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Research Article

# Riddle Appreciation and Reading Comprehension in Cantonese-Speaking Children

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**Purpose:** Inference-making skills are necessary for reading comprehension. Training in riddle appreciation is an effective way to improve reading comprehension among English-speaking children. However, it is not clear whether these methods generalize to other writing systems. The goal of the present study was to investigate the relationship between inference-making skills, as measured by riddle appreciation ability, and reading comprehension performance in typically developing Cantonese-speaking children in the 4th grade.
**Method:** Forty Cantonese-speaking children between the ages of 9;1 (years;months) and 11;0 were given tests of riddle appreciation ability and reading comprehension. Chinese character reading and auditory comprehension abilities were also assessed using tests that had been standardized in Hong Kong.
**Results:** Regression analyses revealed that riddle appreciation ability explained a significant amount of variance in reading comprehension after variance due to character reading skills and auditory comprehension skills were first considered. Orthographic, lexical, morphological, and syntactic riddles were also significantly correlated with reading comprehension.
**Conclusion:** Riddle appreciation ability predicts reading comprehension in Cantonese-speaking 4th-grade children. Therefore, training Cantonese speakers in riddle appreciation should improve their reading comprehension.

**Key Words:** reading comprehension, riddles, inference, decoding, Chinese

The purpose of reading is to comprehend the meaning of a text. Gough and Tunmer (1986) proposed that normal text comprehension involves at least two processes: language decoding and language comprehension. *Language decoding* refers to the ability to recognize the form (orthographic and phonological) of a word. In English, decoding refers to the ability to associate alphabetic letters and orthographic representations of written words (e.g., *yacht*) with spoken word forms and thus retrieve the semantic content of the word (Gough, Hoover, & Peterson, 1996; Hoover & Gough, 1990; Shankweiler et al., 1999). *Language comprehension* refers to the ability to extract and reconstruct word meaning, enabling sentences, passages, and discourse to be interpreted correctly (Gough et al., 1996; Hoover & Gough, 1990; Ukrainetz, 2006). The processes used for language comprehension are assumed to be similar for written word and auditory word comprehension (Gough et al., 1996; Hoover & Gough, 1990). Successful reading also requires working memory processes to integrate linguistic knowledge, real-world knowledge, and social contexts in order to achieve comprehension of discourse and text (Cain, Oakhill, & Bryant, 2004; Johnston, Barnes, & Desrochers, 2008; Ukrainetz, 2006).

Decoding skills used in reading comprehension have received considerable attention in the literature of reading development. For example, several studies have shown that phonological awareness is a strong predictor of reading comprehension ability in elementary school-age children (Cain et al., 2004; Dahl & Scharer, 2000; Gough et al., 1996; Megherbi, Seigneuric, & Ehrlich, 2006; Roch & Levorato, 2009). It is therefore common for educators to include the training of decoding skills as a core component of literacy programs in primary schools (Dahl & Scharer, 2000; Lovett, Lacerenza, & Borden, 2000; Snow, 2002). Training methods of reading comprehension including phonological awareness training and phonics instruction, such as the identification of basic linguistic components (i.e., sounds and corresponding letters in text), have been shown to enhance reading comprehension ability in several Indo-European languages (Brooks & Brooks, 2005; Dahl & Scharer, 2000).

Phonological awareness is a necessary, but not a sufficient, condition for developing the ability to comprehend text. Comprehension of complex compositions such as expository texts and stories for meaning also requires inference making

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to identify the main ideas and relate new information to stored knowledge. In order to make inferences from text, readers need to extract explicit and implicit meanings from sentences, integrate information from sentences, and form a representation of the intent of the author (Yuill & Oakhill, 1991). Oakhill (1982) proposed that forming a "mental model" was necessary to integrate new information during text comprehension. Such a model is constructed using episodic memory about the content of the text and general knowledge about real-world situations and events (see also Bishop, 1997). This schema allows comprehension during reading by supplementing information that is not mentioned explicitly in the text. The mental models framework therefore assumes that reading comprehension requires decoding skills as well as the retrieval of linguistic and world knowledge and the ability to integrate this information into a coherent whole construct using metalinguistic skills (Bishop, 1997; Yuill & Oakhill, 1991).

### *Inferences and Metalinguistic Awareness*

Metalinguistic awareness refers to the ability to reflect explicitly on the processes and rules of language (Gombert, 1992). For example, when listeners must infer the appropriate meaning of a homophone in a sentence, they have to determine which of the two or more meanings is more relevant to the context (e.g., river *bank* vs. savings *bank*). In the mental models framework, metalinguistic awareness is closely related to inference-making skills. Oakhill, Yuill, and Donaldson (1990) showed that poor readers with weak inference-making skills also demonstrated deficient metalinguistic awareness. These children showed a specific weakness when they were asked to infer a relationship between the literal and intended meaning in text, and this appeared to have a direct impact on their reading comprehension ability.

One example of the relationship among metalinguistic awareness, inference making, and reading comprehension comes from studies of riddle appreciation. Yuill (1996) reported that the ability to identify a riddle ambiguity was related to listeners' reading comprehension ability. To understand a riddle, listeners are required to detect ambiguous or alternative interpretations of the riddle as well as the literal meaning of the content (Shultz, 1974; Yuill, 1996). Riddle appreciation therefore requires metalinguistic skill. Yuill found a positive correlation between riddle recall and reading comprehension ability, which varied across different types of riddles. An understanding of the lexical, word compound, pragmatic, and metalinguistic riddles was more closely related to reading comprehension ability than an understanding of syntactic and absurd riddles was (Yuill, 1996).

In subsequent intervention studies, Yuill (2007, 2009) made use of lexical and syntactic riddle appreciation as a strategy in a treatment program for improving reading comprehension in a group of poor readers in primary grades (see also Zipke, Ehri, & Cairns, 2009). Positive outcomes were reported in these studies. The assumption of the mental models framework that inference-making skills play an important role in poor comprehension with less skilled readers is supported by studies of children who speak Indo-European languages. However, it is not yet known whether relationships between inference-making skills (riddle appreciation), decoding ability, and reading comprehension are observed in languages other than English.

### *Cantonese*

Chinese languages are derived from the Sino-Tibetan family and have many distinctive linguistic features. Cantonese is a Chinese language that is spoken by ~55 million people in the southern China region centered in Guangdong province, Hong Kong, and Macau (Lewis, 2009). The phonological system of Cantonese is largely unintelligible to a speaker of Mandarin (Putonghua), although communication is possible using the written script. In other words, Cantonese, like Putonghua, is basically an *oral* language. The standard *written* form of all Chinese languages, including Cantonese, is the Modern Standard Chinese (MSC). There are various differences in the domains of syntactic structures and vocabulary that are shared among oral Cantonese, Putonghua, and MSC (see To, Law, & Li, 2012).

The standard writing system of English is alphabetic, meaning that a grapheme can be represented by a corresponding phoneme(s). Speakers can pronounce a novel word based on the spelling of the word. By contrast, Chinese employs different principles to categorize the characters used in the writing system (see Table 1). The first form of writing in the Chinese culture was *pictographs,* which are icons or pictures that were developed to represent objects and events. For instance, a circle with a dot inside represents the sun, so the shape resembles the target object. After years of evolution, ancient pictographs were simplified and stylized. The current character for the sun is now "日". Other types of character include ideographs, which can represent concrete objects and events as well as abstract ideas, and logographs, which are similar to ideographs but are related more to the sound rather than meaning of a character (Nöth, 1990). Approximately 80% of Chinese characters belong to semantic-phonetic compounds (Zhu, 1987, cited in Hoosain, 1991), which contain both a semantic component and a phonetic component. The semantic component (also called semantic radical) carries information about the semantic category of the character; the phonetic component (also called phonetic radical) represents sound cues for the pronunciation of the character.

Chinese has also been described as *morphosyllabic* (DeFrancis, 1990) because there are many more morphemes than possible phonological syllabic units in Chinese (Zhou, 1978). As a result, there are a lot of homonymous monosyllables. To avoid ambiguity, Chinese lexical items, regardless of word class, are often disyllabic (Packard, 2000) (e.g., 電腦/tin lou/*computer,* 喜歡/hei fun/*like,* 所以/sɔ ji/*therefore*). Thus, compared with English, Cantonese has a different morphosyntactic writing system.

### *Reading Instruction in Hong Kong Classrooms*

The Hong Kong government provides 9 years of free and compulsory education for all children between the ages

**Table 1.** Three major types of Chinese characters.

| Character type | Examples | | | |
|---|---|---|---|---|
| Pictograph | 日 "sun" | 月 "month" | 田 "Field" | 山 "hill" |
| Ideograph | 一 "one" | 上 "up" | 凹 "concave" | 凸 "convex" |
| Semantic-phonetic compound | 塘 /$t^h$ɔŋ4/ "a pond" | 芽 /a4/ "a sprout" | 姐 /tsɛ2/ "an older sister" | 鵝 /ɔ4/ "a goose" |
| | ■ semantic radical: 土 "soil" | ■ semantic radical (top): 廿 "plant" | ■ semantic radical: 女 "female" | ■ semantic radical: 鳥 "aviary" |
| | ■ phonetic radical: 唐 /$t^h$ɔŋ4 | ■ phonetic radical: 牙 /a4/ | ■ phonetic radical: 且 /$ts^h$ɛ2/ | ■ phonetic radical: 我 /ɔ5/ |

of 6 and 15, including 6 primary years and 3 secondary years. Given the nature of the Chinese writing system, phonological awareness training is not the focus of reading instruction in most Hong Kong classrooms. Traditional methods for the teaching of characters include (a) introducing new characters by describing the meaning, (b) repeated copying of characters according to the sequence of strokes, and (c) dictation tests to ensure progress in the teaching of Chinese characters. Through such instruction, children acquire the meaning, form, and pronunciation of characters, as well as how characters represent words. Even with the many variations in categorizing characters, Cantonese-speaking pupils in Hong Kong are expected to read >3,800 characters over the 6 primary school years (Chung & Leung, 2008).

In contrast to the teaching method in Hong Kong, the *Pinyin* system is used in Mainland China to teach new characters. Pinyin is an alphabetic script that represents the pronunciation of spoken Chinese and can be regarded as a Romanization system of Mandarin Chinese. Pinyin is printed above a character in early primary-grade textbooks. Children are expected to learn Pinyin in early grades so they can use this knowledge to assist their learning of new characters. Cantonese-speaking children in Hong Kong do not use a Romanization system for character learning. They learn characters through exposure and repeated practice. Despite the differences, Cantonese-speaking children in Hong Kong and Putonghua-speaking children in the Mainland make use of the consistencies in the phonetic components of compound characters to retrieve the character pronunciation. Children begin to learn a small set of characters as wholes quickly. As they learn more characters, they often make pronunciation errors as they rely on the phonetic components for whole character pronunciation. With continuous practice, children can associate the correct pronunciation to whole characters for accurate oral reading.

There is no specific instruction given for training reading comprehension in Hong Kong. Teachers make use of textbooks published by commercial publishers in their teaching during the primary school years, and students are requested to buy the corresponding textbooks for lessons. However, many comprehension-based activities are used to teach the Chinese language. For example, teachers read aloud a text and ask questions about the text, and students are asked to answer questions. Regular exercises on reading comprehension are given as assignments.

### *Reading Difficulties in Chinese*

Poor readers can be categorized into distinct groups (Catts & Kamhi, 1999): children who have difficulties with word recognition or decoding but have at least close to typical ability in language comprehension (dyslexia), children who are weak in both word recognition skills and comprehension, and children who have adequate decoding ability but poor comprehension. Research on Chinese-speaking children has focused on the first two groups, revealing that the behavioral manifestations of developmental dyslexia in Chinese are generally comparable to those reported in English (Shu, Meng, Chen, Luan, & Cao, 2005). Chinese-speaking children with dyslexia produce (a) regularization errors whereby characters are read entirely based on the pronunciation of the phonetic radical or other characters with the phonetic radical and (b) morph-orthographic errors in which children read a character as the other part of a word (e.g., 所/sɔ/→以[ji5]; 所以 means *therefore*). Cognitive weaknesses in Chinese poor decoders appear to be similar to those in their English counterparts with weak phonological awareness, which is a characteristic of Chinese developmental dyslexia (e.g., Ho & Ma, 1999; So & Siegel, 1997). Yet, recent findings have shown that other cognitive factors such as orthographic knowledge (Shu, Anderson, & Wu, 2000), morphological skills (McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003), and rapid automatic naming ability (Ho, Chan, Lee, Tsang, & Luan, 2004) have relatively strong associations with developmental dyslexia in Chinese speakers (Klingebiel & Weekes, 2009).

Studies on Cantonese speakers' reading comprehension at the text level are emerging. Studies by Leong and colleagues (Leong, Hau, Tse, & Loh, 2007; Leong, Tse, Loh, & Hau, 2008) used structural equation modeling to explore the role of (a) verbal working memory, (b) pseudoword reading, (c) rapid automatized naming, and (d) phonological segmentation on

inferential text comprehension in a group of Cantonese-speaking children with poor reading comprehension and a group of typically developing (TD) third to fifth graders in Hong Kong. Verbal working memory and pseudoword reading (decoding ability) had a moderately high correlation with text comprehension ability. The Chinese pseudowords designed by Leong et al. (2007) were combinations of two real pronounceable character components combined into meaningless forms. Leong et al. (2007) reported that the phonological–orthographic properties of pseudowords related to how well Chinese text was read and comprehended.

A missing group of Chinese children with reading disability in contemporary research are readers with typical character reading skills and deficient reading comprehension. Extant studies focus on processing and word-level competencies without considering higher cognitive-level skills such as inference making and metalinguistic awareness, although a recent study reported a weaker association between reading comprehension and morphosyntactic ability in younger children and those with dyslexia compared with more experienced Cantonese-speaking readers (Chik et al., 2012).

### *Aims of the Present Study*

Studies with English-speaking children have revealed a relationship between inference-making skills and reading comprehension (Yuill & Oakhill, 1988, 1991). The aim of the present study was to investigate whether this relationship is observed in TD Cantonese-speaking children. Specifically, we tested the contribution of riddle appreciation to reading comprehension after controlling for individual differences in decoding skills and auditory comprehension. We also examined possible relationships between different riddle types and reading comprehension in Cantonese speakers.

## Method

### *Participants*

Forty Cantonese-speaking children in the fourth grade (20 boys and 20 girls) between the ages of 9;1 (years;months) and 11;0 ($M_{age}$ = 9;9) were recruited from four primary schools in Hong Kong, where Cantonese is the primary language of instruction. Participants were selected according to the criteria of having no history of speech, language, hearing, or visual problems. The socioeconomic status of the children was not available.

### *Materials*

Each child completed four tests: (a) an auditory comprehension test, (b) a reading comprehension test, (c) a riddle appreciation test, and (d) a character reading accuracy test.

*Auditory comprehension.* Auditory comprehension was examined using the Textual Comprehension subtest from the Hong Kong Cantonese Oral Language Assessment Scale (T'sou et al., 2006). This subtest is a standardized norm-referenced language assessment that was developed in Hong Kong for Cantonese-speaking children. Children are assessed using two out of three passages according to their age. In the present study, children were evaluated using the same two passages. Children listened to two prerecorded passages of 50 s and 68 s in length. Each child was then asked a series of questions including literal questions, questions that require an inference, and questions that require the child to infer the meaning of some low-frequency vocabulary items in the oral passage. Responses were scored according to the marking scheme used in the test manual. The maximum score is 38.

*Reading comprehension.* Reading comprehension was examined using two passages that were constructed based on the framework of the Hong Kong Territory-wide System of Assessment (Hong Kong Examinations and Assessment Authority, n.d.). The TSA was developed by the Hong Kong Education Bureau to provide information about school standards in Chinese language, English language, and mathematics for the purpose of improving effective teaching and learning ("Basic Competency," n.d.; Hong Kong Examinations and Assessment Authority, n.d.) for all children in Grades 3 and 6. The TSA is based on key learning areas that children acquire at different grades in the curriculum. The two passages were developed with reference to the expected level of attainment over the most recent 4 years (i.e., years 2007, 2008, 2009, and 2010) for the TSA standard of Chinese written text comprehension in Grade 3 and Grade 6 levels published by the Hong Kong Examinations and Assessment Authority. The passages included 408 and 547 characters and were printed in traditional Chinese character font.

Using TSA as a reference allowed us to minimize the effect of any prior learning on the children's performance. For each passage, six open-ended questions were designed: two literal questions, two coherence inference questions, and two elaboration inference questions. *Literal* questions assess the ability to draw on linguistic knowledge (e.g., asking a child to identify relevant words and phrases in the text with reference to a definition); *coherence inference* questions assess the ability to integrate propositions and make referential links among persons, place, and time across propositions (e.g., asking a child about the relationship of two characters given that they have lessons together); and *elaboration inference* questions assess the ability to read beyond the stated messages in the text to make predictions about the consequences of an event (e.g., asking a child what would happen next or to explain the intention of a character's behavior). The children were asked to read two printed text passages silently and to answer questions relating to the text by writing their answers in the space provided without worrying about their writing quality. A marking scheme was developed, and a score of two was awarded according to the accuracy, clarity, completeness, and relevance of the written answer to each question. The maximum score for the reading comprehension test was 24 (2 passages × 2 marks for 6 questions per passage).

To ensure that the reading comprehension test along with the marking scheme was developmentally sensitive, 30 children at Grades 2, 4, and 6, with five boys and five girls in each grade, were recruited from schools to complete the

test. A strong and significant positive correlation was found between grade level and total score of the reading comprehension test ($r = .89$, $p < .01$). Six passages (chosen randomly) were also scored independently by a second marker, producing 86% interrater agreement. The theoretical background, developmental sensitivity, and high interrater reliability provide evidence that the reading comprehension test is valid and reliable in Hong Kong.

*Riddle appreciation.* The riddle appreciation test consists of two tasks, the riddle retelling task and the riddle explanation task. The test was developed based on Yuill (1996). Given the differences between the English and Chinese writing systems, we modified the types of riddles presented in our test. One type of riddle that is common in Chinese culture and children's books is the orthographic riddle. This type of riddle is similar to the "metalinguistic" riddle described by Yuill and defined as "terms for linguistic entity" (p. 198) such as *word* and *letter*. For example, what is the longest word in English? The answer is *smiles* because it is a mile between the first and last letter. An orthographic riddle in Chinese also involves decomposing a character and understanding the meaning of the component parts. With the change of the metalinguistic riddles to orthographic riddles, six types of riddles were developed; namely, morphonological, orthographic, lexical, morphological, syntactic, and pragmatic riddles, with seven exemplars for each type of riddle, yielding a total of 42 riddles. Table 2 shows the six riddle types and the corresponding examples used in Yuill (1996). (see the Appendix for examples of Chinese riddles with English translation and explanation).

According to the classification and examples in Yuill (1996), *morphonological* riddles are less complex than other types of riddles. These contain a morpheme replaced by a homophonic morpheme. As mentioned before, *orthographic* riddles require decomposition of characters and knowledge of Chinese character orthography. *Lexical* riddles involve the understanding of double or multiple meanings of words that share the same character and word class. *Morphological* riddles are similar to the compound types described in Yuill and rely on multiple interpretations of compound words by understanding the decomposed lexical structure of various constituent morphemes (Zhou, Marslen-Wilson, Taft, & Shu, 1999). *Syntactic* riddles consist of syntactic ambiguity (Yuill, 1996) either by a change of word class using word segmentation strategies or by ellipsis of a word or phrase. *Pragmatic* riddles refer to riddles that are out of the listener's expectation about the speaker's intent: The speaker either gives too much specific detail in a statement or does not follow the general presupposition of an utterance (Yuill, 1996). To ensure the accuracy of riddle type classification, all riddles were reclassified by a native Cantonese speaker. Disagreement was found in three out of the 42 riddles, and this was resolved after discussion.

All riddle questions and riddle answers were recorded in a female voice, and a simple line drawing picture was prepared for each riddle stimulus. The picture provided no cues to the riddle answer; the purpose of including a picture was to maintain the children's attention during the test. The recorded stimuli and pictures were incorporated into a PowerPoint program that was used to present the riddle appreciation test. Children first listened to a riddle question presented via the computer and were then encouraged to guess the answer. Regardless of the accuracy of the child's response, the correct answer of the riddle question was then presented to the child before moving to the next riddle question. The riddle answers provided to the children were only in aural mode and were in a declarative form without any detailed elaboration and explanation.

After all of the riddles were presented, the child was presented with the auditory test and the character reading accuracy test. Finally, the riddle retelling task and explanation task were conducted. In the retelling task, recorded riddle questions were presented to the child again via PowerPoint. This time, the child was requested to provide the answer. After giving the answer, the child was asked to provide an explanation about the ambiguity, and this was the riddle explanation task. The presentation order of the riddles was randomized for all of the children. For scoring, one point was given to each correct answer to the retelling and the explanation; the maximum score for each task was 42.

*Character reading accuracy.* Children's character reading accuracy was tested using the Hong Kong Graded Character Naming Test (HKGCNT; Leung, Cheng-Lai, & Kwan, 2008). The HKGCNT is a standardized character recognition test that is designed to assess children's character naming ability. In this test, children are asked to read aloud 150 single Chinese characters taken from the Grade 4 subtest. One point is given to each correct item.

## Procedure

The reading comprehension test was administered to the children as a group. The auditory comprehension, riddle appreciation (riddle retelling and explanation tasks),

**Table 2.** Examples of English riddles used in Yuill (1996).

| Riddle type | Riddle question | Riddle answer |
|---|---|---|
| Morphophonological | What kind of keys are furry? | Monkeys |
| Metalinguistic | Why is the letter *E* lazy? | Because it's always in bed. |
| Lexical | Why do leopards never escape from the zoo? | Because they are always spotted. |
| Morphological (or word compound) | Why did the girl tiptoe past the medicine cabinet? | She didn't want to wake the sleeping pills. |
| Syntactic | What animal can jump higher than a tree? | All animals because tree can't jump. |
| Pragmatic | When is a black dog most likely to go into a house? | When the door is open. |

**Table 3.** Mean score, standard deviation, and range of scores for all tests.

| Test | Maximum score | Mean | *SD* | Range |
|---|---|---|---|---|
| Auditory comprehension | 38 | 24.85 | 3.80 | 18–36 |
| Reading comprehension | 24 | 17.13 | 3.60 | 9–23 |
| Riddle appreciation | | | | |
| Riddle retelling | 42 | 36.83 | 3.65 | 25–42 |
| Riddle explanation | 42 | 24.85 | 6.78 | 10–36 |
| Character reading accuracy | 150 | 119.78 | 15.55 | 82–142 |

and character reading accuracy tests were carried out individually. For individually administered tests, the sequence was always as follows: All riddles were presented to the child once, the auditory comprehension test and the character reading accuracy test were then administered, and the riddle retelling and explanation tasks were conducted at the end of the session, thus minimizing the effect of rote memory on the recall of riddle answers. The whole session was audio recorded, and all responses from the riddle retelling and explanation tasks were transcribed verbatim. Thirteen percent of all riddle retelling and explanation tasks were rescored by a second rater to assess interrater reliability. Riddle retelling scores were coded with 100% agreement, and riddle explanation scores were coded with 98% agreement. The auditory comprehension test, the reading comprehension test, and the character reading accuracy test were coded by a single coder only.

## Results

Descriptive statistics from each test are summarized in Table 3. No child scored <1.25 *SD*s below the mean score for their age in auditory comprehension (i.e., they all showed age-appropriate performance). That means that all of the children were normal auditory comprehenders.

### *Univariate Analyses*

We used Pearson's product–moment correlation coefficients to calculate the children's performance on the reading comprehension test and their performance on all of the other tests (see Table 4). There was a significant positive correlation between all tests and reading comprehension. Performance on the riddle explanation task demonstrated the strongest correlation with reading comprehension performance ($r$ = .69, $p < .001$) followed by character reading accuracy ($r$ = .56, $p < .001$), auditory comprehension ($r$ = .40, $p < .05$), and riddle retelling ($r$ = .36, $p < .05$). It is of interest to note that, although riddle explanation was an oral task, the correlation with auditory comprehension ($r$ = .41) was not as high as the correlation with reading comprehension ($r$ = .69).

### *Hierarchical Multiple Regression Analyses*

Given the significant univariate correlations of the four variables (auditory comprehension, riddle retelling, riddle explanation, and character reading accuracy) with reading comprehension, all of the variables were subject to a multiple hierarchical regression with reading comprehension as the dependent outcome variable. A direct entry method was used, and the entry order of the variables was based on the strength of the correlation coefficients: (a) riddle explanation, (b) character reading, (c) auditory comprehension, and (d) riddle retell. The results from the regression analyses are summarized in Table 5.

With all of the variables entered into the regression model, the final model explained ~54.6% of the variance in reading comprehension, and the overall model was significant, $F(4, 39) = 10.54$, $p < .001$. When riddle explanation was first entered into the regression model, the model with this single variable already explained most of the variance (47.4% out of 54.6%). When the variables of character reading and auditory comprehension were entered, these accounted for an additional 1.5% and 1.0% of the variances, respectively. Riddle retelling was then entered in the final model and accounted for an additional 4.7% of variance. However, the contribution of character reading, auditory comprehension, and riddle retelling in the final model was not statistically significant.

The unstandardized coefficients ($B$) in the regression model in Table 5 indicate strength and direction, characterizing the predictive power of the independent variables. The $B$ value of riddle explanation in the final model is 0.42, which suggests a positive relationship between riddle explanation performance and reading comprehension. As the effects of character reading accuracy and riddle retelling were controlled for, this value indicated that as riddle explanation increases by one unit, reading comprehension increases by nearly half a unit (0.42).

**Table 4.** Intercorrelations among reading comprehension, auditory comprehension, character reading, riddle retelling, and riddle explanation.

| | Reading comprehension | Auditory comprehension | Character reading | Riddle retelling |
|---|---|---|---|---|
| Auditory comprehension | .40* | — | | |
| Character reading | .56** | .40* | — | |
| Riddle retelling | .36* | .34* | .44** | — |
| Riddle explanation | .69** | .41** | .68** | .73** |

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

**Table 5.** Results of the hierarchical regression analyses.

| | $R^2$ | $\Delta R^2$ | Model sig. | Unstandardized *B* | *p* |
|---|---|---|---|---|---|
| Model 1 | .474 | .474 | <.001 | | |
| Riddle explanation | | | | .366 | <.001 |
| Model 2 | .489 | .015 | <.001 | | |
| Riddle explanation | | | | .306 | .001 |
| Character reading | | | | .039 | .304 |
| Model 3 | .499 | .010 | <.001 | | |
| Riddle explanation | | | | .290 | .002 |
| Character reading | | | | .033 | .393 |
| Auditory comprehension | | | | .109 | .392 |
| Model 4 | .546 | .047 | <.001 | | |
| Riddle explanation | | | | .424 | <.001 |
| Character reading | | | | .024 | .510 |
| Auditory comprehension | | | | .129 | .297 |
| Riddle retelling | | | | −.318 | .064 |

### *Riddle Type*

To examine the relationship between riddle type and reading comprehension, we computed correlation coefficients. Table 5 displays the percentage of accuracy of riddle explanation for each riddle type as well as the correlation values with reading comprehension expressed in terms of Pearson's *r*. Performance on all riddle types with the exception of the morphonological and pragmatic riddles showed a significant positive correlation with reading comprehension ability. Among the six riddle types, orthographic riddle explanation had the strongest correlation ($r = .66$, $p < .001$), and lexical, morphological, and syntactic riddle explanations showed moderate correlations with reading comprehension. When compared to the results of Yuill (1996), whose results are also summarized in Table 6 for reference, the patterns were generally similar. Although the orthographic riddles showed the strongest correlation with reading comprehension here, the correlation between metalinguistic riddles (i.e., the corresponding form of orthographic riddle) in Yuill was the strongest among all of the riddle types. Moreover, morphophonological riddles in both studies showed no significant correlation with reading comprehension. One difference between the two studies is that the correlation of syntactic riddles was significant in our study but not in the Yuill study.

## Discussion

In our study, reading comprehension ability in Cantonese-speaking children was significantly associated with riddle retelling, riddle explanation, and character reading accuracy. Yet, when all variables were considered simultaneously in a regression model and auditory comprehension was controlled, only riddle explanation predicted reading comprehension performance significantly, with riddle retelling and character reading accuracy making no significant unique contribution. These results point to a relationship between metalinguistic skill and reading comprehension ability and are therefore compatible with the mental models account of reading comprehension skills.

Our observations are also consistent with studies that characterize a trajectory of reading comprehension with experience. Perfetti, Landi, and Oakhill (2005) argued that the relative contribution of decoding and comprehension varies during the course of development. For beginning readers who are starting to read, the focus is on decoding and identification of new words. In other words, the link between reading and (oral) language comprehension is not established for beginning readers (Sticht & James, 1984). However, as word recognition becomes advanced, the importance of comprehension ability increases, resulting in stronger correlations between reading comprehension and language

**Table 6.** Descriptive statistics and correlations (Pearson's *r*) between riddle explanation and reading comprehension for different types of riddles.

| | Present study | | | Yuill (1996) | | |
|---|---|---|---|---|---|---|
| **Riddle type** | ***M* (max = 7)** | ***SD*** | ***r*** | ***M* (max = 8)** | ***SD*** | ***r*#** |
| Morphophonological | 3.23 | 1.21 | .26 | 5.74 | 1.62 | .21 |
| Orthographic | 3.38 | 2.13 | .66*** | 3.97 | 1.37 | .51** |
| Lexical | 4.47 | 1.49 | .52** | 5.61 | 1.73 | .46** |
| Morphological (word compound) | 3.98 | 1.73 | .53*** | 5.38 | 1.63 | .33* |
| Syntactic | 3.60 | 1.63 | .59*** | 4.64 | 1.31 | .29 |
| Pragmatic | 6.25 | 0.93 | .27 | 5.41 | 1.77 | .34* |

*Note.* # correlation with age and reading accuracy partialled out.

*$p < .05$ (2-tailed), **$p < .01$ (2-tailed), ***$p < .001$ (2-tailed).

comprehension (Gernsbacher, 1990). Similarly, in a 2-year longitudinal study of 4- to 5-year-old English-speaking children, Muter, Hulme, Snowling, and Stevenson (2004) reported that word identification predicts later reading comprehension as well as vocabulary and grammatical knowledge. Young children direct effort into decoding print from word components in text via comprehension of vocabulary and sentences. However, with experience, the relative contribution of word recognition skills to reading comprehension diminishes as other higher level factors become influential.

Leong et al. (2008) examined various cognitive factors associated with Chinese text comprehension in third to fifth graders and reported that pseudoword reading made a rather small contribution to the variance in reading comprehension in their model. Oakhill, Cain, and Bryant (2003) also found that inference-making skills and text integration skills were predictive of reading comprehension at ages 7–8 and 8–9, but word reading accuracy was not. Oakhill et al. argued that this is because older children become more proficient in decoding print using orthographic forms instead of analyzing the component parts (Perfetti et al., 2005). Children in the present study were in the fourth grade between the ages of 9;0 and 11;0. It can be assumed that basic word decoding skills have been mastered at this age, and therefore we assume that reading comprehension depends more on higher level skills such as inference making. In other words, we can conclude that decoding and word recognition are necessary for successful reading comprehension; however, they are not sufficient for successful reading comprehension, particularly when the reading demand increases in terms of the text type, content, and structure. This could explain why character reading accuracy was significantly correlated with reading comprehension ability in the univariate analysis but showed no unique contribution in the multivariate analysis when other factors were taken into account.

We observed that riddle explanation was a better predictor of reading comprehension than riddle retelling. Riddle explanation may be considered a proxy for inference-making ability. In order to appreciate a riddle, children have to discover the incongruity between riddle questions and riddle answers. Then they must detect the alternative and hidden meanings generating these ambiguities. Some children in the present study could merely retell the answer and were unable to provide an explanation that resolved the ambiguity. We contend that these children relied on verbatim memory to retell the riddle answers without any inferential analysis (see also Weekes, Hamilton, Oakhill, & Holliday, 2008). In other words, the riddle retelling task did not involve inference making. A post hoc observation was that the children who successfully explained the answer enjoyed the riddle (smiled) after resolving the incongruity.

In the analyses of different types of riddles and correlations with reading comprehension ability, the general pattern was comparable to Yuill (1996) except that syntactic riddle answers in the present study had a significant association with reading comprehension. Orthographic riddle explanation was strongly correlated with Chinese written text comprehension. This type of riddle is specific to Chinese and is popular in Chinese culture. To successfully explain an orthographic riddle, speakers need a repertoire of characters in their lexicon and the ability to decompose a character into different components. Speakers also need to understand the meaning of the subcharacter components and their sound (i.e., Chinese semantic and phonetic radicals) and the orthographic rules that govern the component parts and vocabulary knowledge (Leong et al., 2007; Shu, 2003). This knowledge requires metalinguistic awareness from the speaker. Such an awareness also seems to be a requirement for the metalinguistic riddles used by Yuill. As a consequence, these riddle types were highly correlated with riddle explanation in both studies.

Also consistent with Yuill (1996), morphological and lexical riddles were significantly associated with reading comprehension. In our study, appreciation of such riddles also requires a certain level of metalinguistic and inference making. To understand a morphological riddle, children have to understand the semantic content of the constituent morphemes that form compound words. Interpretation of lexical riddles requires children to be sensitive to multiple meanings of a word (Yuill, 1996). Children must then identify accurate word meanings according to context and explain any ambiguity at different word levels in lexical riddles. We observed no significant correlation between morphophonological riddle appreciation and reading comprehension in the present study as in Yuill. Compared to other riddle types, the correct interpretation of morphophonological riddles may require relatively less metalinguistic awareness. We agree with Yuill, who suggested that morphophonological riddles are sublexical riddles and are thus more closely related to word reading accuracy than reading comprehension ability.

Syntactic riddle explanation was closely related to reading comprehension in the present study and not in Yuill (1996). Shultz (1974) suggested that children's ability to detect syntactic ambiguities emerges at around age 12. Children in the present study were older than in Yuill (age 9;0–11;0 vs. age 7;10–9;9). Therefore, the contribution of syntactic riddles to reading comprehension may be more apparent here. However, this speculation needs further systematic investigation. Another possible reason for the significant correlation between syntactic riddle explanation and reading comprehension may be related to a specific language feature of the Cantonese language. As described in the literature review, the correspondence between oral Cantonese and written MSC is relatively small, with reference to syntactic structures and vocabulary when compared to English. The syntactic abilities of Cantonese speakers developed in their social environment (i.e., the oral form) may not be sufficient to understand the very different and more formal and complex syntax that is depicted in written texts. To be literate in Chinese, Cantonese-speaking children have to acquire additional sets of syntactic structures and vocabulary. A relatively low correspondence between the oral and written forms of MSC for the present sample of children therefore demands greater metalinguistic awareness in syntactic processing

during reading in Cantonese-speaking children than for English-speaking counterparts as we would hypothesize.

### *Conclusion*

The present study supports the simple view of reading model (Gough & Tunmer, 1986) because language comprehension is at least as important as phonological decoding for reading comprehension. We know that there are children who are able to decode words but cannot comprehend text. Intervention for these children should focus on language comprehension. To improve language comprehension, studies in English have supported training grammatical structure analysis in text (Dickson, Simmons, & Kameenui, 1998). Other studies have suggested instruction in reading strategies such as summarization and mental imagery (Dickson, Collins, Simmons, & Kameenui, 1998). The present findings suggest that the use of riddle appreciation training—which has been shown effective in previous studies (e.g., Yuill, 1996; Yuill & Oakhill, 1988; Zipke, 2008; Zipke et al., 2009)—may be a valuable tool for teachers and speech-language pathologists to use with Cantonese speakers. The next stage of our research program will be to focus on these interventions with Cantonese-speaking children who have poor metalinguistic skills and consequently reduced reading comprehension ability.

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**Appendix** (p. 1 of 2)

Examples of Chinese Riddles Used in the Present Study

**Morphophonological Riddle:**

一隊由十人組成的軍隊去打仗，被一架坦克車射中，十名軍人全部*炸*死，請問仲有幾多人未死？ 十個，因為他們全部*詐*死。

**Question:** An army formed by ten people went to war. They were shot by a tank. All the ten soldiers were *exploded*. How many soldiers are still alive?

**Answer:** Ten soldiers

**Explanation:** The word "explode" (pronounced as /tsa/) in Chinese is a homophone of pretend (also pronounced as /tsa/). Therefore, when ten soldiers pretended to die, all of them were still alive.

**Orthographic Riddle:**

我而家想你估一個中文字，有個人喱埋堆草同樹木中間。答案係飲茶個茶字。

**Question:** A man hides between grass and tree. Guess a Chinese character.

**Answer:** The word 茶 "tea" (pronounced as /ts$^{h}$a/)

**Explanation:** This Chinese word 茶 is composed by a semantic radical representing *grass* on top, the Chinese character *people* in the middle, and the Chinese character *wood* at the bottom. As a result, it appears that a man is between grass and wood (tree) in this Chinese character.

**Lexical Riddle:**

有個人屋企停電，佢仲可唔可以睇電視呢？可以，可以睇住部電視機。

**Question:** Would a person be able to *watch* television if there is a power shortage?

**Answer:** Yes

**Explanation:** The Chinese word "see" entails the meaning of "watch." A person can still look at the television (i.e., the television as an object vs. television program) even though the power is off.

**Morphological Riddle (or Word Compound Riddle):**

呢個世界上有男人又有女人，請問先有男人或先有女人呢？男人，因為男人係先生

**Question:** There are men and women in this world, which of them come first?

**Answer:** Men

**Explanation:** The compound word *sir* in Chinese (pronounced as /sin saŋ/) is composed of two characters (/sin/ and /saŋ/), which represents *first born* (/sin/ = first, and /saŋ/=born). As a result, *sir* represents that men were first born, so they come first.

**Syntactic Riddle:**

要點樣跳先跳得高過棵樹？隨意跳一跳都會比樹跳得高。

**Question:** How can you jump higher than a tree?

**Answer:** You can jump higher than a tree no matter how you jump.

**Explanation:** Trees cannot jump.

**Appendix** (p. 2 of 2)

Examples of Chinese Riddles Used in the Present Study

**Pragmatic Riddle:**

有五個人出街，但係只帶一把雨傘，返屋企後，佢地會唔會濕呢？唔會，因為冇落雨。

**Question:** Five people went out with only one umbrella, would they get wet when they return home?

**Answer:** No

**Explanation:** Because it was not raining.