The Phonological Short-term Memory in Preschool Children with Down Syndrome

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Introduction:
According to studies by Comblain (1999) and Laws (2000) etc, phonological short-term memory affects the acquisition of language. Besides a word span task and a digit span task, a non-word repetition task is also another way to assess phonological short-term memory capacity. Gathercole and Baddeley (1990) and Gathercole, Emsikle, Emslie, Wills and Baddeley (1991) suggested that nonword repetition allows a measure of short-term memory abilities than classic memory span test. Generally adults typical have a span of about seven items (Miller, 1956), but among individuals with Down syndrome verbal short-term memory spans are usually lower than this.

Research studies consistently show that children with Down syndrome have characteristically poor short-term memory. For example, Mackenzie and Hulme (1987) compared groups of mental age matched typically developing children, a learning disabled group and a group with Down syndrome. They found that on an auditory sequential memory task the group with Down syndrome were poorer than the typically developing children and also poorer than the other severely learning disabled group. Furthermore, over a five year follow up the memory spans of the group with Down syndrome did not improve as much as their increase in mental age would have predicted. That is, for the children with Down syndrome there was an increasing difference between mental age and short-term memory performance.

Children and adults with Down syndrome show poor auditory memory compared with visual memory and recognition memory (Marcell and Armstrong, 1982). As this population they also tend to have poor muscle tone, hearing, voice and articulation skills (Broadley, MacDonald and Buckley, 1995). Given this combination of factors then it could be hypothesised that they would be particularly disadvantaged in tasks that require use of the ‘phonological loop’. In particular it was predicted that they would fail
to show the standard effects since they have poor auditory and phonological processing skills.

The phonological systems of Chinese is totally different from those of western languages. In Taiwan, We hard to finding any researches which are focusing on the relevant to phonological short-term memory of Down syndrome. How is the fact of phonological short-term memory of Chinese population with Down syndrome? This study is trying to explores the development of this condition among preschool children with Down syndrome in central Taiwan.

Method:

Participants

A total thirty children participated in the experiment, All were native Chinese speakers. Fifteen children with Down syndrome and fifteen typical developing were studies. Their chronological age (CA) range from 4 years to 6 years old. The subjects can be divided into three sub-groups according to their chronological age. Each group included 5 children with Down syndrome and 5 others were typical developing. These children were recruited from central local area in Taiwan.

Procedure

Individual testings took place either at the child’s home or at his or her kindergarten. A battery of memory tasks were administered to each child, and focused on subjects’ repetition. All the following tasks: a non-words repetition task, a non-meaning vocabulary repetition task, a digit span task, vocabulary repetition test and sentences test of WPPSI-R are used for assessing subjects’ phonological short term memory. Then we will compare the scores within these groups.

Non-words repetition task
This task is designed from the study of Comblain (1999). The subjects were asked to repeat 25 nonwords of Chinese immediately after the examiner. One each trial the experimenter spoke aloud a sequence of non-words from the list. (see Appendix A for the list of nonwords)

Non-meaning vocabulary repetition task
The vocabulary sets used here were 20 items with non-meaning of Chinese characters. (see Appendix B)
Digit span task
Auditory digit span was measured using the composed from 2 numbers to 6 numbers. (see Appendix C). The numbers were orally presented. Subjects were to repeat immediately after the examiner.

Vocabulary repetition task
As a part of WPPSI (Wechsler Preschool and Primary Scale of Intelligence)
Sentences test of WPPSI-R
As a part of WPPSI (Wechsler Preschool and Primary Scale of Intelligence),

Results

The results of this study indicate as follows:

1. In non-words task, all the groups of DS perform much worse than ND when carrying out the following: non-word repetition task, non-meaning vocabulary repetition task, and digit span task.
2. In word task, all the groups of DS perform much worse than ND, both in vocabulary repetition test and sentences test of WPPSI-R.
3. Compared to ND, those DS do not have much better performances in auditory phonological memory as they grow in age.
4. The subgroups of four, five and six years old DS generally show significant differences between vocabulary repetition, sentences test and other varieties under the performances of auditory phonological memory.

Appendix A Non-word repetition task

小朋友：

我們現在來玩幾個和聲音有關的遊戲，這些遊戲是想看你能不能模仿老師說的每一句話，把老師說的內容重複唸出來。待會要你仔細聽我唸，在我唸完每一串字詞之後，請把你聽到的內容原原本本、按照順序地重新唸一次。在唸完每一个題目之後，老師會問「你應該說什麼？」，你就直接把你聽到的再唸出來。每一題我只會唸一次，唸完之後不會再唸，並且停五秒等你。所以請你一定要注意聽，才會回答。好，我們先來練習幾次。

現在是第一題：ㄍㄧ、ㄎㄧ 你應該說什麼呢？(停頓五秒) 停！

剛剛的過程如果你有不懂或者是覺得很奇怪的地方，請你現在問老師。(停頓一下) 如果沒有問題的話，我們就要開始了。
第一階段  （各階段依子音發展順序設計而成）
1. ㄅㄛ、ㄊㄝ
2. ㄉㄟ、ㄇㄨ∥ㄍㄧ
3. ㄆㄛ、ㄏㄣ∥ㄊㄛ∥ㄉㄜ
4. ㄆㄡ、ㄊㄥ∥ㄏㄤ∥ㄌㄡ∥ㄍㄝ
5. ㄆㄥ∥ㄊㄝ∥ㄇㄤ∥ㄌㄤ∥ㄇㄟ∥ㄅㄝ

第二階段
1. ㄧㄟ∥ㄉㄟ
2. ㄧㄞ∥ㄅㄛ∥ㄇㄨ
3. ㄊㄜ∥ㄇㄨ∥ㄍㄝ∥ㄏㄤ
4. ㄆㄡ∥ㄅㄝ∥ㄍㄧ∥ㄉㄜ∥ㄌㄡ
5. ㄏㄣ∥ㄌㄤ∥ㄇㄟ∥ㄋㄣ∥ㄊㄝ∥ㄅㄛ

第三階段
1. ㄎㄣ∥ㄅㄛ
2. ㄍㄛ∥ㄎㄧ∥ㄗㄟ
3. ㄎㄟ∥ㄕㄛ∥ㄅㄝ∥ㄘㄧ
4. ㄏㄤ∥ㄇㄟ∥ㄉㄜ∥ㄌㄡ∥ㄊㄟ
5. ㄘㄜ∥ㄇㄨ∥ㄗㄛ∥ㄎㄛ∥ㄋㄧ

第四階段
1. ㄊㄟ∥ㄉㄛ
2. ㄉㄛ∥ㄉㄣ∥ㄇㄨ
3. ㄏㄧ∥ㄉㄛ∥ㄊㄝ∥ㄌㄥ∥ㄎㄠ

Appendix B  Non-meaning vocabulary repetition task
非字義聽覺詞彙測驗/非字義聽覺音韻測驗  EX 子你(非語彙)
第一階段  哇登、機約去、八咧魯窩、跟踢搭菸冷、
差拍姿壓他呢
第二階段  楚撈、蔣郭挑、嚕咪壓安、抽該嘉依巫、嘎誰趨喝央噹
第三階段  雲蚵、髒胎凹、開昭起不、噴腳淑語稱、牙蘇拋剛小如
Appendix C A digital span test

(一) 数字記憶測驗

1. 第一階段
   1. 23
   2. 85
   3. 99
   4. 47
   5. 34

2. 第二階段
   1. 435
   2. 879
   3. 068
   4. 241
   5. 103

3. 第三階段
   1. 4892
   2. 3364
   3. 2587
   4. 9614
   5. 0382

4. 第四階段
   1. 05894
   2. 32467
   3. 88421
   4. 54906
   5. 87657

二、非字音節記憶廣度測驗

1. 第一階段—單韻母
   1. ㄛ、ㄜㄟ
   2. ㄜー、ㄜㄡ
   3. ㄜㄌ、ㄜㄛ
   4. ㄇ、ㄑㄝ
   5. ㄕ゚、ㄕ
   6. ㄑ゚

2. 第二階段
1. 一ㄠ、ㄆㄠ
2. 口ㄆ、
3. ㄅㄠ、ㄆㄠ、ㄤㄨ
4. ㄍㄠ、ㄆㄨㄛ、ㄈㄠ
5. ㄆㄨㄢ、ㄈㄨㄢ、ㄕㄨㄢ
6. ㄆㄨㄨ、ㄕㄨㄢ、ㄋㄨㄢ
7. ㄏㄢ、ㄕㄨㄥ、ㄊㄨㄚ

〔第三階段〕
1. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
2. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
3. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
4. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
5. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ

〔第四階段〕
1. ㄌㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
2. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
3. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
4. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
5. ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ、ㄆㄢ
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