# Reading Errors of Students with Dyslexia in Chinese

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## Abstract

The purpose of this study is to explore different types of reading errors made by Chinese students with reading disabilities. Based on dual-route model of reading, readers may use either the lexical (words are recognized as wholes) or sub-lexical (words are recognized through grapheme-phoneme correspondence) procedure to read. Siegel (1993) suggested that the reading disabled children made more semantic errors in English language. This is due to the fact that many of these children use the lexical route to read. In the case of Chinese reading, results of this investigation show that . Primary students made more visual errors and secondary students displayed another pattern that they made more phonological errors.
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In English language, the principles of word decoding can be realized in various ways. Dual route theories of word identification (e.g., Besner, 1990; Coltheart, 1978; Paap & Noel, 1991) assume that phonological conversion processes occur along one route, while direct access, unmediated by phonology, occurs along the other route. Using Coltheart's terminology, readers may use either the lexical or sub-lexical procedure to read, depending on their purposes and skills. When reading aloud through the lexical procedure, words are recognized as "wholes" and their corresponding pronunciation retrieved as "wholes". When readers use the sub-lexical procedure to read, they are reading words through grapheme-phoneme correspondences which specify sub-grapheme orthographic and phonological segments.

In the past decade, convincing evidence has accumulated to suggest that the major difficulty confronting the dyslexic child is in decoding single words (Stanovich & Stanovich, 1995). One source of the difficulty is that poor readers do not readily grasp the phonemic structure of words (Bryne, 1992). These children have unusual difficulties in using the regular patterns of correspondences between letters and

sounds in words as an aid in deciphering unfamiliar words they encounter in text (Siegel, 1989).

Based on the phonological, semantic, and visual properties of a language, Siegel (1993) suggested that more semantic errors were observed among the reading disabled children. This is due to the fact that a large proportion of this target group has problems in using phonological analytic skills to read and they are forced to use lexical procedure to decode words. Based on this suggestion, it is assumed that a relative higher percentage of semantic and/or visual errors would be made by phonological dyslexic readers and phonological errors by surface dyslexic readers. This is due to the fact that phonological dyslexic readers rely heavily on a lexical procedure to read and surface dyslexic readers on a sub-lexical procedure.

In the case of Chinese language, whether phonological awareness is an essential process in reading is still a controversial issue. Sasanuma (1974) provides convincing evidence of differential mechanisms by suggesting that logographic and alphabetic processing may represent distinctively different modes of linguistic operation. It is believed that the visual direct route is used to read in logographic writing systems, whereas the phonological route is used to read in alphabetic writing systems. Reading Chinese words, therefore, depended mainly on the visual route without the need to recognize the phonological structure of words. If this is true, dual-route model of reading in Chinese should not be meaningful. Until recently, the view that a direct visual access to meaning, for written Chinese is the major route for reading, was still supported by a number of researchers (e.g., Chen, 1993; Zhou, Marslen-Wilson, Shu, Bi, & Tang, 1996; Zhou, Shu, Bi, & Shi, 1999) although these researchers did not totally deny the phonological mediation in Chinese.

Zhou, Shu, Bi and Shi (1999) assume that each word has, at least, orthographic, phonological, and semantic representations in the lexicon. Visual word recognition involves the mapping from orthography to semantics, from orthography to phonology, as well as from phonology to semantics. The efficiency of mapping depends very much upon the regularity of the correspondence between different domains (e.g., Plaut, McClelland, Seidenberg, & Patterson, 1996).

Zhou, et al. (1999) claimed that, for Chinese, both the mapping from orthography to semantics and the mapping from orthography to phonology are rather arbitrary.

The following are some of the examples used to illustrate the abstractness of the relationship between orthography and semantics, for example:

- orthographically similar characters with different semantics properties: [e.g., "□" (sound: "muk", meaning: "wood"); "□" (sound: "mei", meaning: "not yet"); "□" (sound: "mood", meaning: "end"); "□" (sound: "wo", meaning: "straw")]
- orthographically different characters with similar semantic properties: [e.g., "□" (sound: "shui", meaning: "water"); "□" (sound: "sup", meaning: "wet"); "□" (sound: "wad", meaning: "slippery")].

and relationships between orthography and phonology, for example:

- Phonologically similar characters with similar orthographic components: [e.g., "□" (sound: "chong", meaning: "warehouse"); "□" (sound: "chong", meaning: "pale"); "□" (sound: "chong", meaning: "pistol")].
- Phonologically different characters with similar orthographic components: [e.g., "□" (sound: "tsai", meaning: "guess"); "□" (sound: "ching", meaning: "clear"); "□" (sound: "sin", meaning: "beautiful")].

It can be seen that the mapping from orthography to phonology is approximately as arbitrary as the mapping from orthography to semantics. Based on the theory of the time course of processing, the route from orthography to semantics is more efficient than the route from orthography to phonology and then from phonology to semantics, with the condition that phonology does not have many opportunities to influence semantic activation. The direct flow of activation from orthographic representation to semantic representation should be faster than the indirect flow of activation through phonological representations.

The opposite position, that phonology plays a more important part in processing characters, is also supported by experimental evidence (e.g., DeFrancis, 1989; Jackson, Lu, & Ju, 1994; Perfetti & Tan, 1999; Tan & Perfetti, 1997; Tzeng, Hung, Wang, 1977).

This is due to the fact that 85% of Chinese characters are phonograms in the six categories of Chinese characters (Perfetti & Tan, 1999). Among the phonograms, most of them are formed by two parts; on the right, a phonetic, dictating the sound, and on the left, a radical (signific), dictating the meaning (Wang, 1973). Zhou (1978) maintained that with the ability to pronounce a limited number of basic logographs and knowledge of orthographic rules in the construction of logographs, readers of Chinese can, in fact, make reasonably successful guesses about how to pronounce logographs that share the same phonetic component, even those that they have never encountered before. Taylor and Taylor (1990) suggested that the phonetic part of a phonogram provides at least a hint linking pronunciation of the character to the approximately 400 syllables in the Chinese dialects. In about 25% of phonograms, the phonetic gives the full pronunciation of the character (Hoosain, 1991), and it gives

guidance in about 39% of the phonograms (Perfetti, Zhang, & Berent, 1992). The efficiency coefficient of such sound reading is estimated to be .36 ( see Tzeng & Hung, 1980).

In addition, Perfetti, et al (1992) suggested that the use of phonology is a general characteristic of reading that exists across writing systems. Contact with printed words in any writing system automatically arouses phonological properties associated with the words. Perfetti, et al. (1992) argued this for writing systems in which orthographic-phonological relationships are more reliable than graphic-semantic (or phonological-semantic) relationships in identification. "□" is an example to illustrate the likelihood of a more rapid activation of orthographic-phonological relationships. The meanings of "□"could be (1) life; (2) produce; (3) Mr ; (4) baby delivery ; or (5) lively . The pronunciation of this character is restricted to "san". In this case, Chinese readers can build up stronger graphic-phonological associations than graphic-semantic associations. There is evidence that phonological forms of characters are activated very rapidly in Chinese, more rapidly than meanings under some circumstances. There is a greater degree of one-to-one mapping between graphic forms and phonological forms compared with the mapping between graphic forms and meaning (Tan & Perfetti, 1997).

The focus of the controversy is now on how much phonological information can be recovered in reading Chinese characters rather than on whether phonological information is included in Chinese reading. If Chinese characters give clues to sound, it can be inferred that the dual-route model of reading is plausible in Chinese reading. The reading patterns of dyslexia shown in English readers may also occur in their Chinese counterparts.

It can be seen that both phonological and visual variables do contribute to reading difficulties in Chinese language. In English, there is a consensus that the major factor accounting for the reading problems is the deficit in phonological processing. In the case of Chinese reading further investigation is still required in determining the relative importance of the phonological and visual variables.

Sun (1989) indicated that the proportion of orthographic, phonological and semantic errors in Chinese language in primary school children of Primary 3 and Primary 4 is 61: 23:16 and in Primary 5 and Primary 6 it is 61:30:9. It can be seen that orthographic error is the major kind of error that Chinese children made in their writing. Tse & Cheung (1995) conducted another study on Secondary 1, 2 and 3 students. The result shows that the number of orthographic errors in Secondary 1, 2 and 3 is around 3.6 times less than that of the total of phonological and semantic errors in Chinese language. Age is a variable attributing to this reverse pattern of errors. This also suggested that students in different age group may rely on different routes to read. However, this error pattern is shown in Chinese writing and in children with average intelligence.

There are very few error analysis studies available in Chinese reading, particularly focusing on children with reading disabilities. The purpose of this study therefore, focused on testing the different patterns of reading errors in different age groups of students with reading disabiliteis.

## Method

**Participants**

10 participants of each Primary 3 level and Secondary 1 level were chosen for this study. The participants were attending remedial classes in their schools. The remedial support is provided under the names of Intensive Remedial Support Programme in primary schools and School-based Remedial Support Programme in secondary schools in Hong Kong. These students were all identified as having problems in Chinese language learning.

**Stimuli**

Two passages were selected from Primary 3 and Secondary 1 basal textbooks respectively for the testing.

**Procedure**

Each child was withdrawn from class for individual testing, for a period of approximately 25 minutes. Children were asked to sit opposite to the investigator in a quiet room. They were then asked to read out aloud the passage. Each error was then recorded,

**Categorization of Errors**

These errors were categorized as semantic, visual and phonological errors.

Examples of semantic errors:

Text item: □(blow)

Reader: □(wind)

Text item: □(cow)

Reader: □(goat)

Examples of visual errors:

Text item: □(juice)

Reader: □(sweat)

Text item: □(clean)

Reader: □(tidy)

Examples of phonological errors:

Text item: □(bright)

Reader: □(zero)

Text item: □(cry)

Reader: □(house)

## Results and Discussion

Table 1. Mean Number of Errors in Each Level

| | Primary 3 | | Secondary 1 | |
|---|---|---|---|---|
| | Mean | S.D. | Mean | S.D. |
| Orthographic errors | 7.7 | 3.02 | 2.90 | 1.52 |
| Phonological errors | 4.60 | 2.22 | 6.70 | 2.26 |
| Semantic errors | 1.90 | 1.29 | 1.40 | .84 |
| No responses | 2.20 | 1.62 | .80 | .79 |

The number of errors was analyzed using a two-way ANOVA, with Level varied between subjects, and Error Type varied within subjects. In the comparison of students of Primary 3 and Secondary 1, the analysis detailed a significant two-way interaction of this comparison by Error Type [$F(1, 18)=4.55$, $p<.05$]. Primary students made more visual errors than that of phonological and semantic errors. Secondary students displayed another pattern that they made more phonological errors than that of visual and semantic errors.

These results are consistent with the studies focusing on written errors. In writing Chinese words, the major kind of errors that children made is phonological errors in older students and that of visual errors in younger students. It can be concluded that the pattern of reading errors is similar to that of written errors in Chinese.

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