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## Hemispheric asymmetries in stutterers: Disorder severity and neuroticism?

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### Abstract

This study tests the hypothesis that there is atypical brain asymmetry in stuttering children. In particular, the association of both severity of stuttering and neuroticism with cerebral laterality in perception of visuospatial material is tested. Subjects were asked to recognize faces presented laterally in the left or right visual field and point to the exposed stimuli on response cards containing three different faces. Recognition errors committed in the left and right field presentations were analyzed. In fluent speakers and in moderately neurotic stutterers, fewer errors were found for the right hemisphere independently of their neuroticism score; in contrast, stutterers with a high neuroticism score showed fewer errors for the left hemisphere. The latter was true regardless of severity of stuttering. The study suggests a close link between atypical hemispheric dominance in the face recognition test and the emotional state in stutterers as defined by their neuroticism score. This characteristic may be related to the negative emotional reactions demonstrated relatively often by stuttering individuals. In highly neurotic stutterers, the negative affective states might be associated with disturbances of right hemisphere functioning and related to an atypical asymmetry pattern in the processing of right-hemispheric stimuli. These results illustrate the importance of controlling for subject-related factors while conducting and interpreting investigations on stutterers.

*Keywords:* Hemispheric asymmetry; Stuttering; Neuroticism; Severe stutterers; Mild stutterers

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## 1. Introduction

A number of investigations on the physiological base of stuttering have focused on the functional asymmetry of the cerebral hemispheres.

Orton (1928) and Travis (1931) theorized that stuttering is due to incomplete cerebral laterality of language functions in the brain. According to this hypothesis, as the child grows older, the language lateralization becomes more complete and the disfluency disappears. However, some children retain an atypical speech representation in brain hemispheres and continue to stutter.

Once again the hypothesis proposed by Orton and Travis enjoys renewed interest. Currently on the theoretical front, there is still no unequivocal evidence concerning hemispheric asymmetry in stutterers and many authors argue that stuttering can be caused by a disturbance of cerebral lateralization. This hypothesis has received support from clinical investigations, handedness studies and experimental research. This research used various methodologies to test hemispheric asymmetry in stutterers for functions usually mediated predominantly by the left or right hemisphere in fluent speakers.

### *1.1. Clinical investigations of speech representation in stutterers*

Several authors have explored the relationship of stuttering to hemispheric asymmetry via the Wada test (Wada and Rasmussen, 1960). The results of this test showed that bilateral speech representation was present in five out of a total of 11 single cases of stutterers (see Walter and Moore, 1984, for a review). Jones (1966) compared the results of the Wada test, obtained from four stutterers prior to and following unilateral cerebral surgery in the classical speech areas. Prior to surgery, all four stutterers showed bilateral speech representation, whereas a repeated Wada test carried out after the intervention revealed a temporary language loss only following amytal injection on the non-operated side. Moreover, all four of Jones's subjects subsequently ceased stuttering. The patients lost the bilaterality of their speech representation and they no longer stuttered. This finding is perhaps the strongest support for linking stuttering with bilateral speech distribution. However, the attempts of other authors (Walter and Moore, 1984) to replicate Jones's results failed. Generally, the results of the Wada test suggest a lack of hemispheric dominance for speech functions in stutterers. The major argument against accepting results of the Wada test as explaining the neuropsychological bases of stuttering is that some patients have a bilaterally positive Wada test but do not stutter (Milner et al., 1966). Thus, the results of the sodium amobarbital test give only partial support to the hypothesis that bilateral speech representation is implicated in stuttering.

### *1.2. Handedness studies in stutterers*

Another piece of evidence is the purported higher prevalence of left-handedness and ambilaterality among stutterers compared to nonstutterers (Dellatolas et al., 1990; Geschwind and Behan, 1984). The notion that the handedness distribution among stutterers should reflect their atypical pattern of cerebral lateralization stems from the assumption that both left-handers and ambidextrous individuals tend to be less lateral-

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