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Stuttering, emotions, and heart rate during anticipatory anxiety: a critical review

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Abstract

Persons who stutter often report their stuttering is influenced by emotional reactions, yet the nature of such relation is still unclear. Psychophysiological studies of stuttering have failed to find any major association between stuttering and the activity of the sympathetic nervous system. A review of published studies of heart rate in relation to stressful speech situations indicate that adults who stutter tend to show a paradoxical reduction of heart rate compared with nonstuttering persons. Reduction of heart rate has also been observed in humans and mammals during anticipation of an unpleasant stimulus, and is proposed to be an indication of anticipatory anxiety resulting in a "freezing response" with parasympathetic inhibition of the heart rate. It is suggested that speech-related anticipatory anxiety in persons who stutter is likely to be a secondary, conditioned reaction based on previous experiences of stuttering.

Educational objectives: The reader will be able to: (1) describe how the autonomic nervous system is modulated by emotional responses; (2) explain how anticipatory fear often results in inhibition of heart rate due to parasympathetic activation; (3) discuss why emotional reactions in persons who stutter may be secondary to negative experiences of speech problems.

Keywords: Stuttering; Emotions; Heart rate; Parasympathetic nervous system; Freezing

The relation between stuttering and emotional factors has long been a matter of debate. Many people who stutter have the experience that stuttering is influenced by their emotional reactions, and this is also a common clinical experience. One way to investigate emotional aspects of stuttering is to measure physiological changes associated with activation of the

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sympathetic branch of the autonomic nervous system. Two of the most thorough studies in this field (Peters & Hulstijn, 1984; Weber & Smith, 1990) failed to find any significant overall group differences in sympathetic activation between the stuttering and the nonstuttering group, either at rest or in relation to speech or nonspeech tasks. However, speech was associated with relatively large increase in sympathetic activity for both groups. Weber and Smith (1990) showed significant correlations between measures of sympathetic activity and speech dysfluency in persons who stuttered, but the correlations only accounted for between 3 and 17% of the variance in fluency. In brief, this type of research has not been able to show any major association between sympathetic activity and stuttering.

If there is a close connection between stuttering and emotional factors, the nature of this connection is still unclear. Menzies, Onslow and Packman (1999) reviewed the existing research on stuttering and anxiety and came to the conclusion that the lack of evidence for a relationship between stuttering and anxiety may be a result of inadequate research designs regarding definitions and measures of anxiety, insufficient statistical power, or inappropriate speech tasks. They stated "It is our contention that the inadequate literature on anxiety and stuttering is not just an academic problem .... Until the precise nature of the relationship between anxiety and stuttering is understood, fully appropriate treatment of adult stuttering cannot be offered" (p. 8).

An assumption in psychophysiological research about stuttering has been that an increase in anxiety is related to increase in heart rate. In this article it will be argued that *reduction* of heart rate can indicate an emotional response of anticipatory anxiety, and that indications of this type of response have repeatedly been shown in the previous psychophysiological studies of stuttering. First, a brief overview of the functions of the autonomic nervous system (ANS) will be presented, and related to cardiovascular effects of different affective responses. Thereafter, studies of heart rate changes in persons who stutter will be reviewed and possible interpretations will be discussed.

1. The autonomic nervous system

The ANS controls the visceral functions of the body, such as the contractions of the heart, constriction of blood vessels, blood pressure, digestion, and sweating. The ANS consists of two major subdivisions, the *sympathetic* and the *parasympathetic systems*, which cooperate to adapt the bodily functions to different situations and demands (Guyton & Hall, 1996). In many autonomic functions, but not all, the sympathetic and parasympathetic systems have opposite effects, like acceleration versus deceleration of the heart rate, or dilation versus constriction of the pupil. The parasympathetic system is mainly passing through the two *vagus nerves* from the brain stem (Guyton & Hall, 1996). The vagus nerves send autonomic fibers to the heart, lungs, and digestive organs, but also non-autonomic fibers to organs involved in speech, like the larynx, pharynx, and soft palate (Porges, 1995).

The sympathetic system is often discussed in relation to stress and anxiety. Cannon (1915) found that fear, rage and pain tend to result in massive activation of the sympathetic system, a reaction known as the *fight or flight response* (also called the *alarm* or *stress response*). This is a catabolic reaction that prepares the body for action, with increased heart rate, blood pressure, blood sugar, and redirection of blood from the viscera and skin to the muscles