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Inducement of fluent speech in persons who stutter via visual choral speech

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Abstract

A novel phenomenon of fluency enhancement via visual gestures of speech in the absence of traditional auditory feedback is reported herein. The effect on visual choral speech on stuttering frequency was investigated. Ten participants who stuttered recited memorized text aloud under two conditions. In a visual choral speech (VCS) condition participants were instructed to focus their gaze on the face, lips and jaw of a research assistant who 'silently mouthed' the text in unison. In a control condition, participants recited memorized text to the research assistant who sat motionless. A statistically significant ($P = 0.0025$) reduction of approximately 80% in stuttering frequency was observed in the VCS condition. As visual linguistic cues are sufficient to activate the auditory cortex, one may speculate that VCS induces fluency in a similar yet undetermined manner as altered auditory feedback does.

Keywords: Stuttering; Visual choral speech; Feedback

A substantial number of phenomena have been recognized that immediately eliminate or nearly eliminate stuttering and induce relatively fluent speech (i.e. 90–100% reduction in stuttering frequency) in those that stutter [1,2,9,10,20,21]. A wealth of replicated empirical reports and the near total absence of opposing reports substantiate these phenomena. In general, fluency can be induced by either an 'altered manner of speaking' via 'motoric strategies' (e.g. lipped speech prolonged speech, slowed speech, rhythmic speech, or singing) or with 'altered auditory feedback strategies' (e.g. choral reading, shadow speech, delayed auditory feedback, and frequency altered feedback). The ameliorative effects of these phenomena, unfortunately, are generally temporary and must be engaged constantly to reduce stuttering frequency.

Altered auditory feedback (AAF) conditions appear to induce fluent speech in the stuttering population via a 'second speech signal' [4,9]. The second speech signal may be synchronous (in the cases where the signal is generated by an electronic signal processing device) or nearly synchronous (in the cases where the signal is generated by a second speaker or slightly delayed by an electronic signal processing device). Further, it would appear that at least a second congruous speech signal is more fluency enhancing than other forms of auditory feedback (e.g. masked auditory feedback, metronome, etc. [1,2,9]).

Findings demonstrating the integration of auditory and visual information during speech perception [6,7,14–16,22] lead us to the present study. Specifically, it is known that observing articulatory movements of a talker's face provides information for speech comprehension. We speculated that a non-auditory speech signal could generate fluency. That is, a visual representation of second speech signal (i.e. visual gestures) may generate fluency enhancement similarly as auditory choral speech. Thus, we sought to determine if visual choral speech (VCS) would induce fluency in persons whom stutters without the attendant auditory speech signal.

Ten adults who stutter (eight males, two females, mean 27.9 years, SD 9.4 years) participated. Participants did not present with any other speech, language, or hearing disorders and all had normal or corrected vision. Each participant had a history of therapy, and four were enrolled currently. While sitting across from a research assistant, participants viewed cue cards with printed text (three to seven words per

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card). The text for the cue cards was derived from numerous passages, taken from junior high school level textbooks, which have been used, in previous experiments. Participants were instructed to first read silently and memorize the text on the cue card and repeat it in two different conditions. Participants were given one practice trial prior to data acquisition.

In the non-visual choral speech (NVCS) condition, participants recited the memorized portion aloud after the cue card was placed out of their view. Following an initiation signal, they were instructed to focus their gaze on the face, lips and jaw of the research assistant who sat motionless. In the VCS condition, following the initiation signal participants were instructed to focus their gaze on the articulatory movements of the face, lips and jaw of the research assistant who 'silently mouthed the words' found on the cue card. If the participant stuttered a syllable, the experimenter would then repeat this same syllable until the end of the stuttering moment. Participants memorized and recited aloud at a normal rate of speaking 300 syllables in both conditions. Experimental conditions were counterbalanced between participants. Participants were instructed not to use any strategies or techniques to control or reduce disfluencies.

Stuttering episodes were calculated from the first 300 syllables of participants' videotape recorded speech samples[1]. Stuttering was defined as part-word repetitions, part-word prolongations, and inaudible postural fixations. The mean values for stuttering frequency for the NVCS and VCS conditions were 77.2 (SE = 16.5) and 16.5 (SE = 6.6) per 300 syllables, respectively. Stuttering frequency was reduced by approximately 80% in the VCS condition. A one factor repeated measures analysis of variance revealed that the reduction in stuttering frequency in the VCS condition was statistically significant [$F_{(1,9)} = 17.2$, Greenhouse–Geisser $P = 0.0025$, $\eta^2 = 0.66$].

This study demonstrated that VCS is a powerful and immediate fluency enhancing condition for persons who stutter. Reduction of stuttering frequency by approximately 80% is comparable to other robust effects [1,2,9,10,20,21]. Unlike previous fluency enhancing phenomena only visual gestures of speech were used to induce the fluency. That is, there was no creation or manipulation of a 'second auditory speech signal' via electronic or other means to induce an ancillary visual gesture. In addition no instruction to initiate an endogenously manipulated motor plan (e.g. slowed speech) was given. Thus we have shown an exogenous visual speech gesture inducing fluency in persons who stutter. VCS could be employed with individuals who stutter as a means of enhancing fluency within the therapeutic environment. It may also be the case that the reduction of stuttering frequency while utilizing VCS could be enhanced when coupled with traditional therapeutic motoric strategies.

Previous research has reported that visual feedback [12,13,19] in the form of a flashing light reduces stuttering frequency, however, not as impressively as observer with VCS. It would appear that sensory feedback that is congruous to the speech production in the stutterer is the most ameliorative toward reducing stuttering. This notion is supported by the fact other forms of auditory feedback (e.g. masked auditory feedback, metronome, etc.) [1,9] and feedback in the tactile modality are not as effective [11–13,19] as AAF and VCS.

Recent neurophysiological findings have confirmed that visual linguistic cues are sufficient to activate the supratemporal auditory cortex [3,17,18]. One may speculate that this activation may in someway induce fluency in a similar yet undetermined manner as AAF does. We have yet to determine if the VCS signal needs to be congruent with the speech production of the person who stutters or it can be any ballistic movement, which is speech-like. Further research is underway to address this and other VCS phenomena (e.g. carry-over effects and/or the permanence of stuttering reduction induced via VCS). However, this is, to the best of our knowledge, the first example of synchronized visual speech gestures without the attendant auditory signal generating fluency in persons who stutter.

[1] Stuttering episodes were calculated by a trained research assistant. The same research assistant, for 10% of the speech samples chosen at random, recalculated stuttering frequency. Intrajudge syllable by syllable agreement was 0.80, as indexed by Cohen's *kappa* [5]. *Kappa* values above 0.75 represent excellent agreement beyond chance [8]. A second trained research assistant also independently determined stuttering frequency for 10% of the speech samples chosen at random. Interjudge syllable by syllable agreement, was 0.85 as indexed by Cohen's *kappa*.

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