

Syntactic Deficit and Sentence Comprehension of Chinese Dyslexic Children¹

Cecilia Yuet Hung Chan²

Abstract

This research investigated the syntactic ability of Chinese dyslexic children in sentence comprehension. A sentence reading comprehension test consisting of ten types of simple and complex structures was conducted with dyslexic and non-dyslexic primary school students. Results of the test indicate that Chinese dyslexic children were significantly weaker than their non-dyslexic counterparts in sentence comprehension. The syntactic deficit of Chinese dyslexic children was reflected in their poor comprehension of six types of sentence structure. It is suggested that the syntactic ability of Chinese dyslexic children, which is crucial for the enhancement of reading comprehension, needs to be developed.

Keywords: Chinese dyslexia; syntactic ability; reading comprehension; sentence structure

1. Introduction

Research interests in Chinese dyslexia always focus on the deficits in processing Chinese characters. Deficits in orthographic processing, rapid naming, and phonological knowledge of characters are considered to be the major problems in Chinese dyslexia and the crucial predictors of reading and writing inability (Ho, Chan, Lee, Tsang & Luan, 2004; Chan, Ho, Tsang, Lee & Chung; 2006). In contrast, relatively little research in Chinese dyslexia investigates the deficit in syntactic ability, which has recently received some attention in Hong Kong. Chik, Ho, Yeung, Wong, Chan, Chung & Lo (2010) found that Chinese dyslexic children in Hong Kong were less competent in the measures of word order and morpho-syntactic skills. Chik, Ho, Yeung, Wong, Chan, Chung & Lo (2011) suggested that syntactic skills, through the measures of connective usage, word order and knowledge of morpho-syntactic structure, were the significant predictors of a later ability in sentence reading comprehension.

Dyslexia research in languages other than Chinese long ago found that there are syntactic deficits in dyslexic children (e.g. Vogel, 1974; Plaza & Guitton, 1997; Leikin & Assayag-Bouskila, 2004). Syntactic deficits are also revealed in dyslexia research on adolescents (Whitehouse, 1983) and even adults (Wiseheart, Altmann, Park & Lombardino, 2009). This suggests that syntactic deficits can be persistent in dyslexic subjects at higher ages. In addition, some research also delineated the important role of syntactic ability in reading comprehension and development. Harber (1979) suggested that syntactic complexity is a key determinant of the readability of a text for the children. Hagtvet (1997) found that not only phonemic awareness, but also syntactic ability, plays a role in later reading development in children. Scott (2009) further argued that ability regarding sentence comprehension is a criterion of successful reading comprehension. The above research in the non-Chinese context lays a foundation for similar explorations in the Chinese context, which will be worthwhile.

¹ Research supported by CTL Small-Scale Research Grant Scheme, City University of Hong Kong. Special thanks to the principals and teachers who helped to schedule and coordinate the experiments, and to the students who participated in the study.

² Department of Linguistics and Translation City University of Hong Kong, Tat Chee Avenue, Kowloon Tong Hong Kong. E-mail address: ctcyhc@cityu.edu.hk, Tel no: 852 3442 8792, Fax No.:852 3442 8706

Based on the previous insightful research on the relationship of syntactic ability and reading comprehension, and on the syntactic deficits of dyslexic subjects in the non-Chinese context, this study investigates the syntactic ability and sentence reading comprehension of Chinese dyslexic children.

2. Aims of the Study

This study aims to investigate:

- (1) Whether Chinese dyslexic children's syntactic ability is generally lower than their non-dyslexic counterparts in sentence reading comprehension;
- (2) Whether Chinese dyslexic children differ from non-dyslexic children in the comprehension of particular complex sentence types. If yes, what complex sentence types cause comprehension difficulty to dyslexic children? What are the reasons behind this?

3. Research Methods

3.1 Participants

Two groups of participants, dyslexic and non-dyslexic groups, were included in the study. Each group consisted of 50 participants. They were fourth to sixth graders recruited from eight local primary schools in Hong Kong, which voluntarily joined the research. The participants in the dyslexic group were matched with their counterparts in the non-dyslexic group in terms of age, educational level and IQ scores. Raven's Standard Progressive Matrices (Raven 2006) was conducted as the measure of intelligence. The average age and IQ scores of the dyslexic and non-dyslexic groups are presented in Table 1.

Table 1: Average age and IQ Scores of the Dyslexic and Non-Dyslexic Groups

	Dyslexics		Non-dyslexics	
	Mean	SD	Mean	SD
Age	11.48	.96	11.23	.93
IQ Score (out of a full score of 64)	42.24	7.99	44.50	7.25

3.2. Test instruments

A sentence reading comprehension test was designed to investigate dyslexic children's syntactic ability. Apart from the basic sentence type, Subject-Verb-Object, which was used as the baseline for comparison of the syntactic competence of dyslexic and non-dyslexic children, there were ten types of sentences included in the test, as listed below:

- (1) Active sentence
- (2) Passive sentence
- (3) Single negative sentence
- (4) Double negative sentence
- (5) Sentence with coordination of two clauses
- (6) Sentence with subordination of two clauses
- (7) Sentence with a subject-extracted relative clause
- (8) Sentence with an object-extracted relative clause
- (9) Sentence with serial verb construction
- (10) Sentence with a clausal-subject

The experimental design of including ten types of sentences allowed us not only to compare the participants' syntactic competence of the ten sentence types, but also to compare specific sentence types in an opposite nature.

The ten sentence types form five pairs: (1) active sentence and passive sentence, (2) single negative sentence and double negative sentence, (3) sentence with coordination of two clauses and sentence with subordination of two clauses, (4) sentence with a subject-extracted relative clause and sentence with an object-extracted relative clause, (5) sentence with serial verb construction and sentence with a clausal-subject. All of the above comparisons enable us to know more about the nature of syntactic deficits of dyslexic children, if existing. The length of each sentence was controlled to be within the range of eleven to thirteen words. The words used in the test sentences were taken from the Hong Kong Primary School Vocabulary list (2007). There were six trials in each of the ten types of sentences. In addition to the six SVO sentences used as the baseline for comparison, there were 66 sentences in the whole test. The sequence of presentation of each type of sentence in the test was randomized. For each trial in the test paper, the test sentence was presented. Right under the test sentence, choices of four simple sentences were presented. The participants had to choose one sentence among these four choices that matched the meaning of the test sentence.

3.3. Administration Procedures

All the participants did the IQ test and sentence comprehension test on two separate days in a week. The IQ test, Raven's Standard Progressive Matrices, required the participants to identify the missing element that completed a pattern in each test item. There were 64 test items in the test. The students did the test at their own pace, spending 25 to 30 minutes to complete the test. Only those students whose IQ scores fell within the average score range were selected to do the sentence comprehension test. Before the sentence comprehension test, each participant was given a vocabulary list and asked to identify the words, if any, they did not know. The research assistants would explain those words to the participants to make sure they knew all the words in the list, which were included in the test. This procedure was to ensure that if the participants could not comprehend the meaning of the test sentence, it would not be due to vocabulary problems. At the beginning of the sentence comprehension test, the participants were given clear instructions to complete the test. To avoid the test performance of participants being affected by fatigue, the whole test was divided into two parts with equal numbers of test sentences, and the participants were given a five-minute break before being given the second part of the test sentences. Students completed the test at their own pace, and spent about 30 to 40 minutes to complete the whole test.

3.4. Methods of Scoring and Data Analysis

For the sentence comprehension test, one score was given for each correct answer, and zero for each incorrect answer. The mean scores of each type of sentence for each subject group were calculated. An independent sample t-test was conducted to investigate whether the test result for dyslexic students was significantly different from that of their non-dyslexic counterparts for each type of sentence. A paired sample t-test was conducted to find whether in each subject group, there was a significant difference between the comprehension of the two sentences in each sentence pair.

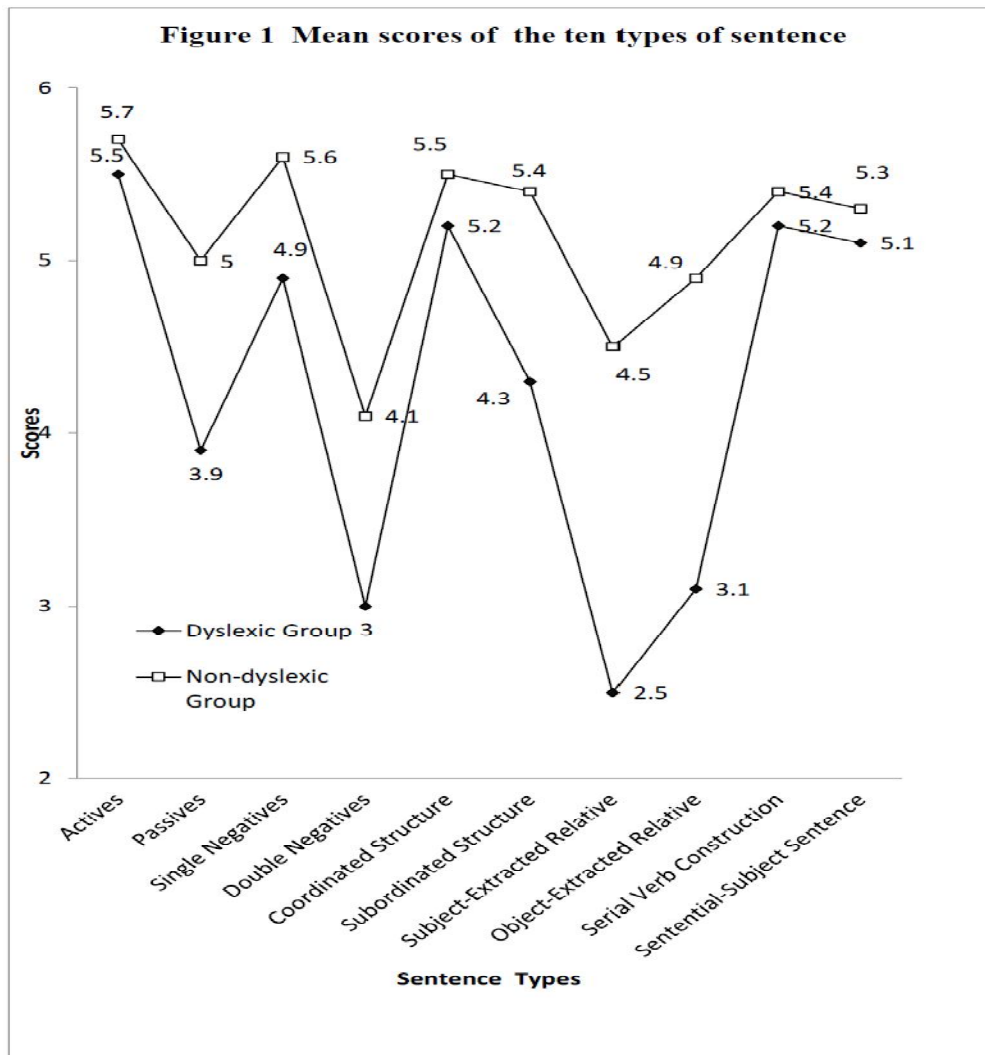
4. Results

4.1. Comparison of the Overall Results of the Two Subject Groups

For the six SVO sentences used as the baseline for comparison, the dyslexic group scored 5.68 (out of 6) and non-dyslexic group 5.83. There was no significant difference between the two groups ($t=0.8$, $df=98$, $p>0.05$). This means that the dyslexic children understood the meaning of the most basic sentence type equally well as the non-dyslexic children. Regarding the overall results for sixty experimental sentences, the dyslexic and non-dyslexic groups scored 42.7 and 51.4 (out of 60) respectively. Independent sample t-test results show that dyslexic children performed significantly worse than their non-dyslexic counterparts ($t=-4.5$, $df=98$, $p<0.001$).

4.2. Results of each Type of Sentence of the Two Subject Groups

Figure 1 shows the results of the ten types of sentence for the two subject groups. Both of the groups received the highest score in the comprehension of active sentences. The dyslexic and non-dyslexic groups attained the lowest score in the comprehension of subject-extracted relatives and double negatives respectively. In addition, we found that dyslexic children scored lower than non-dyslexic children in all types of sentence. The independent sample t-test was conducted to compare the results of the two subject groups in each type of sentence, and the results are given in Table 2. It was found that except for the four types of sentences, active sentence, sentence with coordinated structure, sentence with serial verb construction and clausal-subject sentence, dyslexic children performed significantly worse than non-dyslexic children in comprehension of the other six types of sentence.



Full scores of each type of sentence = 6

Table 2: Independent Sample T-Test Results of the Comprehension Scores of the ten types of Sentence of the Dyslexic and Non-Dyslexic Groups

Sentence types	With a significant difference (p < 0.05) between the two subject groups	Without a significant difference (p > 0.05) between the two subject groups
Active sentence		✓
Passive sentence	✓	
Single Negative	✓	
Double Negative	✓	
Coordinated Structure		✓
Subordinated Structure	✓	
Subject-Extracted Relative	✓	
Object-Extracted Relative	✓	
Serial Verb Construction		✓
Clausal-Subject Structure		✓

4.3. Results of Each Pair of Sentences of the Two Subject Groups

We further investigated whether each of the two subject groups had a different performance in the two sentences in pairs. The paired-sample t-test results are shown in Table 3, indicating that for the non-dyslexic group, there was no significant difference between the two sentences in each pair, while in the dyslexic group, significant differences were found in three pairs of sentences. In the dyslexic group, the comprehension of passives was significantly poorer than actives, subordinate structure was worse than coordinate structure, and subject-extracted relative was inferior to object-extracted relative.

Table 3: Paired Sample T-Test Results of the five Pairs of Sentences of Each Group

Sentence pairs	Dyslexic Group	Non-dyslexic group
	With a significant difference ($p < 0.05$) between the two sentences in pair	
Active vs Passives	✓	X
Single Negative Vs Double Negative	✓	X
Coordinated Structure vs Subordinated Structure	X	X
Subject-Extracted Relative vs Object-Extracted Relative	✓	X
Serial Verb Construction vs Clausal Subject structure	X	X

5. Discussion

In this study, among the ten sentence types investigated, six sentence types, passives, single negative, double negative, subordinated structure, subject-extracted relative and object-extracted relative, caused comprehension difficulty to the dyslexic children when compared to the non-dyslexic children. This result delineates that dyslexic children's syntactic ability is lower than their non-dyslexic counterparts, as reflected in their sentence reading comprehension. This study builds a resource base for further investigation into the possible reasons for the syntactic deficits of Chinese dyslexic children, as revealed by different sentence types. As shown in this study, negatives and sentences with relative clauses are two major categories that pose more challenges to dyslexic children than to non-dyslexic children. As reflected from the results of negatives, the orientation of the sentence proposition does matter in the dyslexic children's ability in comprehending a sentence. Single negatives, with the sentence proposition reversed, cause difficulty for the dyslexic children, and double negatives, with double reversal of the sentence proposition, cause even more difficulty. Relative-clause sentences, similar to clausal-subject sentence, involve an embedded structure. In a clausal-subject sentence, the subject of the matrix sentence is an embedded sentence, whereas in a relative-clause sentence, a clause is embedded in a noun phrase which is a subject or an object of the matrix sentence. Yet only relative-clause sentences, not clausal-subject sentences, were comprehended with difficulty by the dyslexic children. The results suggest that relative-clause sentences are structurally more complex than clausal-subject sentences.

Scott (2009) discussed that the extent and nature of complexity in noun phrases and verb phrases is a criterion in measuring syntactic complexity, apart from the extent to which a sentence contains more than one clause. The structural complexity of the noun phrase of relative-clause sentence is higher than that of the clausal - subject. The implicit syntactic ability of knowing that a relative clause modifies a noun phrase in the matrix clause is crucial for comprehension. Furthermore, Chinese dyslexic children comprehended subject-extracted relative clauses with significantly greater difficulty than in object-extracted relative. As argued in Chan (2014), working memory plays an important role in causing difficulty to Chinese dyslexic children in comprehending subject-extracted relatives which involve a heavier processing load than object-extracted relatives. The working memory deficit has been suggested in the literature as one reason leading dyslexic children to have difficulty in processing syntactically complex sentences (e.g. Wiseheart et al., 2009). Undoubtedly, working memory is required for processing relative-clause sentences (e.g. Gibson, 1998). Despite the fact that working memory will play a role in sentence comprehension, the syntactic ability as linking and configuring elements within a sentence in the correct way is very important for comprehension.

Moreover, the number of clauses or phrases in a sentence in our study of grade 4 to 6 students is not the essence leading to the difficulty. The sentence structure, particularly how clauses or phrases semantically and structurally relate to one another in the sentence, is the essence. Not all sentences with two clauses create difficulties for dyslexic children when compared to non-dyslexic children. Dyslexic children can handle the sentences with two clauses linked with each other with additive meaning as in the sentence of coordination. Also, they were able to comprehend the serial verb constructions with two to three verb phrases linked together in an additive manner.

However, dyslexic children showed difficulty in understanding the sentences with subordination of two clauses having adversative, conditional or causal meaning. Also, dyslexic children found it difficult to comprehend passive sentences in comparison with active sentences, and their comprehension of passives was significantly poorer than that of non-dyslexic children. This difficulty is due to the special structure of passives: the subject of a passive is a patient, not an agent, and the object is an agent, not a patient, as in a more frequently used active sentence.

6. Conclusion

All in all, this study indicates that syntactic deficits negatively affect sentence reading comprehension among Chinese dyslexic children, who thus had difficulty in comprehending the sentences with complex structures, including sentences with single or double negatives, relative clauses, sentences of subordination, and passives. The findings of this study shed light on enhancing the syntactic ability of sentence comprehension of Chinese dyslexic children. It is suggested that specific syntactic training on comprehending the complex sentences that proved to be difficult for Chinese dyslexic children in this study is needed. It is believed that investigations of the relationship of syntactic incompetence and reading comprehension in the context of Chinese is worth further exploring.

References

- Chan, D., Ho, C., Tsang, S.-M., Lee, S.-H., & Chung, K. (2006). Exploring the reading– writing connection in Chinese children with dyslexia in Hong Kong. *Reading and Writing*, 19 (6), 543-561.
- Chan, Y.H.C. (2014). The role of working memory in the comprehension of relative clauses by Chinese dyslexic children. *Asian Journal of Education and E-Learning*, 2 (3), 165-172.
- Chik, P. P. M., Ho, C. S. H., Yeung, P. S., Wong, Y. K., Chan, D. W. O., Chung, K. K. H. & Lo, L. Y. (2010). Contribution of discourse and morphosyntax skills to reading comprehension in Chinese dyslexic and typically developing children. *Annals of Dyslexia-Springer.com*, 1-18.
- Chik, P. P. M., Ho, C. S. H., Yeung, P. S., Chan, D. W. O., Chung, K. K. H., Luan, H., Lo, L. Y. & Lau, W. S. Y. (2011). Syntactic skills in sentence reading comprehension among Chinese elementary school children. *Reading and Writing*, 24,1-21.
- Gibson, E. (1998). Linguistic complexity: locality of syntactic dependencies. *Cognition*, 68(1), 1-76.
- Hagtvet, B. E. (1997). Phonological and linguistic-cognitive precursors of reading abilities. *Dyslexia*, 3(3), 163-177.
- Harber, J. R. (1979). Syntactic complexity: A necessary ingredient in predicting readability. *Journal of Learning Disabilities*, 12(7), 437-443.
- Ho, C. S. H., Chan, D. W. O., Lee, S. H., Tsang, S. M. & Luan V. H. (2004). Cognitive profiling and preliminary subtyping in Chinese developmental dyslexia. *Cognition*, 91, 43-75.
- Hong Kong Education Bureau. (2007). *Xinfgang Xiaoxue Xuexi Zicibiao*. (Hong Kong Primary School Vocabulary List). Hong Kong: Hong Kong Education Bureau.
- Leikin, M. & Assayag-Bouskila, O. (2004). Expression of syntactic complexity in sentence comprehension: A comparison between dyslexic and regular readers. *Reading and Writing*, 17, 7-8, 801-821.
- Plaza, M. & Guitton, C. (1997). Working memory limitation, phonological deficit, sequential disorder and syntactic impairment in a child with a severe developmental dyslexia. *Dyslexia*, 3, 93-108.
- Raven, J. C. (2006). *Standard Progressive Matrices (Kit)*. London: Pearson Assessment.
- Scott, C. M. (2009). A case for the sentence in reading comprehension. *Language, Speech and Hearing Services in Schools*, 40,(2),184-191.
- Vogel, S. A. (1974). Syntactic abilities in normal and dyslexic children. *Journal of Learning Disabilities*, 7(2), 103-109.
- Whitehouse, C. C. (1983). Token test performance by dyslexic adolescents. *Brain and Language*, 18(2), 224-235.
- Wiseheart, R, Altmann, L. J. P., Park, H., Lombardino, L. J. (2009). Sentence comprehension in young adults with developmental dyslexia. *Annals of Dyslexia*, 59(2), 151-167.