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Prognostic indicators for stuttering: the value of computer-based speech analysis☆

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Abstract

There are currently no known acoustic parameters by which stuttering children can be appraised in order to predict the further course of their speech disfluency. The present study investigates the usefulness of a computer-based speech analysis of fluent utterances. Correlations between acoustic variables, severity, and course of stuttering were sought in a prospective longitudinal study. This analyzed 57 preschool children at 6-month intervals over a period of 4.6 years. The acoustic analyses yielded no clearly distinguishing characteristics. There was, however, one subgroup consisting of children who were still disfluent at study end which showed more variable values at various measurement points for different parameters. Speech control seems to be different in children exhibiting chronic stuttering.

Keywords: Stuttering; Acoustics; Preschool children

1. Introduction

Stuttering typically develops before the age of 6 and has a high spontaneous remission rate. Thus 60–70% of sufferers are clear by adolescence and 80% by adulthood. The remission probability is approximately 50% within 2–3 years after onset up to the age of 6–9 years. It is as yet unclear why, despite this overall high remission rate, there remains a subgroup of children who do not become fluent. The aim of the present study is to elucidate how these children differ in their planning, performance, coordination and control of respiratory, phonatoric, and articularmotorial procedures from children with normal speech ability.

During the course of their speech development, about four of five children have developmental disfluencies for a shorter or longer period. This might be based on a mostly temporarily limited interference of various feedback systems. Small children

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initially listen to themselves in order to compare their own speech with that of their reference person and correct it. It is assumed that in the further course of speech development the social sense "audition" becomes more important for the reception of information from the environment than for such (necessary) self-control mechanisms. Hence a gradual transition to kinesthetic, proprioceptive, and tactile feedback may occur (van Riper, 1971). During this transition period the still developing, immature brain can be inundated by too much feedback information and disintegrate. The result is that output orders for subsequent speech can no longer be sufficiently coordinated. Developmental disfluencies are the possible consequence which disappear after sufficient withdrawal of the acoustic feedback. However, if further factors disturbing the sequence of speech become effective during this period, persistent stuttering may evolve.

Many research results support the assumption that stuttering can also be an expression of a neuromotor asynchronism (Caruso, Conture, & Colton, 1988; Öhman, 1966) with possible disturbances in the interaction of speech respiration, phonation, articulation as well as coarticulation, and even the cerebral control of the whole system.

Cerebral organization of speech functions is supposed to be different in some stutterers when compared to the majority of nonstutterers. In the latter, motor procedures relevant to the act of speaking are mainly controlled by the left hemisphere. In the case of developmental stuttering it is assumed that the predominant hemisphere for the processing of speech has not definitely been established by the fourth or fifth year of life. In the case of one subgroup of sufferers exhibiting insufficient lateralization of speech ability, stuttering may be theoretically based on irritations of the sinistrocerebral segmentation of articulation, originating from the right hemisphere (Fiedler, 1992; Johannsen & Victor, 1986; Orton, 1927; Stier, 1911; Travis, 1931).

2. Materials and methods

In February 1992 the Department of Phoniatrics and Pediatric Audiology started a prospective longitudinal study in which 71 stuttering preschool children participated. Nine families were lost for follow-up between t_3 and t_9, so that until study end complete data from a total of 62 children were available. Fifty-seven of these children (15 girls and 42 boys) could be included in the acoustic analysis. In this study, which was supported by the "Deutsche Forschungsgemeinschaft," the circumstances of the onset and development of stuttering were investigated.

The parents of each child completed a questionnaire about the stuttering and to this was added a more detailed problem oriented history. The stuttering severity was evaluated by the Riley method (1972). The detailed quantitative and qualitative evaluation of the stutter symptomatology was based on videotaped interactions of quasi-natural play situations of the children with one parent. In order to calculate the absolute stutter frequency in words ("total stuttering") 200 turn takings were taken into consideration. For every child the general cognitive ability and the stage of speech development were psychometrically assessed by a clinical psychologist. The German version of the Kaufman Assessment Battery for Children (K-ABC, 1983) was employed for rating the current cognitive ability (Häge, 1994). The Heidelberger Sprachentwicklungstest (HSET; Grimm & Schöler, 1991) was used for registration of the receptive and expressive syntactic, semantic, and pragmatic abilities of the children. For children ages 3–6 the Aktive Wortschatztest (AWST 3–6; Kiese & Kozielski, 1979) was carried out to measure the expressive-semantic ability.