Nonword Repetition and Phoneme Elision in Adults Who Do and Do Not Stutter

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Abstract

The purpose of the present study was to explore the phonological working memory of adults who stutter (AWS) using a nonword repetition and a phoneme elision task. Results suggest that advancements in the phonological working memory of AWS are not comparable to those demonstrated by adults who do not stutter.

Introduction

-Research suggests that children who stutter (CWS) may differ from fluent peers in their ability to process phonological information (e.g., Byrd, Conture, & Ohde, 2007).

-The ability to temporarily retain/maintain verbal information is linked to speech–language processing (e.g., Montgomery, Magimairaj, & Finney, 2010)

-CWS exhibit difficulty during nonword repetition tasks (e.g., Anderson, Wagovich, & Hall, 2006).

-However, the extent to which these persist into adulthood is unclear given adults' increased phonological working memory capacities (e.g., Sasisekaran, Smith, Sadagopan, & Weber-Fox, 2010).

-**The purpose of this study was to explore phonological working memory in adults who do and do not stutter (AWS and AWNS).**

Research Questions

Thus, the **four main research questions** were as follows:

During **nonword repetition tasks:**

•What is the accuracy of the initial nonword repetition between AWS and AWNS?

•How many attempts are required to achieve accurate nonword repetition for AWNS and AWNS?

During **phoneme elision tasks:**

3) What is the accuracy of the initial nonword production during phoneme elision tasks between AWS and AWNS?

4) What is the accuracy of production during phoneme elision tasks between AWS and AWNS when multiple nonword attempts were required?

Methods

Participants

- 14 AWS (12 males; 17 to 44 years of age).
- 14 AWNS (12 males; 20 to 46 years of age).

-Standard American English-dominant or monolingual.
-No reported hearing neurological, social, psychiatric, or emotional problems.
-No observed speech and/or language problems, with the exception of stuttering in AWS.
-Both groups within normal limits expressive and receptive vocabulary (*PPVT-4; EVT-2*).
-Stuttering severity ranged from mild to severe (O'Brian, Packman, Onslow, & O'Brian, 2004).

Procedure

Stimuli construction
Properties of 48 nonwords were comparable across syllable lengths (Table 1).

Table 1. Properties of nonword stimuli used during repetition and elision tasks.

	2-syll	3-syll	4-syll	7-syll
N = 48	12	12	12	12
Phonotactic probability (segmental)*	1.217	1.293	1.437	1.676
Phonotactic probability (biphone)*	0.009	0.021	0.024	0.029
Word-likeness**	2.718	2.442	2.474	2.833
Phonemic onsets (C ; V)	10 ; 2	10 ; 2	10 ; 2	9 ; 3
Phonemic offsets (C ; V)	12 ; 0	10 ; 2	11 ; 1	8; 4

*Gupta (2003); Dollaghan & Campbell (1998); * Vitevitch & Luce (2004); **Gathercole (1995)*

Tasks
1) Nonword Repetition: participant attempted accurate repetition of nonword
Maximum number of attempts: 6

2) Phoneme Elision: participant produced nonword without one phoneme
- phoneme following each syllable boundary for all syllables
- phoneme preceding each syllable boundary for all syllables
Maximum number of attempts: 1

Measures

Nonword Repetition
-Number of accurate of initial repetition
-Number of attempts required for accuracy
** Inter-rater reliability= 99%*

Phoneme Elision
-Accuracy of initial response
-Accuracy of response if multiple NWR attempts were required.
** Inter-rater reliability = 93%*

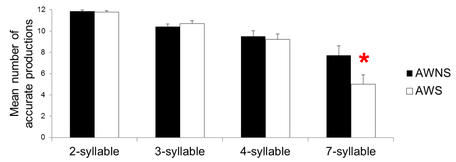
Statistical Analysis

Four Repeated Measures ANOVAs
Between-group factors: AWS and AWNS
Within-group factors: nonword length in syllables

Results

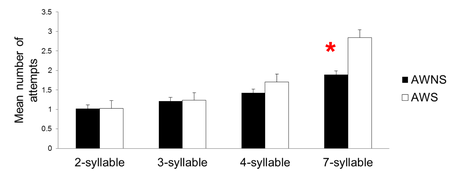
Research Question 1: What is the accuracy of the initial **nonword repetition** between AWS and AWNS?

Results: Accuracy on first repetition was significantly poorer for both groups as number of syllables increased ($F(3,78) = 54.011$, $p \leq .0001$, partial $\eta^2 = .675$). AWS were significantly less accurate at 7-syllable level than AWNS ($F(3,78) = 4.598$, $p = .005$, partial $\eta^2 = .150$).



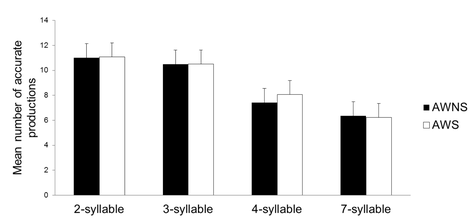
Research Question 2: How many attempts are required to achieve accurate **nonword repetition** for AWNS and AWNS?

Results: Both groups required significantly greater number of attempts as number of syllables increased ($F(3,78) = 28.715$, $p \leq .0001$, partial $\eta^2 = .525$). AWS required significantly greater number of attempts at the 7-syllable level than AWNS ($F(3,78) = 3.993$, $p = .011$, partial $\eta^2 = .133$).



Research Question 3: What is the accuracy of the initial nonword production during **phoneme elision tasks** between AWS and AWNS?

Results: Both groups were significantly less accurate as number of syllable increased on first attempt ($F(3,78) = 101.983$, $p \leq .0001$, partial $\eta^2 = .797$). However, no between-group effects or interactions or interactions were observed.



Research Question 4: What is the accuracy of production during **phoneme elision tasks** between AWS and AWNS when multiple nonword attempts were required?

Results: Both groups were significantly less accurate as syllable length increased ($F(3,78) = 60.464$, $p < .0001$, partial $\eta^2 = .699$). However, no between-group effects or interactions or interactions were observed.

Discussion

The present study related in **three main findings**.

1)AWS were comparable with AWNS during nonword repetition and phoneme elision tasks at 2-, 3-, and 4-syllable level, but less accurate the 7-syllable level.

- *Shorter words are more easily maintained in short-term memory in both groups Baddeley, Chincotta, Stafford, & Turk (2002).*
- *Poorer performance at the 7-syllable level in AWS suggests that working memory may be less efficient than AWNS when required to maintain phonological information beyond 4-syllables.*
- *Although nonword repetition accuracy was comparable at 1-4 syllables between AWS and AWNS, motor coordination was perhaps less stable with increased length (e.g., Smith, Sadagopan, Walsh, & Weber-Fox, 2010).*

2) Both groups required similar numbers of attempts to accurately repeat nonwords at 2-, 3-, and 4-syllables, but AWS required significantly more attempts than AWNS at 7-syllable level.

- *Multiple overt repetitions attempts appear to benefit AWNS more so than AWS. Findings suggest stable phonological representations in AWS are less robust during encoding, or decay more rapidly during rehearsal (e.g., Anderson & Wagovich, 2010).*
- *Findings also suggest that increased motor instability during repetition may prevent eventual stabilization of subvocal rehearsal (e.g., Namasivayam & Van Lieshout, 2008; Smith et al., 2010).*

- **AWS were comparable to AWNS at nonword phoneme elision during 2-, 3-, 4-, and 7-syllable levels.**

2) Although null findings suggest comparable phonological encoding between AWS and AWNS, greater differences may have been observed if increased number of attempts were permitted during the phoneme elision task, similar to the nonword repetition task.

Future studies should consider the length of syllable, as well as amount of practice, when examining differences in phonological working memory between AWS and AWNS.

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