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A Temporal Analysis of Disfluencies: Exemplary Data of a Stuttering and a Non-stuttering Child

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Abstract. Stuttering as well as non-stuttering children show „functional disfluencies“, which enable them to gain time for speech-planning. Young stuttering children show additional „stuttering-like disfluencies“. There is a lack of knowledge concerning the development and interaction of these disfluencies in children. Therefore the occurrence and proportion of these disfluencies will be investigated in 24 stuttering children (aged 2.8 to 5.0) and 24 non-stuttering children. The study's method is described and data of one stuttering and one non-stuttering child are presented as an example, and discussed in view of the question whether stuttering children have a smaller proportion of functional disfluencies.

1. Introduction

Wendell Johnson was able to show in his Iowa Study that very different types of disfluencies occur in the speech of stuttering as well as non-stuttering children (Johnson et al., 1959). Since then, several studies confirmed this finding and provided a more detailed insight into the occurrence and development of stuttering-like disfluencies in the speech of young stuttering children and the occurrence of disfluencies which are not regarded as symptoms of stuttering (e.g. Yairi,1981, 1982; Yairi & Lewis, 1984; Yairi & Ambrose, 1999; Haynes & Hood, 1978; Bjerkan, 1981; Zebrowski, 1991; DeJoy & Gregory, 1985; Hartmann, Schlicksupp & Jehle, 1989).

Bloodstein (1995) suggested that stuttering of young children can be identified by specific categories of disfluencies: repetitions of syllables and sounds, prolongations, and blocks. Yairi and Ambrose (1999) divide stuttering-like disfluencies (SLD) in part-word-repetitions, monosyllabic-word repetitions, and dysrhythmic phonation. They can also be found in the speech of non-stuttering children, but they occur less frequently (Yairi, 1981). The second category of disfluencies, the so-called „other disfluencies” (OD), occur in the speech of every child and adult (Starkweather, 1987, Starkweather & Givens-Ackerman, 1997). This category contains poly-syllabic word repetitions, interjections, phrase-repetitions, sentence-corrections, revisions, and filled pauses, which are also called functional discontinuities (Starkweather, 1987). They seem to be important for the process of speech-planning (Kowal et al., 1975).

There is a lack of data concerning the development of normal disfluencies and their influence on the occurrence of stuttering-like disfluencies in children who stutter. There are indications that in the speech of stuttering children the proportion of normal disfluencies is smaller than in non-stuttering children (Sandrieser, 1999). This fact emerges only when the duration of disfluencies are analysed and pauses are taken into account. Such a group difference in the occurrence of normal disfluencies might be important in the development of stuttering. OD (including pauses) influence speech rate and might therefore be one factor in the development of stuttering (Throneburg & Yairi, 1994; Kloth et al., 1995). Starkweather (1987) assumes that OD give the speaker the opportunity to gain time for the speech-planning process. The bigger the proportion of OD in speech time is, the more profitable is their use. To evaluate the functional value of disfluencies, it is necessary to examine their duration.

Stuttering children with a high proportion of OD might have an advantage in respect to remission of stuttering, compared to stuttering children with a small proportion of OD. A difference of the proportion of OD dependent on the age of the children is expected. Some types of OD seem to be more sophisticated and therefore not used by very young children (Kowal et al. 1975). The second hypothesis is that stuttering children have a smaller proportion of OD in their speech time. Althaus et al. (1993) were able to show that it is possible to identify pauses reliably, but that the analysis of duration requires specific methods, which exclude inaccuracy resulting from reaction-time errors when using a stop-watch. Methods which visualise the duration seem more suitable for this task.

The purpose of the study described here is to investigate the occurrence and the duration of stuttering-like and functional disfluencies in stuttering and non-stuttering young children. Furthermore it is examined whether there is a relationship between stuttering and a low proportion of functional disfluencies. The method of the study is described and data of one session with a stuttering child and a non-stuttering child are presented as an example and discussed. The study is still in progress.

2. Method

24 stuttering children and 24 non-stuttering children as controls participated. The examination of the control-group is still in progress. The stuttering group consists of 14 boys and 10 girls with a mean age of 3.6 years (SD = 0.75 years). The stuttering children were referred by pediatricians or speech-language-pathologists, who informed the parents about this study. In some cases referrals were made in response to a newspaper article. All stuttering children underwent the following procedure: Spontaneous speech of the children was investigated in two play sessions one week apart. The interaction between investigator and child was videotaped, while the audio signal was recorded digitally. Speech samples consisted of at least 1000 syllables. In addition, the performance of speech and language skills was measured using the articulation examination by Ilse Wagner (Wagner, 1955) and a non-standardized examination of oral motoric and syntactic-morphologic skills. Children with phonetic or phonological disorders were not excluded. Intellectual abilities and acquired skills were tested with the Kaufman Assessment Battery for Children (K-ABC, German version, Kaufman & Kaufman, 1983). The results of the global scales were: Sequential Processing 96,4 (SD = 17,29), Simultaneous Processing 98,1 (SD = 12,14), Mental Processing Composite 98,1 (SD = 10,79), and Achievement 97,7 (SD = 12,33).

Riley's Stuttering Severity Instrument (SSI, Riley, 1981) was used for stuttering diagnostics. Additional criteria were the occurrence of at least 3 stuttering-like disfluencies (SLD) per 100 syllables and that the children were judged by their parents and an experienced examiner to have a stuttering problem. Time of stuttering onset was determined with a questionnaire and an extensive parent interview. The mean post-onset interval was 8.9 month (SD = 6.58 month). Three children received therapy because of their stuttering.

The control-group undergoes the same procedure. They will be matched based on age (within 4 months), gender, and age-appropriate test-results from the K-ABC. Parents of non-stuttering children do not regard them to have a history of stuttering, and their speech samples must contain fewer than three SLD. Children of the control-group participate voluntarily after being informed by the parents of the stuttering children. They are play-mates or kindergarten-peers of the stuttering children. However, no siblings of stuttering children are chosen.

Speech samples are orthographically transcribed. Stuttering moments are identified and classified by watching and listening to the recording repeatedly. Speech samples are transcribed and analysed using CHILDES and CLAN (MacWhinney, 1991), to which a special coding system for disfluencies was added. Unintelligible utterances as well as isolated affirmatives and negatives, which are produced fluently in general, are not included. The first 100 syllables of speech samples are excluded from analysis. The resulting speech samples consist of at least 1000 syllables for every child. Stuttering moments are defined as prolongations, blocks before or within words, and repetitions of sounds, syllables, and one-syllable-words. Multiple stuttering moments, e.g. a prolongation combined with a sound repetition, are counted separately. Functional disfluencies (OD, Yairi & Ambrose, 1999) are also identified and classified by watching and listening to the recording repeatedly, using the visual presentation of spoken language presented by the CLAN-program. OD were defined as interjections, polysyllabic-word repetitions, phrase repetitions, sentence-corrections and revisions.

Pauses were classified in three different categories using Goldman-Eisler's scheme (1961): Filled pauses at conventional loci (e.g. beginning of a phrase); filled pauses at times when they are not expected or conventional, and silent pauses. Conventional pauses were defined according to Starkweather (1987) as OD based on their functional value. Unconventional filled pauses and silent pauses were both defined as SLD. The pauses are identified and classified like the other disfluencies. The duration of all disfluencies including the pauses is determined by using the CLAN-program. This is done by listening to the recording repeatedly and watching the visualised sound-file simultaneously. The utterance is marked and thereby defined in the sound-file. The onset and ending of the disfluencies is determined by means of clear visible and audible changes (see Figure 1). Inter-rater reliability has to be confirmed. The analysis of the duration was chosen to gain information about the functional character of OD, including conventional filled pauses.

3. Results

The results of one session of a stuttering child and her non-stuttering peer is presented. The stuttering child (S) was aged 2,9 years, the post-onset interval of stuttering was 8,1 month. The child did not receive speech-language therapy for stuttering. Her SSI-score was 20. She had good speech and language skills, and the following results in the K-ABC test: Sequential Processing 91, Simultaneous Processing 94, Mental Processing Composite 93 and Achievement 101. The non-stuttering peer (NS) was 2,8 years old. Her SSI-score was 0. She had moderate speech and language skills, and the following results in the K-ABC test: Sequential Processing 94, Simultaneous Processing 96, Mental Processing Composite 95 and Achievement 100.

506 syllables of S and 501 syllables of NS were analysed. The total number of disfluencies was 114 for S and 21 for NS. S had a speaking rate of 2,1 syllables per second and NS had a speaking rate of 2,9 syllables per second. Ratio of syllables per utterance were 5,3 (SD = 2,7) in the speech of S and 2,8 (SD = 1,8) in the speech of NS.

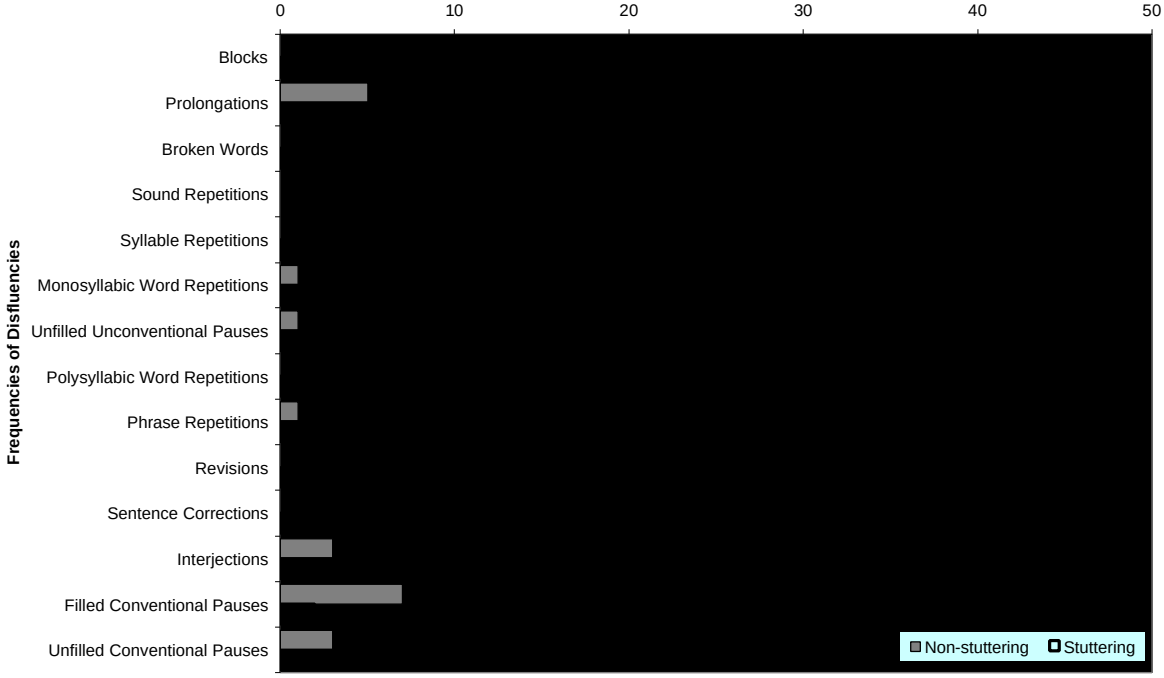

Figure 1 shows the frequency of disfluencies in the Speech of S and NS.

S shows more disfluencies in both categories (114 compared to 21 disfluencies for NS). NS neither shows all types of SLD nor does she show all types of OD. Of all disfluencies, prolongations have the highest frequency in S with 37%. An important type of disfluencies in both children are the conventional unfilled pauses (21% of all disfluencies for S, 14% for NS).

In both children the proportion of the duration for disfluencies in both categories is similar to the proportion of the frequencies for these types of disfluencies. In the speech of S, unfilled conventional pauses have a larger proportion of speech time (26%) than frequency (33%). The proportion of time is reduced for prolongations (26%) compared to the proportion of frequency (37%). In the speech of NS the proportion of duration (13%) is reduced for prolongations compared to their frequency (23%) as well. The proportion of time for all other types of disfluencies are within 5% of their frequencies. The proportion of all disfluencies in the total speech time is 26% in the speech of S (SLD = 16%, OD = 10 %) and 6% in the speech of NS (SLD = 2%, OD = 4%).

4. Discussion

As Johnson and other researchers stated before, both categories of disfluencies were found in the speech of the stuttering and non-stuttering child. The high amount of SLD in the stuttering child is not surprising because it is a required condition for the diagnosis of stuttering. The analysis shows that the stuttering child has a lack of filled pauses and interjections in the category OD, compared to the non-stuttering peer. Starkweather (1987) states that pauses are a tool to help organising the speech planning process, especially in utterances with several phrases. This analysis does not yet pay attention to the mean length of utterances (MLU). For the interpretation of occurrence of pauses it could be helpful to take linguistic aspects like the MLU into account. The small amount of OD in the non-stuttering child cannot be explained so far. We suspect a connection of OD and MLU. Further investigation may provide answers to this question.

The exemplary data presented here does not show that stuttering children have a smaller proportion of OD in their speech time. By investigating 48 children in the described study, we will obtain information about the occurrence of OD in stuttering and non-stuttering children, which can be tested statistically to validate our hypotheses. The development of disfluent speech is of special interest when comparing stuttering and non-

stuttering children and different age-groups. These findings might help to find prognostic factors in the remission of stuttering children.

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