PHONOLOGICAL ENCODING IN STUTTERING: NON-SPEECH RESPONSES TO VISUAL STIMULI

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INTRODUCTION

- Transformation of a thought into speech requires:
  1) forming an idea of what is to be said,
  2) selecting units of meaning with specific grammatical properties,
  3) phonological encoding (PE): selecting phonemes to transform the selected grammatical units into actual words,
  4) overt articulation of speech.

- Interruption of fluency that is recognized as stuttering occurs due to disturbances in one or more of the above steps.

- Covert Repair Hypothesis (CRH) (Postma & Kolk, 1993) proposes that stuttering is caused by slower PE.

- Several studies compared adults who stutter (AWS) and adults who do not stutter (ANS) to examine the CRH, with some supporting (e.g., Sassekaran & De Nil, 2006; Sassekaran, De Nil, Smyth, & Johnson, 2006; Wijnen & Boers, 1994) and some rejecting the hypothesis (e.g., Bernstein Ratner, Newman, & Strekas, 2009; Bosshardt, Ballmer, & De Nil, 2002; Burger & Newman, 1999; Hennessy, Nang, & Beilby, 2008; Weber-Fox et al., 2004).

PURPOSE

- The present study further examined the CRH and whether PE is slower or somehow deficient in AWS when compared to ANS.

METHODS

PARTICIPANTS

- Experimental group: 15 AWS (mean age = 33 years; range = 20-62 years)
- Control group: 15 ANS and gender-matched ANS (mean age = 33 years; range = 21-60 years)

INSTRUMENTATION AND STIMULI

- Computer with E-prime and Serial Response Box (Psychology Software Tools, Inc.)
- Pretesting: participants identified the names and initial sounds of all visual stimuli (pictures)
- Experimental tasks: pictures presented during one neutral and two PE tasks:
  - neutral task: push the response button as soon as an asterisk appears on the screen
  - measured variable: manual response time (MRT)
  - vowel task: push the response button if a picture whose name begins with a vowel appears on the screen
  - measured variable: vowel response time (VRT) = response time produced in the vowel task - MRT
  - consonant task: push the response button if a picture whose name begins with a consonant appears on the screen
  - measured variable: consonant response time (CRT) = response time produced in the consonant task - MRT

RESULTS

ERRORS

- Inclusion criterion of 90% correct responses satisfied.
- Four types of errors were analyzed: picture naming error (E1), initial sound identification error (vowel/consonant) (E2), manual response time error (E3), and phonological encoding error (E4).
- 1-way ANOVA showed that AWS and ANS did not significantly differ in E1, E2, E3, and E4.

MANUAL RESPONSE TIME (MRT)

- Participants pushed the response button as soon as the neutral stimulus (asterisk) appeared on the computer screen.
- 1-way ANOVA showed that AWS and ANS did not significantly differ in MRT.

PHONOLOGICAL ENCODING RESPONSE TIME

- VRT and CRT were calculated by subtracting MRT from response times produced in the vowel and consonant tasks.
- Repeated measures ANOVA revealed a significant sound group interaction, significant main effect of sound, and nonsignificant main effect of group on response time.
- AWS identified consonants as initial sounds more slowly than vowels, and ANS identified vowels and consonants at similar speed.
- Consonants were identified more slowly than vowels.

DISCUSSION AND CONCLUSION

ERRORS

- This study found no significant between-group differences for the number of errors made by AWS and ANS. This finding suggests the following: a) both groups had comparable knowledge of picture names, b) both groups were equally proficient in differentiating words from consonants, and c) there was no speed-accuracy trade-off, which means that neither group achieved greater response speed by reducing response accuracy.

MANUAL RESPONSE TIME (MRT)

- AWS and ANS did not significantly differ in their manual responses to neutral visual stimuli. Despite this, MRT was subtracted from PE response times in order to evaluate the actual time that AWS and ANS took to process the phonological information.

PHONOLOGICAL ENCODING RESPONSE TIME

- The participants identified vowels as word-initial sounds in 384.8 (ANS) to 396.5 ms (AWS) and they identified consonants as word-initial sounds in 357.6 (ANS) to 440.0 (AWS) ms. These VRT and CRT values are within the typical range of 250 to 470 ms reported by event-related brain potential studies on PE time in fluent speakers (e.g., Schiller, Bles, & Jansma, 2003; Schmitt, Münte, & Kutas, 2000; van Turenout, Hagoort, & Brown, 1998).

- The lack of significant between-group differences suggested that AWS were not slower in PE than ANS. This finding is in agreement with several earlier studies (e.g., Bernstein Ratner et al., 2009; Bosshardt et al., 2002) and does not support the CRH.

- There was a significant sound effect on response times and a significant group x sound interaction. AWS were faster during vowel than consonant identification task, while ANS identified both sound types equally fast. Event-related brain potential studies have revealed that different processing times may be required for vowels and consonants (e.g., Carreras, Gillon-Dowens, Vergara, & Peree, 2008), as demonstrated by AWS, but not ANS in the present study.

- Considering that AWS did not respond more slowly than ANS during the PE tasks, but they responded differently to the two sound groups, the following may be suggested: a) AWS are not slower in PE than ANS, and b) AWS may be different from ANS in the way they process vowels vs. consonants.

REFERENCES


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