

Abstract

Introduction: The current study sought to explore the relationship between speech initiations using altered forms of fluency enhancement and stuttering frequency.

Methods: Nine participants verbally read seven, 300 syllable length passages in 8-12 syllable length phrases, under seven conditions: Baseline, pantomime initial, pantomime medial, pantomime final, silent reading initial, silent reading medial, and silent reading final.

Results: Stuttering was significantly reduced during the initial pantomime condition. Additionally, there was a reduction trend noted in all conditions, which was the most robust in the initial pantomime then in the final syllable positions for pantomime and silent reading.

Discussion: It is likely that these procedures altered feed-forward processing, as described by and by Max's inverse model of sensorimotor control (Max et al., 2004).

Introduction

Stuttering is defined as part-word repetitions, part-word prolongations, and inaudible postural fixations (i.e., "silent blocks"). Stuttering can occur at any time during a person's utterance, but typically the greatest frequency of stuttering occurs during phrase initiations.

Stuttering has been found to have a marked reduction during whispered speech and a complete elimination during pantomime speech (Perkins, 1976). Van Riper (1971) hypothesized that a reduction in stuttering during whispered and pantomime speech was in part due to people who stutter (PWS) focusing on the articulation of specific speech sounds at a slower speech rate. This allows for synchronization to occur between the varying motor sequences. It has been shown that slower speech is sufficient for the reduction of stuttering (Andrews, Howie, Dozsa & Guitar, 1982) but not necessary - via experimentation on forms of altered auditory feedback that have demonstrated equivalent reductions at fast and normal speech rates (Hargrave, et al., 1994; Hudock et al., 2010; Kalinowski, et al., 1993).

Max described an integrative internal mechanism of speech production and perception for stuttering that utilizes two processes: feedforward and feedback systems (Max, et al., 2004). The feedforward system uses motor commands that are prepared in the premotor and speech motor areas before the initiation of movements (Max et al., 2004; Ingham et al., 2000). The feedback system utilizes no preparation prior to the action; rather motor commands are generated at the same time as the execution of an action with adjustments occurring in real time.

Max's model of the perception and production of speech integrates both the feedforward and feedback systems, stating that the actual internal model of speech (how speech is processed and produced) is composed of motor commands that are prepared beforehand, with real-time adjustments occurring as needed (Max et al., 2004). Specific to stuttering, Max and colleagues suggest an over-reliance on the feedback system as a possible cause of stuttered events. If stuttering reduction strategies such as pantomime speech or silent reading are employed, it may lead to an increased activation of pre-planning (the feedforward system) which may change the persons internal model of speech and lead to enhanced fluency.

Methods

Participants

Nine participants who stutter signed approved (ISU Human Subjects Committee) informed consent documentation prior to taking part in the study. One participant was removed from data analysis due to experimenter error with condition presentation.

Stimuli

Participants were presented 8-12 syllable length utterances until the total 300 syllable length passage was completed, retrieved from Biographies Skill-Based Story Cards, reading level 3-4 (Remedia Publications, 2006). The passages were written in black font with a white background at 28-point Calibri font and were presented via Microsoft PowerPoint on a 15-inch laptop screen. The designated experimental syllable were grey colored and underlined and for pantomime speech, the silently read syllable were only grey colored (Hudock, unpublished work). Passages and condition sequences were randomly assigned to participants using numeric sequences on www.randomize.com. Participants completed a total condition prior to beginning the next condition.

Procedures

Researchers verbally briefed participants about procedures prior to experimental conditions. The researcher then demonstrated the procedures of verbally reciting the utterance under the specific conditions, which was then repeated by the participants. Participants verbally read each utterance from the computer screen using the experimental procedures.

Analysis

Stuttering was defined as part-word repetitions, part-word prolongations, and inaudible postural fixations (i.e., "silent blocks") (Armson & Stuart, 1998). Researchers analyzed stuttering frequency per condition and syllable position within the utterance. Stuttering episodes were then transformed into proportional values by dividing the number of episodes by the total syllable length of the passage. For inferential statistical analysis proportion of stuttering was then transformed into arcsine units to reduce end point weighting of proportional values (Viera & Garrett, 2005).

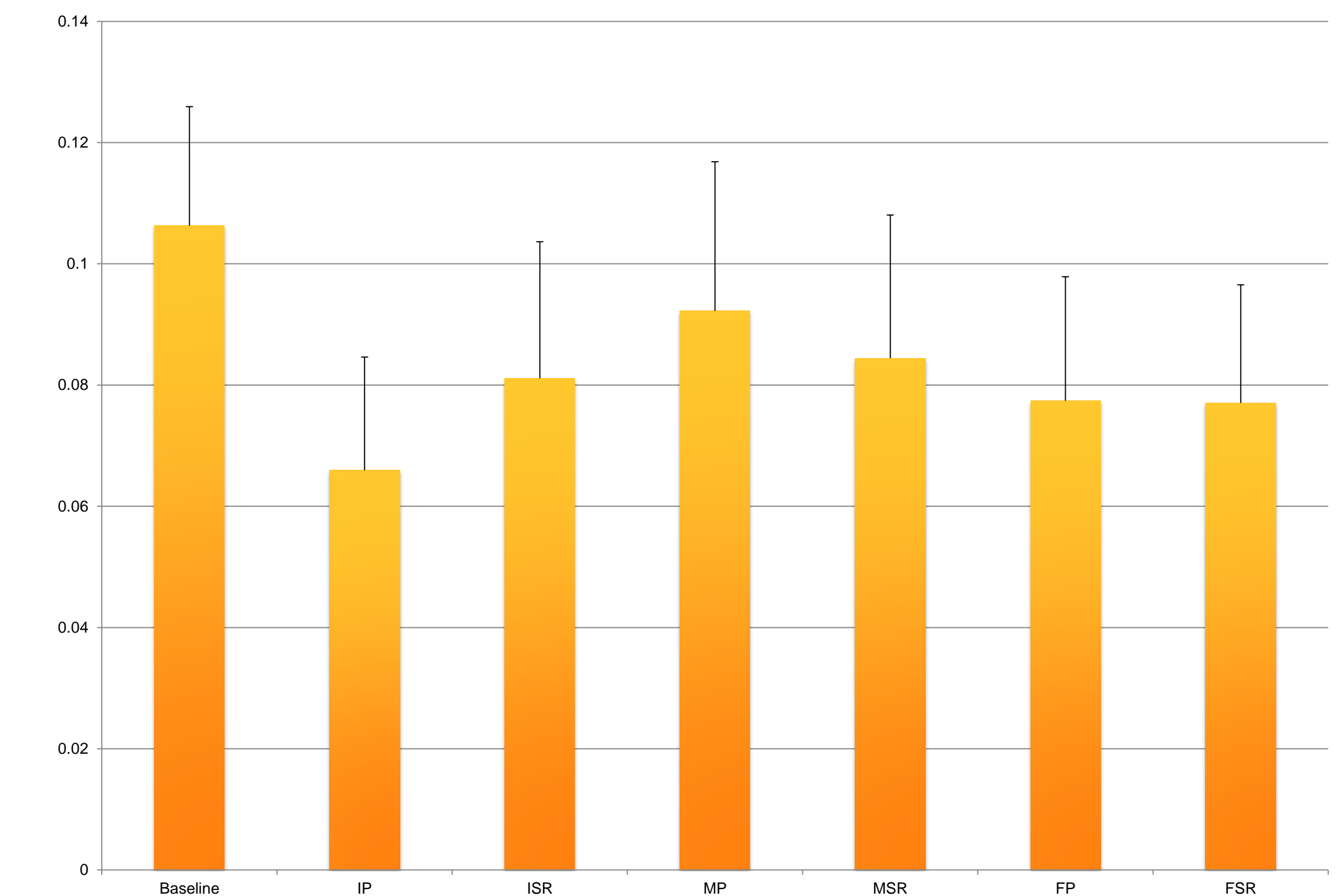


Figure 1: Average proportion of stuttering by condition

Results

A one-factor repeated measures analysis of variance was conducted to examine the effect of condition on stuttering frequency. A significant main effect for condition was revealed [$F(3.237, 26.188) = 3.475, p = 0.027$] $\eta^2 = .303$]. Posthoc Bonferroni adjustments revealed differences between baseline and initial pantomime conditions ($p = 0.005$) with data trending towards significance between the IP and MP condition.

Discussion

Stuttering displayed a marked reduction under the initial pantomime condition and although no other conditions created significant difference from the baseline condition, all conditions had a reduction in stuttering compared to baseline measures.

Silent reading was unable to create a significant change in stuttering reduction across each position. This lack of change may have to do with silent reading not accessing the motor mechanisms necessary for fluent speech production which requires more than just the imagination of fluent speech. The lack of effect in pantomime speech in the medial and final position may be a result of the spatio-temporal relationship of the condition being too far away from the actual planning of the motor movement.

Pantomime speech used in the initial position did yield a significant drop in stuttering that supports the notion that stuttering is a result of interference in feed-forward processing, efferent, plans for motor speech (Max, et al., 2005). The alteration of the first syllable of speech using a motor production such as pantomime speech creates changes in the trajectory of future motor productions. This initial change in the trajectory of speech output acts as a spark for future fluent productions as it assist in overcoming the most difficult portion of an utterance for people who stutter.

