness was correlated with both Pinyin Sentence Reading and Pinyin Syllable Dictation. In Experiment 2, tone awareness was correlated with Pinyin Syllable Naming. These findings support our hypothesis that learning pinyin, an alphabetic coding system in which tones are explicitly denoted by tone marks, facilitates children’s tone awareness. To our knowledge, only a small number of studies have examined the impact of pinyin on tone awareness. Shu et al. (2008) showed that Chinese first graders had a significantly higher level of tone awareness than kindergarteners and attributed the improvement to pinyin instruction given at the beginning of Grade 1. Leong et al. (2005) observed a similar positive effect of pinyin on tone perception in Grades 4 and 5. Our study targeted Chinese children in Grades 2 and 3. Taken together, the results of these studies indicate that pinyin knowledge enhances tone awareness throughout the primary school years.

It should be pointed out that the relationship observed between tone awareness and pinyin in all the studies, including ours, is based on correlations. As such, causation cannot be claimed. As argued by Soik and Fletcher (2001), the relationship is likely to be bidirectional in nature. It is possible that tone awareness initially develops as a consequence of pinyin knowledge, because the learning of Pinyin makes children realize that Chinese is a tonal language and that the mastery of pinyin provides an effective tool for explicit processing of tones. On the other hand, children who have more advanced tone awareness can read pinyin faster, given that tonal skills are required for disambiguating meanings of homophonic syllables. Thus, there may be mutual facilitation between tone awareness and pinyin knowledge in learning to read Chinese.

<table>
<thead>
<tr>
<th>Step</th>
<th>Predictor</th>
<th>( R^2 )</th>
<th>( \Delta R^2 )</th>
<th>( \Delta F )</th>
<th>( B )</th>
<th>( SE_B )</th>
<th>( T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RAN Digits</td>
<td>0.09</td>
<td>0.09</td>
<td>5.76*</td>
<td>−0.02</td>
<td>0.01</td>
<td>−2.13*</td>
</tr>
<tr>
<td>2</td>
<td>Chinese Character Naming</td>
<td>0.13</td>
<td>0.04</td>
<td>2.42</td>
<td>−0.14</td>
<td>0.11</td>
<td>−1.27</td>
</tr>
<tr>
<td>3</td>
<td>Pinyin Syllable Naming</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
<td>0.05</td>
<td>0.03</td>
<td>1.89</td>
</tr>
<tr>
<td>4</td>
<td>Onset Judgment</td>
<td>0.13</td>
<td>0</td>
<td>0.29</td>
<td>−0.04</td>
<td>0.14</td>
<td>−0.29</td>
</tr>
<tr>
<td>5</td>
<td>Tone Judgment</td>
<td>0.29</td>
<td>0.16</td>
<td>11.96**</td>
<td>0.54</td>
<td>0.16</td>
<td>3.46**</td>
</tr>
</tbody>
</table>

\* \( p < .050 \); ** \( p < .010 \).

Table 4 Summary of hierarchical regression analysis in Experiment 2
Another important finding produced by the present study is that tone awareness was a unique predictor of Chinese reading, after controlling for rapid naming, pinyin knowledge, and onset awareness. Our finding, in combination with those of Shu et al. (2008) and Leong et al. (2005), indicates that tone awareness is related to Chinese reading throughout the primary school years. As we hypothesized, this may be due to the fact that Chinese is a tonal language, and thereby the ability to reflect on and manipulate tones helps children distinguish between characters with the same syllable but different tones. Unlike other aspects of phonological awareness, tone awareness can only develop from experience with a tonal language. The specificity of tone awareness may account for why it explains unique variance in Chinese reading after controlling for other aspects of phonological awareness. Interestingly, the results of our study seem to indicate that tone awareness plays an even more important role in Chinese reading than onset awareness for children at Grade 2 and 3, as the latter was no longer a significant predictor of Chinese reading after controlling for the former (Experiment 1). This finding needs to be confirmed by future research.

Finally, the results of the present study demonstrate that while pinyin knowledge facilitated tone awareness, it did not make a direct contribution to Chinese reading. That is to say, the effect of pinyin knowledge on Chinese reading is mediated through phonological awareness. The lack of a direct contribution can be explained by the different nature of pinyin and the Chinese writing system—pinyin is a transparent alphabetic coding system, while in Chinese a character represents a morpheme rather than a phoneme. Nowadays, in Mainland China, many children begin to learn English in Grade 1, around the same time they receive pinyin instruction. It remains to be seen whether pinyin knowledge makes a direct, positive contribution to English reading, since both are alphabetic systems. There is also the belief, however, that pinyin may interfere with English learning because the Roman letters in the two systems have different pronunciations (see Zhang and McBride-Chang, same volume). These topics, though beyond the scope of the present study, should be explored in future research.

The present study has several limitations. The main limitation centers on the fact that Chinese reading was only measured by sentence level reading in both experiments. There were no measures of character reading. While reading comprehension is the ultimate goal of reading, character and word reading is an important step toward that goal. As such, it will be of both theoretical and practical interest to examine the relationship among character reading, tone awareness, and pinyin knowledge. A related limitation lies in the inconsistency in the measures used in the two experiments. For example, pinyin knowledge was measured with a dictation task in Experiment 1, but a naming task in Experiment 2. Future studies should include tasks with improved construct validity.

Despite the limitations, the findings of the present study are of interest and have implications for educational practice. The associations observed between pinyin knowledge and tone awareness, and between tone awareness and Chinese reading should lead educational policy makers and teachers in Mainland China to reconsider the importance of pinyin instruction in primary school education. Better and earlier acquisition of pinyin knowledge facilitates the development of phonological awareness which, in turn, facilitates Chinese reading. Moreover, pinyin knowledge may also be important for learning English in Mainland China. In fact, the contribution of pinyin knowledge to English reading has been reported in studies involving Chinese bilingual children in the USA. Wang et al. (2005) found that pinyin knowledge and Chinese tone awareness were each independently associated with English pseudoword reading among 8-year-old Chinese immigrant children. Future research should examine whether pinyin is uniquely associated with both Chinese character reading and English word reading in children in China.

References


