

**LEARNING TO READ CHINESE:  
THE ROLE OF PHONOLOGICAL AWARENESS  
IN A PHONETICALLY OPAQUE SCRIPT**

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A positive relationship of phonological awareness and reading alphabetic writings is well documented. Chinese does not have the transparent speech-script correspondence as the alphabets do. We review several studies carried out in Hong Kong, Taiwan, and China on the effect of phonological awareness on reading Chinese. Data reveal that almost all subjects were aware of speech sound at the syllabic level. Smaller than syllabic unit speech sound awareness may require some form of instruction in phonetic aids. Yet it is not a must in order to learn to read Chinese. The finding is discussed in relation to the structure of Chinese characters that provide phonetic cues and help phonological coding when reading characters.

### **1. Phonological awareness and reading**

In western literature concerning the acquisition of reading, the main focus is directed to decoding single words and more specifically, phonological awareness (Adams 1991). A positive relation between phonological awareness and reading ability has been established (I. Liberman, Shankweiler, & A. Liberman 1989).

Phonological awareness refers to an explicit mental representation of phonological information in processing oral and written language. In English, phonological awareness has been operationalized as the ability to discriminate phonemes. For example, segmenting /cat/ into /k/-/æ/-/t/. Most of the alphabetic script and speech correspondence is transparent, each sound is represented by a letter, as in *cat*. To segment speech sounds, there are Grapheme-Phoneme conversion (G-P-C) rules to follow. It would be very natural and easy then, for the alphabetic readers to perform the phoneme segmentation tasks. However, this is not the case.

In alphabetic research, of particular interest is the data regarding the explicit analysis capacities of non-readers — whether the preschool children, disadvantaged readers, or adult illiterates often perform less well to readers. For example,

Lieberman, Shankweiler, Fisher & Carter 1974 had shown that kindergarten children found it nearly impossible to follow instructions to count the number of phonemes in a pronounced syllable, yet they performed much better when the units to count were syllables. The performance of first graders on both tasks was well within the capacities. Morais, Bertelson, Cary, & Alegria 1986 compared literate and illiterate adults in rural Portugal found that the illiterate could not add and delete the initial consonant of words. These studies seem to suggest that analyzing speech sounds at the syllabic level could come more easily than at the phonemic level. A task of the latter type requires some form of training to be performed successfully.

Hence, a debate of the direction of the nature of the relation between phonological awareness and reading arose among researchers (Perfetti, Beck, Bell, & Hughes 1987; Wagner, Torgesen, Roshotte 1994).

Chinese does not have the transparent scrip and speech correspondent characteristics. It is considered a logographic writing system. The basic symbols of written Chinese are characters. Most of the characters are constructed with components. In many cases, the components either denote the meaning or the phonological information. There is a 'radical' component which signifying the meaning of the character. There is also a 'phonetic' component functioning as the phonetic reminder. In character recognition, the pure semantic character directly representing meaning is only a tiny minority among all Chinese characters. In reading the majority of radical plus phonetic characters, the phonetic component is far superior in predicting pronunciation than is the radical in predicting meaning (DeFrancis 1991). Nevertheless, the phonetic components do not act like alphabets. Recognizing characters does not require the use of so called G-P-C rules. Then, is a native Chinese reader capable of performing the phonological tasks such as segmenting speech sounds?

Read and his Chinese colleagues (Reid et al. 1986) administered consonant addition and deletion tasks to represent phonological awareness to two groups of Chinese adults in China. One group was the alphabetic group who had learned the alphabetic Pin-Yin system with simplified Chinese characters. The other group was the non-alphabetic group who entered school before the Pin-Yin system was introduced in China. They learned only the Chinese characters. On the phoneme manipulation tasks, the non-alphabetic subjects gave 21% correct responses and the alphabetic subjects 83%. The results implied that with 40 years of reading and writing a non-alphabetical system, the phonological awareness ability would not develop naturally. Read et al. thus suggested that performing the phonological awareness tasks required 'a non-spontaneity of explicit phonemic instruction'.

However, there is a fact that cannot be overlooked, i.e., the necessity of speech recoding in reading Chinese characters (Tzeng, Hung, & Wang 1977). How can this phonological recoding processing be accomplished if there are no G-P-C rules in Chinese?

## 2. The structure of Chinese characters

As we mentioned earlier, most of the Chinese characters are constructed with a radical and a phonetic component. This kind of character is named phonetic compounds. It has the largest number among all Chinese characters, estimated at around 79-90% (DeFrancis 1991). Empirical studies have shown that the speed to pronounce characters is influenced by the presence and the degree of consistency of the phonetic components (Cheng, C. M. 1992; Fang, Horng, & Tzeng 1986). By consistency we mean that no matter what radical is combined with the phonetic component, the pronunciation of the character would be the same as the phonetic component. Therefore, Chinese readers need to know the orthographic rules in the construction of characters. Some authors suggest there are orthography-phonology correspondence rules (OPC) in reading Chinese characters (Chen 1993, in Ho & Bryant 1997a). However, when tone is taken into consideration, the estimation of the predictive accuracy of using phonetic component cue to pronounce a character is only around 26%. If we further take frequency into consideration, the percentage drops to 19% (Ho & Bryant 1997a), because there is more regularity in low-frequency characters (Shu & Anderson, in press). Therefore, the expected percentage of using phonological regularity for character recognition is a little less than one fifth of the number of characters. Thus, for the beginning readers of Chinese, how do they learn and make use of the partially valid phonological information available in the phonetic component of the character? Do they develop phonological awareness as their western counterparts do? In this paper, we are going to examine these issues by reviewing the roles of phonological awareness in learning to read Chinese in Hong Kong, Taiwan and China. We believe this paper will help clarifying the nature of the relation between phonological awareness and reading.

To explore this topic we need to return to schools to observe how the reading instructions are carried out in the Chinese-speaking communities.

## 3. Character instruction

In Taiwan, there are Zu-Yin symbols (phonetic symbols) used as a pronunciation aid system. Thirty-seven consonant and vowel symbols can be put together, synthesized, and spelled. In the beginning of elementary school education, children are introduced to Zu-Yin symbols to help them recognize characters. They learn phonetic symbols and the synthesis (spelling) of symbols for 10 weeks. After 10 weeks, characters are presented in short paragraphs. Character instruction focuses on the radical and the position of each stroke. Due to its variations, the role and the function of the phonetic component are not taught at school. Students are required to practice characters as homework.

In China, Pin Yin (an alphabetic phonetic system) is introduced to children at the beginning of school for about 4 weeks, before the character instruction (Read et al. 1986).

In Hong Kong, according to Ho & Bryant 1997a, children start learning to read single Chinese characters in their first kindergarten year. In the second and the third kindergarten years, they learn to read multiple-character words and short phrases. In the first grade, students read a Chinese text, in which new vocabularies of single Chinese characters and multiple-character words are highlighted at the end of each piece of text. Characters are introduced as a whole (a whole-word approach), and no phonetic system is developed to aid children to read Chinese. From grade 3, the students learn how to use radicals to look up characters in Chinese dictionaries. The role and the function of the phonetic components are not taught by school teachers.

Since Taiwan and China all have constructed phonetic systems to aid reading, we assume their phonetic symbols play the role as alphabets. Then, will Hong Kong children differ from Taiwan and China children in the development of phonological awareness?

#### 4. The measurement of phonological awareness and the phonological features of Chinese

The studies we reviewed all adopted the western paradigm to study the relationship between phonological awareness and reading.

A wide variety of tasks have been used in the alphabetical literature to assess the concept of phonological awareness (Yopp 1988; Wagner & Torgesen 1987). According to Yopp's review, there are 11 tasks that are used to assess phonological awareness. They are:

- (1) Sound-to-word matching: Is there an /f/ in *calf*?
- (2) Word-to-word matching: Do *pen* and *pipe* begin with the same sound?
- (3) Recognition or production of rhyme: Does *sun* rhyme with *run*?
- (4) Isolation of a sound: What is the first sound in *rose*?
- (5) Phoneme segmentation: What sounds do you hear in the word *hot*?
- (6) Phoneme counting: How many sounds do you hear in the word *cake*?
- (7) Phoneme blending: Combine these sounds: /k/-/a/-/t/
- (8) Phoneme deletion: What word would be left if /t/ were taken away from the middle of *stand*?
- (9) Specifying deleted phoneme: What sound do you hear in *meat* that is missing in *eat*?
- (10) Phoneme reversal: Say /os/ with the first sound last and the last sound first?
- (11) Invented spellings: Write the word *monster*.

Among them, the most used tasks are rhyming tasks, phoneme segmentation tasks, matching tasks, phoneme substitution tasks, blending tasks, and phoneme counting tasks (Stanovich, Cunningham, & Cramer 1984). All these tasks have high interrelations (Stanovich, Cunningham, & Cramer 1984; Wagner, Torgesen, & Rashotte 1994; Yopp 1988).

Perfetti, Beck, Bell, & Hughes 1987 renamed the tasks by their processes: synthesis and analysis. These two represent different components of phonemic knowledge. The synthesis tasks require subjects to produce a word or pseudo-word in response to segments spoken in isolation by an examiner. It is phoneme blending, which taps basic and simple phonemic knowledge. The analysis tasks that include tapping and deletion require more sophisticated phonemic knowledge. With a longitudinal study of 1st graders, Perfetti et al. 1987 suggested that success in reading depended on synthesis, and reading itself enabled child to analyze speech segments.

It is obvious that all the above tasks require the subjects to pay attention to the phonemic unit of the word. This is very different from Chinese's pronunciation. Chinese characters are pronounced at the syllable level (Tseng, Huang, & Jing 1996). In fact, characters are morphosyllabic (DeFrancis 1991; Tzeng & Wang 1983). Each character is pronounced as a single syllable and represents a single morpheme. Moreover, The Zu-Yin symbols were invented at the syllabic level. For example, /ai/, /ei/, /ow/, /ang/ and /eng/ are all represented by one Zu-Yin character respectively. For this reason, the phonological awareness tasks developed in Taiwan and Hong Kong are limited to the discrimination of sounds at the syllabic level.

In China, the Pin-Yin symbols are represented by Roman letters so that speech sounds could be written down with phonemic units. For example, the character 東 'east', in Pin Yin, is 'dong' with four phonemes; in Zu Yin, it is represented by three Zu-Yin symbols. In Read et al.'s 1986 study, they only asked the subjects to add or delete the first consonant. It will be interesting to see how subjects in the P. R. China with Pin-Yin training differentiate the sounds that in speech involve one syllable, but in Pin Yin involve more than one phoneme. Will they be influenced by the syllabic nature of Chinese or by the nature of phonemic Pin-Yin training?

## 5. The Hong Kong study

In Hong Kong, Ho & Bryant 1997a conducted a research to test the psychological reality of the OPC rules. They studied the Hong Kong children's ability to use the phonetic component to read characters and the relationship between phonological awareness and character reading. The tasks used were 1) Chinese ideophonetic compound reading, 2) Chinese word reading, 3) Chinese pseudo-character reading, 4) Onset deletion and Rhyme detection as tasks for phonological awareness. 5) The Raven's Standard Progressive Matrices. The results showed that after controlling the effect of IQ differences, rhyme detection ceased to be significantly related to Chinese ideophonetic compound reading at grade 1, and none of the phonological awareness tasks correlated statistically significantly with any of the reading tasks in Grade 2. But the correlation among word reading, ideophonetic compound reading, and pseudo-character reading stayed statistically significant.

Ho & Bryant 1997b also studied the phonological awareness of Hong Kong children from the ages of 3 to 8. They have considered acoustically separable sounds in Chinese syllable and adopted onset (the initial segment) and rhyme (the final segment) and tone attached to the rhyme to define phonological awareness.

Either cross-sectional or longitudinal data all showed that Hong Kong children were able to detect global sound (homophones and combined rhyme/tone difference). But before 5 years old, children were not able to detect rhymes or tones alone. They were able to detect onsets at the age of 7. The authors concluded that exposing to Cantonese facilitates Hong Kong children to develop an awareness of onsets, rhymes, and tones. There is an age-related developmental pattern observed in this study. An interesting phenomenon is that after partialling out IQ scores (measured by the Stanford-Binet Intelligence Scale at age 3 and by the Raven's Standard Progressive Matrices at age 7), the correlation coefficients of the phonological tasks given to children at those two ages were found to be not significant. It seems to imply that the advancement of phonological awareness depends on a general cognitive ability rather than the initial ability (age 3) to separate syllables.

## 6. The Taiwan study

Ko & Lee 1997a,b have involved two groups of subjects to explore the relation between phonological awareness and learning to read Chinese. All these subjects just started to learn to read Chinese.

There were adult female subjects, aged 40 to 45 who were illiterate, and were taking elementary literacy classes from year one to year three. In the very beginning of the first year, students were taught Zu-Yin symbols. The following next two years, they read Chinese characters with Zu-Yin symbols beside each character. Our first testing (pretest) was held at the beginning of school year. Second testing (post test) was held at the beginning of the 2nd semester.

Another group was the 1st grade children who were tested longitudinally at five points:

- (1) Just entering elementary school without any formal language instructions.
- (2) Five weeks after Zu-Yin symbol instruction.
- (3) Ten weeks after Zu-Yin symbol instruction.
- (4) The end of the first school year.
- (5) The end of the 2nd school year.

### 6.1 Tasks

There are many tasks to test phonological awareness. Variation among the tasks does exist. For example, rhyming tasks do not belong to the same factor as other tasks do (Stanovich, Cunningham, & Cramer 1984). The level of difficulties among the tasks is not the same (Stanovich, Cunningham, & Cramer 1984; Wagner, Torgesen, & Rashotte 1994). Nevertheless, many researchers agree that phoneme deletion is the most valid task, for it can differentiate high and low perform-

ance. Its correlation with reading scores is robust even when the IQ scores are held constant. Most of all, it is not easy for the subjects to reach a perfect score (Morais, Bertelson, Cary & Algeria 1986, Stanovich, Cunningham, & Cramer 1984; Wagner, & Torgesen 1987).

In our studies, we adopted the tasks of deletion of the first syllable, deletion of the initial consonant, synthesis of Zu-Yin symbols and Zu-Yin symbol recognition to represent phonological awareness. The last two tasks are formally taught at schools. All tasks were administered on the one-to-one basis.

Other tasks used in the studies were:

- (1) Character recognition, for all subjects, but items were different according to different grade level of difficulty .
- (2) Reading characters in texts, for 2nd and 3rd year adults.
- (3) Peabody Picture Vocabulary Test for children.
- (4) Raven's Colored Progressive Matrices for children.

## 6.2 Results

Both adults and children had no problem with 'Deletion of First Syllable' at any testing points. All the scores reached the ceiling. Their 'Phonetic Symbol Recognition' scores after instruction, the lowest score among all was 85% of the first year adults. The synthesis of Zu-Yin symbol scores were also improved as time progressed, and children performed much better than the adults did.

'Deletion of the Initial Consonant' was the most difficult task among all phonological tasks. Children again performed much better than adults did, especially after 10 weeks of phonetic symbol instruction. After 10 weeks, their average passing rate was around 77%, but the passing rate was never above 40% for the adults. However, the variation of the score was wide. This might imply that there were subjects, children and adults alike, who had difficulty performing the initial consonant deletion tasks at any testing time. From our observation, when the subjects were instructed to do the task of initial consonant deletion, for example, deleting /b/ from /ba/, and sounding out /a/, many of the subjects would analyze the sound /b/ /a/ and then said /a/, the answer. Some of the children used their fingers to help memorizing the position of the sound they analyzed and then gave the answer. The way they synthesized Zu-Yin symbols was the way they learned at school.

For character recognition, with learning, adults' variation grew larger. The variation between the good and the poor character recognizers was getting wider as time progressed. On the contrary, children's variation stayed about the same across different testing points.

From the above description, a summary could be drawn accordingly. Learning makes difference. But, the learning progress of children and illiterate adults is not quite the same.

To explore the relationship of phonological awareness and reading characters, we did an analysis of the children's data. It revealed that after partialling out

the Raven's scores, the correlation coefficient of deletion of initial consonant and character recognition decreased as time passed. But the correlation coefficient of character recognition and Zu-Yin symbol recognition or the correlation coefficient of character recognition and synthesis of Zu-Yin symbols (either word or nonword) stayed at the level of significance ( $p < .001$ ) as time progressed. It implies that the relation between deletion of the initial consonant and character recognition depends on a general cognitive ability. This phenomenon was also observed in Ho & Bryant's 1997b study.

When holding the IQ score constant, a partial correlation between phonological awareness measures and later reading scores showed that the relation was independent of general cognitive ability measured by IQ scores. If general ability plays a role in phonological awareness, we incline to claim:

- (1) that the Chinese case proved that in a non-alphabetic system, it takes a general ability to learn to segment sounds into a subsyllabic level.
- (2) that there are abilities other than segmenting sounds that are more closely relevant to reading Chinese.

For example, after partialling out the Raven's score and 'Deletion of Initial Consonant' score, only the correlation coefficients of Zu-Yin symbols synthesis and character recognition at later testing points stayed the same. This implies that Zu-Yin symbols synthesis is more important to later character recognition than deleting the initial consonant. Moreover, the mechanisms of deletion of the initial consonant (analysis) and synthesis are not the same. This will be elaborated later.

As for the adults' data, due to the first year adults' unstable performance, we only considered 2nd and 3rd year adults' data. At the 2nd year and the 3rd year, the scores of pre-ZuYin symbol recognition (pre-test) correlated significantly with all post-tasks. However, its correlation with phonological variables was much stronger than its correlation with nonphonological ones. On the other hand, the pre-character recognition score was only correlated with character reading variables.

Because adults did not have IQ equivalent measures, we followed Wagner & Torgeson 1987 by taking the initial character recognition score as a control and partialling it out. The results showed the correlation coefficients of character recognition and the scores of all the phonological related tasks weakened or became nonsignificant. This might imply that the relation between character recognition and all the scores of the phonologically-related tasks is built on the initial score of character recognition.

## 7. Discussion

Taken it all together, either in Hong Kong, Taiwan or China, subjects of all ages and all grades had no problem with deleting sounds at the syllabic level. Secondly, explicit instruction of subsyllabic sounds did make a difference. For example, in China, the percent correct in the word target segmenting consonant task was 93 for the alphabetic group, but for the non-alphabetic group it was only 37.

For the nonword target task, the correct percentage were 83 and 21 for alphabetic and non-alphabetic groups, respectively (Read et al. 1986).

Now, let us compare Taiwan and Hong Kong's data. Recall that Hong Kong children receive no Zu-Yin or Pin-Yin instruction, Their performance in onset deletion was less satisfactory than that of Taiwan's children. In Taiwan, the average passing rate on the deletion of initial consonant of the first graders was around 77% after 10 weeks' Zu-Yin symbol instruction. In Hong Kong, the 1st graders' and 2nd graders' passing rate was around 42.7% to 51.3% which was nonetheless above the level of chance (Ho & Bryant 1997a).

Huang & Hanley 1994 have compared 8th graders of Taiwan, Hong Kong and Liverpool (UK). The task was first sound deletion.\* With maximum score of 10, when tested with Chinese language, the mean score for Hong Kong subjects was 2.40, for Taiwan it was 8.42. When tested with English language, the mean scores were 4.59 and 9.09 for Hong Kong and UK subjects, respectively. It is obvious that with explicit instruction, Taiwan children's performance in Chinese sound segmentation task was better than Hong Kong children's performance.

Interestingly, the Hong Kong students with no explicit instruction of phonological processing do show some sense of phonological awareness. In Read et al's 1986 study, a subject in the non-alphabetic group improved a great deal in non-word targets when he took the test the second time. How this ability develops requires more observation and exploration.

Since training makes Chinese subjects more capable of segmenting sounds, does it relate to character recognition?

Studies show the relation between phonological awareness and character recognition decreased as time progressed (Ho & Bryant 1997a; Ko & Lee 1997a,b). In Taiwan, the children's data showed that the relation of Zu-Yin symbol synthesis and character recognition was more stable and stronger than the relation of deletion of the initial consonant and character recognition. The adults' data showed that the initial character recognition score was a much better predictor of later text reading and character recognition than other variables.

### 7.1 The role of Zu-Yin symbol synthesis

Though we have run a factor analysis with Taiwan children's data (Ko & Lee 1977b) and the principle component comprised all the phonological variables, which implied all the variables share some commonality. Yet, as we mentioned before the mechanisms of deletion of the initial consonant and Zu-Yin symbol synthesis were not the same (Please refer to Figures 1 and 2).

**Figure 1:** The process of deleting a sound from a word

MENTAL LEXICON



Input (the sound of a character) — memorization — analyze the individual sounds — find the corresponding phonetic symbols — memorize each sound — delete the required sound — give the answer.

**Figure 2:** The process of Zu-Yin symbol synthesis

From Figures 1 and 2, we can see that the process of Zu-Yin symbol synthesis is actually embedded in the process of deleting sounds. This is similar to Perfetti et al's 1987 suggestion that spelling taps a more primitive phonemic knowledge and deletion requires more complicated knowledge. Since Zu-Yin symbol synthesis is formally taught in Taiwan elementary schools, it is suggested that synthesis could be used to process the deleting a sound from a syllable word after children learn to synthesize Zu-Yin symbols.

Other than the process difference, since Chinese characters are pronounced at the syllabic level, we also suggest that Zu-Yin symbol synthesis is more beneficial to reading than deleting sounds. In fact we believe that Zu-Yin symbol synthesis plays a prominent role for Taiwan children to learn to read Chinese. The evidence is from the positive and significant correlation of synthesis and character recognition. On the contrary, the correlation coefficient of deleting consonant and character recognition decreased in advanced grades. The reason for the need of Zu-Yin symbol synthesis to reading is that blending sounds helps phonological coding of the character especially when encountering new characters. The ability to blend sounds helps efficiently to store the sounds of words while reading. However, this explanation is not applicable to Taiwan adults' data and Hong Kong's data.

## 7.2 Phonological awareness and character recognition

It appears that the low performance of Taiwan's illiterate adults and Hong Kong's children on deleting consonant tasks is not a reflection of inability to understand the requirement of the tasks, but is specific to the linguistic level. We see that their inferiority in speech analysis depends on the linguistic units they use to manipulate, and this experience might be a constraint to them, such as the Taiwan's illiterate adults who had learned, but made less use of, the Zu-Yin symbols.

Subjects in Ko & Lee's study 1997a are native Taiwanese who speak Taiwan dialect most of the time. There is a possibility that they cannot make use of the Mandarin speech sounds in learning to read Chinese. We might argue that their inferiority in performance on the deletion of the initial consonant task is because of their unfamiliarity with the Mandarin sounds. Their learning of Mandarin is probably like a foreigner learning Chinese. We had tried the consonant deletion task with Taiwanese speech sounds. They did not perform well, either. Hence, we propose that their script and speech experience makes them use more of the character information to learn characters.

As we mentioned above there is partially valid phonological information available in the phonetic components of Chinese characters. In fact, research indicates that adults and elementary school children all alike can make use of it when encountering new characters (Ko 1991).

With large sampling of characters and elementary school subjects, Ko 1991 used the errors observed in subjects' responses and categorized them into the strategic patterns of identifying new characters. The task for the subject was to identify each character by writing down the phonetic symbols to represent the character's sound then to make up a word of at least two characters out of the target character. The most used strategy to identify new characters by the elementary school children was 'graphic resemblance only' whose error rates of grades 1 to 6 ranged from .38 to .55. The first grader had the highest 'graphic resemblance' error, the 6th graders had the least. The 2nd highest error students made was a pattern of 'graphic and phonetic resemblance'. The error rates of grade 1 to grade 6 ranged from .15 to .40. The 1st graders had the least and the 6th had the most. These two patterns comprise up to 90% of the character recognition errors. The percentage of 'graphic resemblance only' error made by the grades 4, 5 and 6 are less than that of the grades 1, 2, and 3. The 'graphic and phonetic resemblance' error, however, increased as students advanced in grade.

The use of 'graphic and phonetic resemblance' cue to identify characters also found in Hong Kong and China. In Hong Kong, children made use of the phonetic components to read characters or pseudo-characters. The effect of regularity and frequency was significant for the first graders (Ho & Bryant 1997a). In China, Shu & Anderson (forthcoming) found a developmental trend of phonetic component awareness. The developmental variation of using this cue reflects that the lower graders have not developed the phonetic component awareness.

Chang, Hung, & Tzeng 1992 used an on-line reading analysis and found that while reading, the 3rd and 4th grade poor readers substituted characters with characters which shared 'partial graphic and partial sound resemblance' or 'graphic resemblance only'. The percentage of the former miscue used was 34 to 36%. The percentage of the latter miscue used for the 3rd grader was 17%, and 9% for the 4th graders. Chang et al. again showed a developmental transition from using 'graphic resemblance' to 'graphic and partial sound resemblance' to identify characters.

This developmental transition of character recognition actually reflects the nature of the structure of Chinese characters. Chinese characters share a high degree of similarity in overall visual layout and internal features. For elementary children, the tasks of learning to read characters involves discriminating between graphically similar characters and finding the character construction rules, especially the phonetic component regularities. The research reviewed suggests that Chinese students, whether in Taiwan, Hong Kong, or China have learned to differentiate the graphic similarity and picked up the character construction rules to identify new characters. They have made use of the phonetic component to pronounce characters, even when they do not have the phonetic aids.

## 8. Conclusion

Could we hence draw a conclusion after the discussion above that phonological awareness in reading Chinese is not as important as in alphabetical reading? Although the discussion seems to suggest this conclusion, the answer is: 'it depends'.

If we define phonological awareness as a task of segmenting sounds, this is probably true. Except for Zu-Yin symbol synthesis, the effect of other phonological awareness tasks on reading Chinese characters does not move along with learning. Ironically, phonetic aid is helpful, but it is not a necessary tool in reading Chinese. Students with no phonetic aids or special phonetic training could find other ways to read characters.

If we consider phonological awareness and using phonological information in lexical access or in working memory are from the same source, then phonological awareness does play a role in reading Chinese for beginning readers. Chinese readers, either with phonetic aids training or without it, show a sense of phonological awareness at the syllabic level. How does this phonological awareness develop in Chinese children? It can derive from reading the characters or from learning the phonetic aids. The phonetic aids do help phonological coding of characters. When there is no such aid, students learn to refer to the phonetic component of the characters. Interestingly enough, schools do not teach the function of the phonetic components. Yet, among exceptions and low predictive accuracy, after being exposed to characters for some time or some amount, students eventually and implicitly pick up phonetic cues and apply them to identify new characters. How do they come to have this ability? This should be an important learning issue for research in the future.

## NOTE

\*Huang & Hanley 1994 tested first sound deletion, middle sound deletion, and last sound deletion as phonological awareness tasks. We take only the compatible first sound deletion here for a comparative analysis.

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