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Journal of Fluency Disorders 31 (2006) 1–21

Journal of FLUENCY DISORDERS

Phonological encoding in the silent speech of persons who stutter

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Received 19 February 2005; received in revised form 26 October 2005; accepted 12 November 2005

Abstract

The purpose of the present study was to investigate the role of phonological encoding in the silent speech of persons who stutter (PWS) and persons who do not stutter (PNS). Participants were 10 PWS ($M = 30.4$ years, S.D. = 7.8), matched in age, gender, and handedness with 11 PNS ($M = 30.1$ years, S.D. = 7.8). Each participant performed five tasks: a familiarization task, an overt picture naming task, a task of self-monitoring target phonemes during concurrent silent picture naming, a task of monitoring target pure tones in aurally presented tonal sequences, and a simple motor task requiring finger button clicks in response to an auditory tone. Results indicated that PWS were significantly slower in phoneme monitoring compared to PNS. No significant between-group differences were present for response speed during the auditory monitoring, picture naming or simple motor tasks, nor did the two groups differ for percent errors in any of the experimental tasks. The findings were interpreted to suggest a specific deficiency at the level of phonological monitoring, rather than a general monitoring, reaction time or auditory monitoring deficit in PWS.

Educational objectives: As a result of this activity, the participant should: (1) identify and assess the literature on phonological encoding skills in PWS, (2) enumerate and evaluate some major psycholinguistic theories of stuttering, and (3) describe the mechanism by which defective phonological encoding can disrupt fluent speech production.

Keywords: Stuttering; Phonological encoding; Phoneme monitoring; Reaction time

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doi:10.1016/j.jfludis.2005.11.005

In speech production, phonological encoding can be defined as "the processes involved in retrieving or building a phonetic or articulatory plan from each lemma or word and the utterance as a whole" (Levelt, 1989, p. 12). It has been proposed that phonological encoding involves three components: (a) generation of segments that constitute words, (b) integration of sound segments with word frames, and (c) assignment of appropriate syllable stress (Levelt, 1989). This process is thought to be an interface between lexical processes, on the one hand, and speech motor production on the other (Levelt, 1989; Levelt, Roelofs, & Meyer, 1999).

At least four theories have been proposed concerning the potential link between phonological encoding and stuttering. Howell (2004) in his EXPLAN theory proposed that fluency failures occur due to temporal asynchronies between execution (EX) and speech planning (PLAN). He speculated that such asynchronies are caused by difficulties associated with the planning of complex linguistic segments and fast speech rate and the resulting coping strategies adopted by the speaker. Postma and Kolk (1993) proposed the Covert Repair Hypothesis in which the primary symptoms of stuttering represent overt manifestations of covert corrections of speech plan errors that are caused by delayed phonological encoding of speech sounds. Perkins, Kent, and Curlee (1991) in their Neuropsycholinguistic theory outlined two factors as crucial elements in the causation of stuttering: (a) temporal asynchrony between linguistic, i.e., lexical and phonological, and supralinguistic planning, and (b) time pressure. Finally, Wingate (1988) in his Fault Line Hypothesis proposed that stuttering resulted from a delay in the retrieval and encoding of syllable rhyme during speech production resulting in a fault-line created at the point of integration of the syllable onset with its rhyme. These theories have motivated considerable interest in the role of phonological encoding in speech production in persons who stutter (PWS). In the next section, we will briefly review the main findings from studies investigating phonological encoding skills in PWS and persons who do not stutter (PNS).

1. Phonological encoding in PWS

1.1. Priming studies

In phonological priming studies, the presentation of a target word is preceded by a prime stimulus, which shares one or more phonological segments with the target word. The underlying assumption is that the prime stimulus will increase the activation level of the shared sound segment(s), thereby increasing the probability of their selection for the target word within a network of possible phonemes. Wijnen and Boers (1994) used an implicit priming paradigm in which PWS and PNS learned sets of five word-pairs in Dutch. Within a set, all of the second words within the pairs either started with the same phoneme(s), i.e., consonant-only, e.g., *lepel*, *lila*, *loeder*, *larie*, *luier*, or consonant-vowel, e.g., *leuven*, *leugen*, *leuze*, *leuning*, *leukerd* (homogenous condition) or not, e.g., *lila*, *pekel*, *kater*, *sable*, *tafel* (heterogeneous condition). Upon learning the word sets, participants were presented with the first word and asked to recall and name the second word as fast as possible. The results revealed a comparable naming facilitation effect in speech initiation time for the two groups in the consonant-vowel items in the homogeneous primed condition. The consonant-only primed items, however, showed a reduced facilitation in PWS. This finding was interpreted as suggesting that PWS exhibited delayed encoding specific to the stressed vowel, and that this delay was reduced or eliminated by using a consonant-vowel prime. In a follow-up study, however, Burger and Wijnen (1999) failed to replicate their earlier findings.

Melnick, Conture, and Ohde (2003) conducted one of the few investigations of segmental, phonological priming effects with children who stutter (CWS). They measured speech