

# Nonword Repetition Abilities of Children with Persistent & Recovered Stuttering: Preliminary Study

HeeCheong Chon, M.S. and Nicoline G. Ambrose, Ph.D., CCC-SLP  
Stuttering Research Program, University of Illinois at Urbana-Champaign

## 1. Introduction

### 1.1. Rationale and Purpose of the Study

- Nonword repetition abilities: Related to language abilities, especially phonological working memory, which could influence auditory comprehension (Bishop, North, & Donlan, 1996; Dollaghan & Campbell, 1998)
- Language abilities and stuttering: Some studies show that children who stutter (CWS) have relatively poorer language abilities than children who do not stutter (CWNS) (Anderson & Conture, 2000; Byrd & Cooper, 1989; Ryan, 1992), or that higher language skills in CWS might be related to recovery from stuttering (Yairi, Ambrose, Paden, & Throneburg, 1996). But the relationship between stuttering and language abilities is controversial (Nippold, 1990).
- Stuttering and nonword repetition abilities: CWS scored relatively lower than CWNS, but the total scores were not significantly different between CWS and CWNS (Anderson, Wagovich, & Hall, 2006; Hakim & Bernstein Ratner, 2004; Seery, Watkins, Ambrose, & Throneburg, 2006). For all syllable lengths, CWS showed significantly lower scores at the two-syllable or the three-syllable level, and showed significantly more errors only at the three-syllable level (Anderson, Wagovich, & Hall, 2006; Hakim & Bernstein Ratner, 2004). Hakim and Bernstein Ratner (2004) suggested that nonwords at the three-syllable level could differentiate language abilities between CWS and CWNS. Seery, Watkins, Ambrose, and Throneburg (2006) found that CWS showed significantly lower scores at the five-syllable level, but there were no significant differences between CWS and CWNS in terms of mean phoneme errors. The investigators suggested that poorer nonword repetition skills in CWS might be related to persistent stuttering.

### 1.2. Research Questions

This study compared the nonword repetition ability of children whose stuttering was persistent with that of children whose stuttering was recovered to determine whether poor performance in nonword repetition could be related to stuttering persistence and recovery.

- (1) Do children who recover from stuttering (recovered group) show significantly different nonword repetition skills than children whose stuttering persists (persistent group)?
- (2) Is there any difference in accuracy between the two groups in phoneme accuracy (consonants and vowels)?
- (3) Are the language abilities (Peabody Picture Vocabulary Test-III and Expressive Vocabulary Test) of children related to their nonword repetition abilities?

## 2. Method

### 2.1. Participants

- Recovered Group: 14 school-age children who recovered from stuttering (11 boys and 3 girls), mean age 11.5 years (age range 10.1 - 13.4 years)
- Persistent Group: 5 school-age children who stutter (5 boys), mean age 11.3 years (age range 10.4 - 12.2 years)

All of the children's language abilities, using standardized tests (PPVT-III, EVT), were in the normal range except for one child (persistent group: EVT score of 83). All children showed normal articulation and hearing abilities.

### 2.2. Procedure and Analysis

Participants were asked to listen to and repeat nonword stimuli presented under headphones in a sound-treated booth.

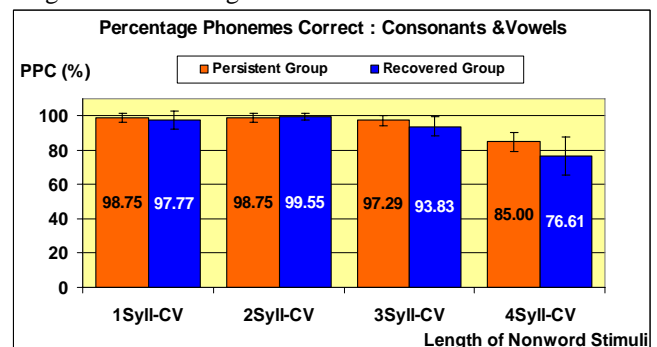
- Stimuli: Nonword Repetition Task (NRT: Dollaghan & Campbell, 1998)
  - ✓ 16 nonword repetition stimuli; 4 nonwords for each syllable length
  - ✓ Syllable length ranged from 1 to 4
  - ✓ Every stimulus began and ended with consonants (i.e., CVC, CVCVC, CVCVCVC, CVCVCVCVC)
  - ✓ Overall, 56 consonants and 40 vowels
- Scoring: Following Dollaghan & Campbell (1998), each phoneme was scored as Correct or Incorrect.
  - ✓ Correct: exact phoneme pronunciation, distortion
  - ✓ Incorrect: substitution, omission
  - ✓ Additions were not considered as errors (p. 1139)
- Analysis: Mean percentage of correct phonemes for each syllable length (Percentage Phonemes Correct: PPC)
  - ✓ PPC-C: Percentage Phonemes Correct-Consonant only
  - ✓ PPC-V: Percentage Phonemes Correct-Vowel only
  - ✓ PPC-CV: Percentage Phonemes Correct-Consonant and Vowel

## 3. Results

### 3.1. Nonword Repetition Abilities in CWS and CWNS: PPC-CV

The mean Total PPC of persistent group was 92.89 (SD = 2.79, Median = 91.61) and that of recovered group was 88.73 (SD = 5.29, Median = 89.20). Interestingly, the Total PPC of persistent group was relatively higher than that of recovered group. At each syllable level, there was no significant difference between two groups in PPC-CV (one-syllable level: Mann-Whitney U-test,  $Z = -0.13$ ,  $p = 0.96$ ; two-syllable level: Mann-Whitney U-test,  $Z = -0.78$ ,  $p = 0.69$ ; three-syllable level: Mann-Whitney U-test,  $Z = -1.37$ ,  $p = 0.19$ ; four-syllable level: Mann-Whitney U-test,  $Z = -1.30$ ,  $p = 0.22$ ).

<Figure 1> Percentage Phonemes Correct

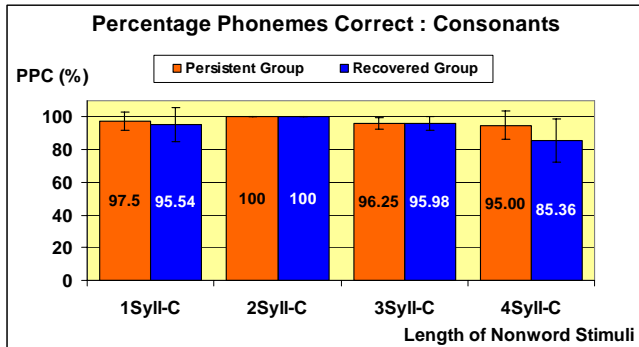


### 3.2. Accuracy in Phonemes (Consonants and Vowels)

#### 3.2.1. Consonants: PPC-C

The mean of the total mean PPC-C of persistent group was 96.78 (SD = 4.26, Median = 98.21) and that of recovered group was 92.98 (SD = 6.24, Median = 93.75). For the PPC-C in each syllable level, there was no significant difference between two groups (one-syllable level: Mann-Whitney U-test,  $Z = -0.13, p = 0.96$ ; two-syllable level: Mann-Whitney U-test,  $Z = 0.00, p = 1.00$ ; three-syllable level: Mann-Whitney U-test,  $Z = -0.05, p = 0.96$ ; four-syllable level: Mann-Whitney U-test,  $Z = -1.57, p = 0.13$ ).

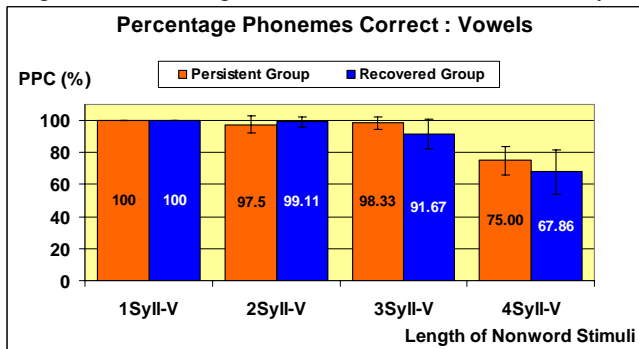
<Figure 2> Percentage Phonemes Correct – Consonants only



#### 3.2.2. Vowels: PPC-V

The mean of the total mean PPC-V of persistent group was 89.00 (SD = 3.79, Median = 90.00) and that of recovered group was 84.46 (SD = 6.88, Median = 87.50). For the PPC-V in each syllable level, there was no significant difference between two groups (one-syllable level: Mann-Whitney U-test,  $Z = -0.00, p = 1.00$ ; two-syllable level: Mann-Whitney U-test,  $Z = -0.78, p = 0.69$ ; three-syllable level: Mann-Whitney U-test,  $Z = -1.52, p = 0.19$ ; four-syllable level: Mann-Whitney U-test,  $Z = -0.95, p = 0.39$ ).

<Figure 3> Percentage Phonemes Correct – Vowels only



### 3.3. Language Abilities (PPVT-III, EVT) and Nonword Repetition Abilities

In the persistent group, there was no significant correlation between each syllable level of PPCs (PPC-C, PPC-V) and the language scores.

In the recovered group, there was a significant correlation between the three-syllable level PPC-V and the PPVT score (three-syllable level PPC-V and PPVT:  $r = 0.63, p = 0.02$ ).

## 4. Discussion

The results of this preliminary study were as follows:

- (1) Children whose stuttering was persistent *did not* have poorer nonword repetition skills than children whose stuttering was recovered. Also this study showed a trend that the nonword repetition performance of the persistent group was relatively higher than the recovered group. Because the present study did not have a control group, the results are hard to compare to previous studies. This result might not be consistent with Seery et al.'s (2006) suggestion that there would be subgroups with high or low nonword repetition skills in stuttering children and the children who revealed lower nonword skills might be more susceptible to stuttering persistence. However, because of the small number of participants in the persistent group ( $n = 5$ ), further investigation with more participants is needed.
  - (2) Even though the persistent group showed a relatively higher percentage of correct phonemes in consonants and vowels except at the two-syllable level, the mean percentage of correct phonemes *did not show any significant differences between the two groups of children*. The rate of accuracy in both consonants and vowels showed a trend that PPC decreased with increased syllable length. More specific analysis such as error analysis and fluency analysis (the persistent group) would be needed to characterize the children's nonword repetition abilities.
  - (3) Similar to Anderson et al. (2006), the expressive and the receptive language abilities were *not significantly related to the children's nonword repetition performance* except the nonwords at the three-syllable level in the recovered group (significant correlation between their PPVT-III score and their PPC-V but not PPC-C). This result might be spurious because one of the participants in the recovered group showed quite lower performance at the three-syllable level PPC-V (i.e., the group mean at the three-syllable level PPC-V was 91.67 (SD = 9.25) but the child's PPC-V was 75). His PPVT score was also lower than other subjects. When excluding this participant, statistical results did not show any significant correlation between each syllable level of PPCs and the language scores in the recovered group (three-syllable level PPC-V and PPVT:  $p$ -value was changed to 0.07). In general, because standardized language tests were designed for clinical objectives, the results might not be able to reveal stuttering children's specific language abilities.
- The results of the present study do not appear to support the notion that nonword repetition ability is one of the risk factors for the development/persistence of stuttering. Further research with more participants and with a control group is needed to compare nonword repetition abilities of children whose stuttering was recovered with children who stutter.
- Also to determine whether stuttering children's performance in nonword repetition is more related to that of their parents' performance regardless of stuttering, further research comparing the stuttering children's nonword abilities with their parents' nonword abilities is needed.

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**Contact information: HeeCheong Chon**  
([hchon3@uiuc.edu](mailto:hchon3@uiuc.edu))

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