ELSEVIER

Journal of Fluency Disorders 31 (2006) 165–176

Journal of FLUENCY DISORDERS

Disfluency data of German preschool children who stutter and comparison children

Ulrich Natke *, Patricia Sandrieser, Reinhard Pietrowsky, Karl Theodor Kalveram

Institute of Experimental Psychology, Heinrich-Heine-University Düsseldorf, Universitätsstr. 1, 40225 Düsseldorf, Germany

Received 19 November 2005; received in revised form 17 April 2006; accepted 18 April 2006

Abstract

This study compared the disfluencies of German-speaking preschool children who stutter (CWS, $N = 24$) with those produced by age- and sex-matched comparison children who do not stutter (CWNS, $N = 24$). In accordance with Yairi and Ambrose's [Yairi, E., & Ambrose, N. (1992). A longitudinal study of stuttering in children: A preliminary report. *Journal of Speech and Hearing Research*, *35*, 755–760] guidelines the CWS group had a narrow age range (2–5 years) and were seen close to the reported time of their stuttering onset (average of 8 months). Furthermore, over 95% of the CWS group had not received any type of speech therapy intervention. Consistent with previous findings for English-speaking preschool children, 'stuttering-like' disfluencies (prolongations, blocks, part- and one-syllable word repetitions) were significantly more frequent in CWS (mean = 9.2%) than in CWNS (mean = 1.2%), whereas no significant group differences occurred with respect to 'normal' disfluencies. The number of iterations in stuttering-like disfluencies was also significantly higher in CWS (mean = 1.28 iterations) than in CWNS (mean = 1.09 iterations). In contrast to previous findings, a sub-group of children who have been stuttering for a shorter time (1–5 months) did not differ from a sub-group who had stuttered for a longer period (8–22 months).

Educational objectives: The reader will be able to: (1) describe how German-speaking preschool children who stutter and who do not stutter display stuttering-like and normal disfluencies including number of iterations; (2) explain how powerful classification measures for the diagnosis of stuttering are for German-speaking preschool children; (3) discuss how disfluency patterns of native English- and German-speaking children close to onset of stuttering differ.

Keywords: Stuttering; Childhood; Diagnosis; Disfluency

* Corresponding author. Tel.: +49 2137 929471.
E-mail address: ulrich@natke.info (U. Natke).

0094-730X/$ – see front matter © 2006 Published by Elsevier Inc.
doi:10.1016/j.jfludis.2006.04.002

1. Introduction

Recently research into stuttering has focused on the analysis of disfluency data of young children close to the reported onset of stuttering (Ambrose & Yairi, 1999; Mansson, 2000; Niermann Throneburg & Yairi, 2001; Pellowski & Conture, 2002; Yairi & Ambrose, 2004). This is also the case in Germany where Rommel and co-workers have reported their results from data of 71 children with a mean age of 5 years (Rommel, 2004; Rommel, Häge, Kalehne, & Johannsen, 2000). There is, however, a need for data from even younger native German-speaking children who stutter (CWS) as well as age-matched comparison children (CWNS) to investigate processes and patterns that operate at the time of stuttering onset. The present study aims to bridge this gap.

Yairi and Ambrose (1992) provided guidelines for studies of this age group which are now considered to be the 'gold standard' in this line of investigation. Recommendations included large sample sizes, data collection should whenever possible take place at two different time points per child, and the overall group's age range should be narrow, that is, from 2 to 5 years only. They also highlighted that the initial visit should take place as close to stuttering onset as possible. This is important for two reasons; first, it can be assumed that at such an early time secondary symptoms are less frequent when compared to older children and adults who stutter. It is also the case that these children had little or no clinical intervention which means that the influences of techniques acquired through speech therapy are kept to a minimum. Consequently, this provides the opportunity to study the core symptoms unbiased by secondary characteristics. Since secondary symptoms are primarily involved in the maintenance of the core features, such an age group could provide valuable insights into the cause of disfluencies. Second, the analysis of data, collected as close to the onset of stuttering as possible, could demonstrate how early stuttering differs from normal disfluency, which might lead to earlier and more precise diagnoses.

Ambrose and Yairi (1999) also developed a weighted measure for stuttering-like disfluencies for this purpose. This measure consists of the weighted sum of part- and one-syllable word repetitions and disrhythmic phonation per 100 syllables. Within this calculation, repetitive disfluencies are multiplied by the mean number of iterations, and disrhythmic phonations are multiplied by the constant 2 (which is a medium factor for the weight or duration—cf. Ambrose & Yairi, 1999, p. 899). The factors, therefore, are used as an indication of the severity of individual stuttering events. Using this measure with a cut-off of 4%, all children (90 CWS and 54 CWNS) were correctly assigned to their respective fluency groups. This group separation, however, was influenced by the stringent selection criteria which specifically excluded children whose speech was judged by their parents to be borderline stuttering. Those CWNS with more than 3 stuttering-like disfluencies (SLD) per 100 syllables or CWS with fewer than 3 SLD were also excluded. Presumably this created a greater division between the resulting two groups than that which is present in the wider population.

For English, Pellowski and Conture (2002) calculated both the weighted and unweighted (that is number of SLD per 100 syllables) SLD of 36 CWS and 36 CWNS. Using a cut-off of 4% for the weighted and 3% for the unweighted SLD measures, 97% of the children were correctly classified. Comparable weighted and unweighted SLD norms have not yet been established for German-speaking children. Pellowski and Conture also investigated time-related variations in disfluencies by analyzing the relationship between time since stuttering onset (TSO) and measures of disfluencies. Their results showed that increases in time since stuttering onset were associated with increases in percentage of stuttering-like disfluencies. Moreover, they reported that 4-year-old CWS showed a positive correlation between TSO and the percentage of disrhythmic phonation. These findings can be interpreted as evidence for a change in the pattern of disfluencies at an early stage of stuttering, considering TSO aims to establish if changes are related to age per se, or to the time elapsed since the onset of stuttering.

In the majority of previous studies only mean disfluency rates are reported without a breakdown of percentages of different disfluency types. Important patterns in the data might be missed if disfluencies are not divided into sub-categories. The present paper reports part of the findings of the first study of German-speaking preschool children who stutter and age-matched comparison children.[1] The purpose of the paper is to: (i) allow a comparison between native English- and German-speaking children close to the onset of stuttering with respect to disfluency patterns and (ii) compare two sub-groups of children who have stuttered for differing lengths of time. The latter can give some insight into developmental patterns at an early stage of stuttering. On a more general level this study relates to a series of projects aimed at widening understanding of early childhood disfluencies and the investigation of possible processes leading to these.

2. Method

2.1. Participants

The experimental group consisted of 24 children who stutter (13 boys and 11 girls), and an age- and sex-matched control group of 24 normally fluent children. The children were recruited by either speech–language clinicians or via short articles announcing the study in local newspapers. All children met the following criteria: (1) age 5 years or younger, (2) native speakers of German (four of which were brought up with a second language: one Russian, two Croatian, and one Swedish), (3) no known or reported hearing, neurological, developmental, intellectual, or emotional problems, and (4) no formal treatment for any other speech or language disorder other than stuttering. Additionally CWS met the following criteria: (a) reported by parents as having a stuttering problem and (b) diagnosed by the second author (PS, who is a qualified speech–language clinician with extensive experience in fluency disorders) as having a stuttering problem. The diagnosis was based on the observation of stuttering-like disfluencies, in particular when associated with escape responses or avoidance behavior (Van Riper, 1971). However, no minimum frequency of SLD was set as a criterion. Furthermore, the parents were asked whether they had observed any escape or avoidance behaviors in the past. CWNS met the following additional criteria: (a) reported by their parents as having no history of stuttering and (b) diagnosed by the second author as not exhibiting stuttering. Again, no criterion in terms of a certain frequency level of SLD was set for CWNS. Children of the control group were primarily playmates or kindergarten-peers of CWS, but not siblings. It was not an explicit criterion that there had been no formal treatment for stuttering; however, only one CWS had received treatment. This child was not excluded from the study.

Table 1 presents detailed information about age at recording for CWS and CWNS, age at onset of stuttering, and time since stuttering onset as reported by the parents. Twelve CWS were tested within 6 months, six CWS within 12 months, and the remaining six CWS within 22 months of stuttering onset. There was a natural gap in the TSO data between 5.2 and 8.1 months; therefore,

[1] Further aspects studied as part of the same research project are: the analysis of aspects of linguistic stress, within-word position, and grammatical word class in relation to stuttering-like disfluencies (Natke, Sandrieser, van Ark, Pietrowsky, & Kalveram, 2004); the characteristic features of one-syllable word repetitions (van Ark, Sandrieser, Natke, Pietrowsky, & Kalveram, 2004), examination of the realizations of linguistic stress (Natke et al., 2004), and temporal aspects of disfluencies (Sandrieser, Natke, van Ark, Pietrowsky, & Kalveram, 2004).

Table 1
Age at recording, age at stuttering onset, and time since stuttering onset (TSO) for children who stutter (CWS) and mean age at recording for those who do not stutter (CWNS) in months (means and standard deviations)

Group	*N*	Age at recording		Age at stuttering onset		Time since onset (TSO)	
		M (S.D.)	Range	*M* (S.D.)	Range	*M* (S.D.)	Range
CWS							
TSO < 6	12	40.6 (9.2)	25–60	36.8 (8.4)	24–56	3.3 (1.4)	1–5
TSO > 6	12	45.5 (8.0)	34–58	31.7 (7.0)	26–48	13.4 (4.4)	8–22
Total	24	43.1 (8.8)	25–60	34.2 (8.0)	24–56	8.3 (6.0)	1–22
CWNS	24	43.3 (8.4)	26–62				

The CWS group is divided in children with time since stuttering onset lower than 6 months (TSO < 6) and higher than 6 months (TSO > 6).

6 months was chosen to divide the CWS into two groups, with time since stuttering onset below or above 6 months. The TSO < 6 group consisted of seven boys and five girls, the TSO > 6 group consisted of six boys and six girls. Age at recording for the TSO < 6 group was, on average, 4.9 months lower than that of the TSO > 6 group. However, there is a significant positive correlation between age at recording and time since stuttering onset ($r = .48$, $p = .009$), which is similar to the correlation found by Yaruss, LaSalle, and Conture (1998) and Pellowski and Conture (2002).

2.2. Data collection

Each child was videotaped in two play sessions in a research laboratory at the University of Düsseldorf. The session took place with both the child and a researcher (the second author) seated at a table, usually in the presence of a parent (who was instructed not to actively engage in playing). Child and researcher were playing with age-appropriate toys (e.g. building blocks and animals). A clip-on microphone (MKE 2-1053, Sennheiser) was attached to the child's clothing at chest level to ensure high quality audio signal recording. The audio signal was digitally recorded (sampling frequency: 22,050 Hz, sampling resolution: 16 bits). The video recording was focused on the child's head and also showed the arms and upper torso. Another research team member watched the recording on a monitor and supervised camera focus and counted syllables spoken by the child. After a minimum of 600 spoken syllables the play situation would be terminated. Usually this occurred within 45 min. After the play session, other tests were conducted including oral-motoric and syntactic-morphologic state, speech and language performance, intellectual abilities, and non-verbal skills (results of these measures will be presented elsewhere). A typical session lasted about 90 min. Speech samples were collected in two sessions 1 week apart (at the same time each day) to reduce the effects of fluctuations in stuttering frequency.

2.3. Data analysis

2.3.1. Transcription

Speech samples were transcribed orthographically and analyzed using the computer program CLAN (MacWhinney, 2000), where a special post-coding system for disfluencies was added, as was done previously by Bernstein Ratner, Rooney, and MacWhinney (1996). Unintelligible utterances, as well as isolated affirmatives ('yes' and 'okay') and negatives ('no'), which are generally produced fluently, were not included. In order to avoid warming up effects at the beginning of the session, the first 100 syllables of each speech sample were excluded from disfluency analysis. Each resulting speech sample consisted of at least 500 syllables, giving a minimum of 1000 syllables for each child over two sessions ($M = 1025.5$, S.D. = 14.1).

2.3.2. Disfluency analysis

Disfluencies were identified by repeatedly listening to the speech recording. Video recordings were consulted in cases where a clear decision could not be reached. The post-coding system was used to identify specific characteristics of the disfluency itself and the affected syllables and words. The following five types of disfluencies were defined: prolongations, blocks, and repetitions of sounds, syllables, and one-syllable words. These five types were grouped as SLD (Yairi, 1997).[2] Furthermore, multi-syllable word repetitions, phrase repetitions, interjections, revisions, and interrupted utterances were defined and combined as other disfluencies (OD). Each code was positioned directly after the affected syllable, word, or phrase. For repetitive disfluency types, the number of iterations was also coded. If multiple disfluency events occurred, each one was coded and counted separately.

2.3.3. Statistical analysis

Percentages for each disfluency type (related to the number of syllables) and the number of iterations were calculated for each participant and were used to derive group means. A syllable-based metric was used because it reflects the amount of speech affected by disfluency more accurately than a word-based metric (Yairi, 1997, pp. 51–52). Both metrics, however, are closely related to each other: Yaruss (2000) showed that in 3–5-year-old children word counts can be converted to syllable counts by multiplying the latter by 1.15. Disfluency analyses were carried out by the first and the second authors, both experienced researchers in fluency disorders. In order to test inter-judge reliability 18 of the total of 48 speech samples were randomly selected and analyzed by both judges. Wilcoxon-signed-rank-tests revealed that the differences between the mean frequencies of SLD ($Z = -.568$; $n = 18$; $p = .570$) and OD ($Z = -.540$; $n = 18$; $p = .589$) were not significant. Pearson's coefficient of correlation between the scores of both judges was .99 for SLD, and .93 for OD, which is commonly regarded as sufficient.

Statistical analysis was carried out using the non-parametric two-tailed Mann–Whitney *U*-tests for comparisons between groups. Due to multiple comparisons the significance level was adjusted using the Bonferroni correction.

3. Results

3.1. Disfluency data

Table 2 shows the disfluency data for CWS and CWNS. CWS were further divided into the TSO < 6 and >6 groups. The categories part-word repetitions and disrhythmic phonation (cf. footnote 2) were added to allow comparisons with the data of Yairi and Ambrose (2004).

CWS as well as CWNS showed all types of SLD. However, the frequencies differ between groups. All types of SLD, as well as grouped SLD, were shown more frequently by CWS than

[2] Yairi and Ambrose's SLD include part-word repetitions (sound and syllable repetitions) and disrhythmic phonation, which consists of prolongations, blocks, and broken words. In this study broken words such as 'o#pen' were categorized as blocks (within a word).

Table 2
Mean (standard deviation) for percentage of disfluency, number of iterations for CWS and CWNS groups

Type	CWS						CWNS	
	TSO < 6		TSO > 6		Total		*M* [%]	Iterations
	M [%]	Iterations	*M* [%]	Iterations	*M* [%]	Iterations		
SLD								
Blocks	.68 (.61)		.84 (1.04)		.76 (.84)		.04 (.06)	
Prolongations	2.21 (1.21)		2.40 (2.70)		2.31 (2.05)		.24 (.17)	
Disrhythmic phonation[a]	*2.89 (1.36)*		*3.24 (3.15)*		*3.06 (2.38)*		*.28 (.18)*	
Sound repetitions	1.63 (1.24)	1.26 (.25)	1.36 (.80)	1.19 (.18)	1.48 (1.02)	1.23 (.22)	.21 (.18)	1.06 (.22)
Syllable repetitions	2.20 (1.53)	1.34 (.39)	2.08 (2.27)	1.28 (.24)	2.15 (1.91)	1.31 (.31)	.14 (.13)	1.02 (.08)
Part-word repetitions[a]	*3.83 (2.70)*	*1.31 (.28)*	*3.44 (2.74)*	*1.25 (.19)*	*3.64 (2.67)*	*1.28 (.24)*	*.34 (.24)*	*1.04 (.17)*
One-syllable word repetitions	2.60 (1.21)	1.31 (.22)	2.44 (2.29)	1.29 (.30)	2.52 (1.80)	1.30 (.26)	.54 (.48)	1.16 (.24)
Total SLD	**9.32 (3.91)**		**9.12 (6.82)**		**9.22 (5.44)**		**1.16 (.68)**	
OD								
Multi-syllable word repetitions	.29 (.25)	1.09 (.15)	.37 (.90)	1.14 (.35)	.33 (.65)	1.11 (.25)	.09 (.11)	1.05 (.15)
Phrase repetitions	.38 (.18)	1.09 (.20)	.30 (.30)	1.06 (.15)	.34 (.24)	1.08 (.18)	.32 (.29)	1.05 (.22)
Interjections	.87 (.91)		.78 (.79)		.82 (.83)		.74 (.58)	
Revisions	.94 (.33)		.99 (.53)		.96 (.43)		1.32 (.70)	
Interrupted utterances	.15 (.13)		.26 (.25)		.20 (.20)		.12 (.11)	
Total OD	**2.63 (1.32)**		**2.70 (1.36)**		**2.66 (1.31)**		**2.59 (1.14)**	

SLD: stuttering-like disfluencies; OD: other disfluencies; TSO: time since stuttering onset.
[a] Disrhythmic phonation (corresponds to blocks and prolongations in this study) and part-word repetitions (corresponds to sound and syllable repetitions) were added according to Yairi and Ambrose (2004) (cf. footnote 2).

by CWNS (all p-values < .001). For OD, however, there are no differences between the groups, with the exception of multi-syllable word repetitions, where there is a tendency for them to be shown more frequently by CWS than by CWNS ($Z = -2.385$, $p = .017$, adjusted significance level .0042).

Examination of the different disfluency types within the CWS group indicated that blocks were shown least frequently, but there were no large differences between the percentages of the other types of SLD. With regard to OD, interjections and revisions were shown most frequently by both groups, whereas other types were rare. There are no significant differences between the TSO < 6 and >6 groups in the frequencies of any types of SLD and OD (all p-values above .13).

3.2. Iterations

Table 2 also shows the mean number of iterations in repetitive disfluency types. This number is by definition greater than 1. Repetitions with high numbers of iterations are rare, so all means, especially in CWNS, are close to 1. For CWNS, repetitive disfluency usually has one iteration.

CWS show a significantly higher number of iterations than CWNS in SLD repetitive disfluencies (sound, syllable, and one-syllable word repetitions) with p-values < .009. OD repetitive disfluencies (phrase and multi-syllable word repetitions) did not differ significantly in the number of iterations (p-values above .28) between CWS and CWNS. The number of iterations did not differ between the TSO < 6 and >6 groups (p-values above .48) for any of the repetitive disfluency types.

3.3. Classification measures

Fig. 1 shows the mean frequency of SLD for each child. The cut-off of 3% (unweighted SLD measure) used by Pellowski and Conture (2002) is plotted as a dashed line. Two CWS are below 3%, one CWNS is above this cut-off. This means that 93.75% can be classified correctly with a SLD cut-off of 3%. For our data, a cut-off of 2.4% would be most selective (one child in each group being classified incorrectly).

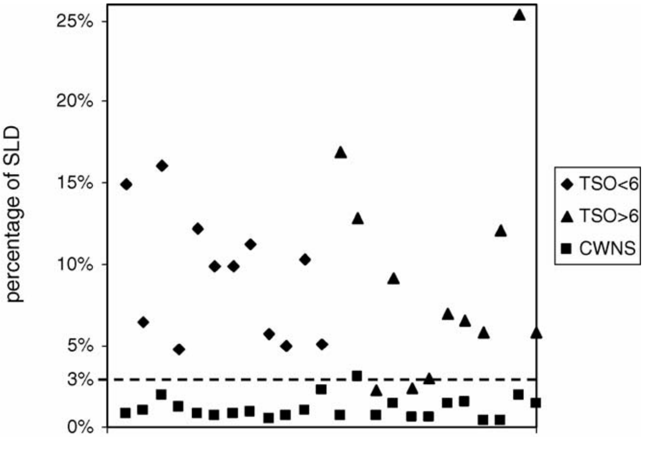

Fig. 1. Individual percentages of stuttering-like disfluencies (SLD). CWS: children who stutter; CWNS: children who do not stutter. The CWS and CWNS with the same x-values are age- and sex-matched. One CWNS is above 3% and two CWS below, which means that 93.75% of all children can be correctly identified with the 3% cut-off.

Both mis-classified CWS are girls and belong to the TSO > 6 group (CWS 1: age 4.9 years, TSO = 9.7 months; CWS 2: age 3.1 years, TSO = 11.5 months). Both children who stutter showed predominantly one-syllable word repetitions, plus part-word repetitions and prolongations, but no blocks. In the first child we observed struggling behavior in terms of tensed facial muscles. The children had not received treatment for stuttering and did not have a second language. The parents of both children reported that they spoke more fluently in the recording sessions than they usually do. The mis-classified CWNS is a boy of age 2.1 years, who did not have a second language. The child showed predominantly one-syllable word repetitions and a few of all other SLDs.

A weighted SLD measure was additionally calculated according to Ambrose and Yairi (1999). With a cut-off of 4% of the weighted SLD measure, three CWS are below the cut-off and no CWNS above.

4. Discussion

The aim of this investigation was to compare disfluency data of children who stutter with those who do not stutter. The guidelines of sufficiently long speech samples (a minimum of 1000 syllables), a narrow age range between 2 and 5 years, and proximity to stuttering onset were adhered to. Only one child had received therapeutic intervention for his stuttering, so almost all data were unbiased by therapeutic intervention.

Consistent with findings recently reported for English-speaking children of this age group (Ambrose & Yairi, 1999; Pellowski & Conture, 2002), results show that the specific types of disfluencies for CWS and CWNS differ significantly even at a very early stage. All disfluency types classified as SLD are produced significantly more often by children who stutter than by children who do not stutter. In other disfluencies, the groups do not differ (multi-syllable repetitions may represent an exception). There is no disfluency type which is shown exclusively by one group. However, SLD are very rare in CWNS.

Repetitive stuttering-like disfluencies shown by both groups differed not only in frequency but also in number of iterations. CWS repeat these disfluencies more often than CWNS—a finding previously observed by Yairi and Hall (1993) and by Ambrose and Yairi (1999). The latter also showed that pause durations between iterations of one-syllable words are shorter in CWS than in CWNS (consistent with findings of Niermann Throneburg & Yairi, 1994; van Ark et al., 2004). However, frequencies of, and pauses within, repetitive disfluencies did not differ to such a degree between CWS and CWNS that they could be applicable in clinical diagnostic practice. Though there were cases with up to 10 iterations in CWS, which did not appear in the CWNS group, 1 iteration is most common. This implies that ranges or upper limits are more informative than means in this context. Nevertheless, results indicate that different causal mechanisms might underlie one-syllable word repetitions shown by CWS and CWNS, indicating types of ‘stuttered’ and ‘normal’ repetitions.

The comparison of the frequencies of disfluency types between English- and German-speaking CWS leads to interesting similarities as well as differences. Yairi and Ambrose (2004, p. 335) have provided updated data from previous publications. CWS in their study were within the same age range as those in the current study, but the children in the present sample were on average about 6 months older. When comparing the two data sets, part-word repetitions occurred most frequently in both studies. For the English-speaking children, the second and third most frequent disfluency types were one-syllable word repetitions and disrhythmic phonation, respectively. For the German-speaking children, this pattern was reversed. The difference between part-word repetitions and the other disfluency types is larger for the English samples than in the German samples. The overall frequency of SLDs from the English samples is higher (11%, range 3–40%) than those produced by the German-speaking children (9.2%, range 2–25%), but presumably this difference would not be statistically significant. The results remain even when only those German-speaking children who stuttered for less than 6 months are compared (this time period is more consistent with the English-speaking group). The higher total frequency of disfluencies in the English sample was mainly due to more part-word repetitions. There is an even larger difference in those types classified as other disfluencies. English-speaking children showed 6.0%, whereas German-speaking children only produced these disfluencies with a frequency of 2.6%. The definition of this category of disfluency type is identical for both languages. One possibility is that these differences are due to linguistic effects. However, the English results by Yairi and Ambrose's group were derived from a much larger group of children who stutter than those presented here. Since this type of research strategy has only just commenced in Germany, a larger group of German-speaking children who stutter is needed to make more direct comparison to the English results possible.

The study was also used to test diagnostic classification measures. Children were originally grouped according to parental report and the diagnosis of a speech language therapist. Children considered to be borderline cases of stuttering were not excluded. A cut-off of 3% SLD was shown to be a powerful measure for the diagnosis of stuttering. More than 93% of the children could be classified correctly into their fluency group. This cut-off is the same as that used by Pellowski and Conture (2002) for English-speaking children. This is a remarkable similarity between stuttering in English and German. The weighted measure proposed by Ambrose and Yairi (1999) did not lead to an improved classification. Using the weighted measure, the same total number of children were classified incorrectly. However, the effect was that one child was correctly classified as a child who does not stutter, whereas another child who stuttered was incorrectly grouped as not stuttering. From a clinical perspective, this is undesirable, since it is better to wrongly classify a non-stuttering child as a child who stutters than vice versa.

Our data thus show for the first time that for German-speaking preschool children the unweighted measure consisting of a 3% SLD cut-off is an effective and appropriate diagnostic measure. It should be noted that in the diagnostic process not only quantitative measures but also supplementary information by parents should be considered. This is primarily due to the variability of stuttering frequency. It should be established whether the number of disfluencies in a particular assessment session is representative for an individual child (this was presumably not the case in the two mis-classified CWS as reported by their parents). Another aspect to consider is avoidance behavior. If children use avoidance strategies, it might mean that their stuttering rate would stay low, whereas disfluencies would be more frequent without such a strategy. As such, the 3% cut-off is useful but certainly not sufficient in its diagnosis.

The comparison within the CWS group, according to the time since stuttering onset (<6 months and >6 months), showed no differences, either in the number of SLDs or ODs or in the number of iterations. In contrast to Pellowski and Conture's (2002) results the data reported here do not show evidence of a developmental pattern in the early stages of stuttering. However, a longitudinal 2 year analysis with a subgroup (from the current study) of 13 children who stutter revealed that for all children the percentage of SLD decreased over time. This was true not only for children who were in remission but also for those whose stuttering persisted (Bendels, 2004). Therefore, it cannot be assumed that those who continue to stutter would do so with increasing frequency.

Overall results are consistent with the statements of Ambrose and Yairi (1999), that "very early stuttering is distinct from normal disfluency" and therefore "it cannot be said that all children go through at least a brief period of 'stuttering"' (p. 906). Stuttering is distinctly different from normal speech (even at an early age) and can be clearly diagnosed in the majority of cases. The opinion that stuttering constitutes a common phase in normal language development is not supported by the data reported here. This popular belief is reflected in Germany in the terminology used in the language development literature, such as ‘Entwicklungsstottern’ or ‘physiologisches Stottern’, words that describe stuttering as a normal phase in the process of typical language acquisition, a view that should not be promoted further. It is generally known that the probability of remission of stuttering in childhood is high. However, this does not mean that non-persistent stuttering was not stuttering in the first instance. To understand stuttering from a life span perspective there has to be a clear differentiation between diagnosis and development (remission or persistence). Therefore, to classify stuttering as a normal phase in language acquisition due to the high spontaneous recovery rates is not a helpful approach. Diagnosis, on the other hand, should be independent of whether therapy should be considered, as diagnosis is not necessarily an indication that therapy is required. However, the diagnosis should be considered as an opportunity to discuss possible treatment options with the individual client, regardless of his or her age.

Acknowledgments

This research was supported by grant Ka 417/28-2 of the Deutsche Forschungsgemeinschaft (DFG). We want to thank Anette Brechtel, Anna Joschko, Melanie van Ark, and Claas P. Bendels who helped running the investigation as well as Katharina Dworzynski for her help with the translation of this article.

CONTINUING EDUCATION

Disfluency data of German preschool children who stutter and comparison children

QUESTIONS

1. Why should the initial visit of children take place as close to stuttering onset as possible?
   a. secondary symptoms are less frequent, compared to older children and adults who stutter, so the core symptoms can be studied less biased by secondary symptoms
   b. the development of secondary symptoms can be studied
   c. children had little or no clinical intervention which means that the influences of techniques acquired through speech therapy are kept to a minimum
   d. children should in any case receive speech therapy as early as possible
   e. one should await until the child is 5 years old, because before this age you cannot be sure that the child really is stuttering
2. Which of the following is true for the occurrence of stuttering-like and normal disfluencies in children who stutter (CWS) and children who do not stutter (CWNS)?
   a. CWS show only stuttering-like disfluencies, CWNS show only normal disfluencies
   b. CWS show less normal disfluencies than CWNS
   c. CWS and CWNS show stuttering-like as well as normal disfluencies
   d. CWS show considerably more stuttering-like disfluencies than CWNS
   e. CWS and CWNS show normal disfluencies with approximately the same frequency
3. How do CWS and CWNS differ regarding the number of iterations of repetitive disfluencies?
   a. the number of iterations of repetitive stuttering-like disfluencies is higher in CWS than in CWNS

b. the number of iterations of repetitive stuttering-like disfluencies does not differ between CWS and CWNS
c. the number of iterations of repetitive disfluencies (stuttering-like and normal) is higher in CWS than in CWNS
d. the number of iterations of repetitive normal disfluencies is higher in CWNS than in CWS
e. the number of iterations of repetitive normal disfluencies does not differ between CWS and CWNS

4. How do classification measures help in the diagnosis of stuttering?
   a. with a cut-off of 3% stuttering-like disfluencies one could classify more than 90% of all children correctly as stuttering or non-stuttering
   b. a cut-off of 3% stuttering-like disfluencies is sufficient for all children for the diagnosis of stuttering
   c. because of variability of stuttering frequency and avoidance behavior, frequency of stuttering-like disfluencies is not sufficient for the diagnosis of stuttering
   d. a weighted measure (part- and one-syllable word repetitions per 100 syllables multiplied by the mean number of repetition units plus disrythmic phonation per 100 syllables multiplied by mean duration) is considerably better in diagnosis of stuttering than an unweighted measure
   e. there is clear evidence that there is a need for different classification measures for the diagnosis of stuttering in different languages
5. Which of the following is true regarding the comparison between native English- and German-speaking children close to onset of stuttering with respect to disfluency patterns?
   a. in both languages part-word repetitions occur most frequently
   b. in both languages the ranking of disfluency types is identical
   c. the overall frequency of stuttering-like disfluencies is higher in German-speaking children than in English-speaking children
   d. the overall frequency of other disfluencies is higher in English-speaking children than in German-speaking children
   e. it is an open question whether differences in disfluency patterns are due to linguistic effects

References

Ambrose, N. G., & Yairi, E. (1999). Normative disfluency data for early childhood stuttering. *Journal of Speech, Language, and Hearing Research*, *42*, 895–909.

Bendels, C. P. (2004). *Entwicklungsverlauf von Sprechunflüssigkeiten bei Remission und Chronifizierung des Stotterns*. Unpublished diploma thesis. Heinrich-Heine-University Düsseldorf.

Bernstein Ratner, N., Rooney, B., & MacWhinney, B. (1996). Analysis of stuttering using CHILDES and CLAN. *Clinical Linguistics and Phonetics*, *10*, 169–187.

MacWhinney, B. (2000). *The CHILDES project: Tools for analyzing talk. Volume 1: Transcription format and programs. Volume 2: The database* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum.

Mansson, H. (2000). Childhood stuttering: Incidence and development. *Journal of Fluency Disorders*, *25*, 47–57.

Natke, U., Sandrieser, P., van Ark, M., Pietrowsky, R., & Kalveram, K. Th. (2004). Linguistic stress, within-word position, and grammatical class in relation to early childhood stuttering. *Journal of Fluency Disorders*, *29*, 109–122.

Niermann Throneburg, R., & Yairi, E. (1994). Temporal dynamics of repetitions during the early stage of childhood stuttering: An acoustic study. *Journal of Speech, Language, and Hearing Research*, *37*, 1067–1075.

Niermann Throneburg, R., & Yairi, E. (2001). Durational, proportionate, and absolute frequency characteristics of disfluencies: A longitudinal study regarding persistence and recovery. *Journal of Speech, Language, and Hearing Research*, *44*, 38–51.

Pellowski, M. W., & Conture, E. G. (2002). Characteristics of speech disfluency and stuttering behaviors in 3- and 4-year-old children. *Journal of Speech, Language, and Hearing Research*, *45*, 20–34.

Rommel, D. (2004). The influence of syntactic variables on the development of stuttering. In A. Packman, A. Meltzer, & H. F. M. Peters (Eds.), *Theory, research and therapy in fluency disorders. Proceedings of the 4th world congress on fluency disorders in Montreal, Canada* (pp. 406–414). Nijmegen: Nijmegen University Press.

Rommel, D., Häge, A., Kalehne, P., & Johannsen, H. S. (2000). Development, maintenance, and recovery of childhood stuttering: Prospective longitudinal data 3 years after first contact. In K. L. Baker, L. Rustin, & F. Cook (Eds.), *Proceedings of the fifth Oxford disfluency conference* (pp. 168–182).

Sandrieser, P., Natke, U., van Ark, M., Pietrowsky, R., & Kalveram, K. Th. (2004). A temporal analysis of disfluencies in children who stutter close to onset and controls. In A. Packman, A. Meltzer, & H. F. M. Peters (Eds.), *Theory, research and therapy in fluency disorders. Proceedings of the 4th world congress on fluency disorders in Montreal, Canada* (pp. 257–264). Nijmegen: Nijmegen University Press.

van Ark, M., Sandrieser, P., Natke, U., Pietrowsky, R., & Kalveram, K. Th. (2004). Characteristic features of single-syllable word repetitions in preschool children who stutter and controls. In A. Packman, A. Meltzer, & H. F. M. Peters (Eds.), *Theory, research and therapy in fluency disorders. Proceedings of the 4th world congress on fluency disorders in Montreal, Canada* (pp. 285–289). Nijmegen: Nijmegen University Press.

Van Riper, C. (1971). *The nature of stuttering*. Englewood Cliffs, NJ: Prentice-Hall.

Yairi, E. (1997). Disfluency characteristics of childhood stuttering. In R. F. Curlee & G. M. Siegel (Eds.), *Nature and treatment of stuttering* (pp. 49–78). Needham Heights, MA: Allyn and Bacon.

Yairi, E., & Ambrose, N. (1992). A longitudinal study of stuttering in children: A preliminary report. *Journal of Speech and Hearing Research*, *35*, 755–760.

Yairi, E., & Ambrose, N. (2004). *Early childhood stuttering for clinicians by clinicians*. Austin, TX: Pro-Ed.

Yairi, E., & Hall, K. D. (1993). Temporal relation within repetitions of preschool children near the onset of stuttering: A preliminary report. *Journal of Communication Disorders*, *26*, 231–244.

Yaruss, J. S. (2000). Converting between word and syllable counts in children's conversational speech samples. *Journal of Fluency Disorders*, *25*, 305–316.

Yaruss, J. S., LaSalle, L. R., & Conture, E. G. (1998). Evaluating stuttering in young children: Diagnostic data. *American Journal of Speech–language Pathology*, *7*, 62–76.

Ulrich Natke was born in Bremen, Germany. After studying mathematics he worked as a lecturer and researcher with special interest in fluency disorders at the Institute of Experimental Psychology of the Heinrich-Heine-University Düsseldorf. In 1999 he finished his doctoral dissertation about sensorimotor control of fluent and stuttered speech. Ulrich Natke is the author of a German monograph on stuttering. As a person who stutters he is also engaged in the fields of self-help, stuttering treatment, and evaluation of treatment outcomes.

Patricia Sandrieser was born in Stuttgart, Germany. After becoming "Logopädin" she studied "Lehr- und Forschungslogopädie" in Aachen and finished her diploma theses on qualitative characteristics of disfluencies in the speech of stuttering and non-stuttering children. She is first author of a book about therapy for children who stutter. From 2000 to 2003 Patricia Sandrieser worked in a research project at the Institute of Experimental Psychology of the Heinrich-Heine-University Düsseldorf on childhood stuttering. In 2004 she finished her doctoral dissertation about temporal features in the disfluencies of stuttering and non-stuttering children. Since 2005 she has been working at the Catholic Hospital of Koblenz as the head of the department "speech and language therapy".

Reinhard Pietrowsky has a full professorship in Clinical Psychology at the Heinrich-Heine-University Düsseldorf. His main fields of research are in eating and sleep disorders and in the biological foundations of psychological disturbances. He has training as a behavior therapist.

Karl Theodor Kalveram was trained at the Universities of Bonn and Marburg/Lahn. After having received the degree "Staatsexamen" in the subjects physics and mathematics, he studied psychology and obtained the diploma and doctoral degree. He was professor of psychology at the Philipps-University of Marburg, and Dean of the Faculty of Psychology. Since 1980 he is professor of psychology at the Heinrich-Heine-University Düsseldorf. Until 2000 he was the head of the section "Cybernetical Psychology and Psychobiology". His research includes sensorimotor control of limb movements, speech control in fluent and disfluent speakers, effects of acoustical noise on men, and modeling of individual–environmental interactions.