THE ROLE OF LANGUAGE FORMULATION IN DEVELOPMENTAL DISFLUENCY

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ABSTRACT

The disfluency patterns of two 2-year-olds are compared. In both children, disfluency shows an increase and a subsequent decline. In one of the children, disfluency is mild, in the other it is excessive. The excessively disfluent child shows many word part repetitions, and relatively few sentence incompletions. Moreover, most of his self repairs are phonologically motivated. In the other child, word- and word-string repetitions as well as sentence incompletions are more frequent, and a relatively large number of self repairs involve syntactic alterations. It is concluded that the disfluencies are related to phonological encoding in the excessively disfluent child, and to sentence planning in the mildly disfluent child.

1. INTRODUCTION

In most children speech fluency deteriorates temporarily between ages 2 and 3 [9], although there is considerable inter-individual variation in the extent of the problem. In some cases the child becomes a stutterer. Several studies have pointed at a connection between developmental disfluency and language development [4]. It is often argued that fluency decreases as a result of the increasing grammatical complexity of utterances, which poses progressive demands on the child's language production ability. In [6] I developed a specific version of this hypothesis: The *Development of the Formulator Hypothesis* (DFH).

The DFH starts from the observation that language development around age 2.5 is characterized by the transition from *telegraphic speech*, which lacks almost all function words and morpho-syntactic elements, to a morphosyntactically more mature level of language competence. The acquisition of closed-class elements and morpho-syntax necessitates the development of a component of the speech production mechanism that is dedicated to morpho-syntactic processing and serial order planning, which can be identified with the *positional planner* in Garrett's speech production model [1]. Due to the positional planner's initial lack of automaticity and imperfect co-ordination with other components in the speech production mechanism, speech planning will start to break down more often, which produces an increase of disfluency. Usually, however, speech fluency will be restored as the new system gets settled. More importantly, the DFH predicts that as the rate of disfluency rises, its distribution over sentence positions will change. Disfluencies will start to concentrate at loci in speech that coincide with moments at which the positional planner is highly active, viz. the onset of clauses and major constituents. This prediction was confirmed in a longitudinal case study. The subject in this study showed a disfluency peak at age 2;8. Before this age, disfluencies were distributed randomly over sentence positions. As of 2;8, however, they occurred predominantly at sentence onsets and phrase-initial function words.

The preliminary results of a second longitudinal case study, however, showed a different pattern [7]. Again, a significant and quite dramatic increase of disfluency was observed, followed by a decrease. However, the disfluencies were concentrated at sentence onsets from the beginning of the observation period onwards. Moreover, the subject appeared to be more advanced linguistically than would have been expected on the basis of the DFH. These results agree with the general observation that there are considerable inter-individual differences in the rate of language development. Furthermore they suggest that the developmental process underlying the disfluency episode in the second child cannot be the one described by the DFH. It is unclear as yet what other process may be responsible for the increase of disfluency in this child.

The primary aim of this paper is to contribute to the solution of this problem. To achieve this aim, I will present some new data with respect to differences between the patterns of disfluency in the two children mentioned before. I will try to corroborate the conclusion of [7], viz. that the disfluencies in the two subjects have different sources. Particularly, I will argue that disfluency in the second subject mentioned is primarily related to another component of language formulation, viz. *phonological encoding*, i.e., the unpacking of word form information from the mental lexicon [3]. In order to do so, I will make two assumptions. First, I will assume that a disfluency always results from a disturbance in the planning of an utterance segment that is yet to be uttered. The second assumption, which is based on Levelt's work on self-repairs [3], states that speakers avoid interrupting a word, unless it is a source of trouble itself. The corollary of these assumptions is that different types of disfluency may signal utterance planning problems at different levels. In particular, the repetition of an initial word fragment will predominantly signal problems in preparing the remaining parts of the word for articulation [8]. A word repetition, by contrast, would point at a planning difficulty with regard to some aspect of the subsequent sentence fragment.

2. METHOD

2.1. Subjects

The data in this study are derived from longitudinal language corpora of two Dutch boys, T and H. Both children were observed between ages 2;4 (years; months) and 3;0. Language development was assessed with the aid of *TARSP*, a Dutch adaptation of Crystal's *Language Acquisition, Remediation and Screening Procedure* [5]. TARSP divides the course of grammatical development into 7 phases. At age 2;4, T appeared to be a relatively backward Phase 3 child, whereas H was at an advanced Phase 4 level. This implies that T could produce sentences containing up to 3 constituents; he was not yet able to expand constituents into word groups and he had very limited morphology. H, on the other hand, could produce 4-constituent sentences, expand constituents into word groups and use some verbal and nominal inflections productively. To advance from Phase 3 to Phase 4, the average child needs about 5 to 6 months.

2.2. Recording and Transcription

The children's speech was recorded at home while interacting with their mothers. Roughly one hour of conversation was recorded per week. Apart from the literal content of the children's utterances, their phonetic structure was transcribed in places where this would clarify the interpretation of speech. The types of disfluency that were transcribed are *repetitions* (of word parts, words and word strings), *revisions*, *incomplete sentences*, *blocks* and *prolongations*, *word breaks*, and *senseless sound insertions*.

3. RESULTS

3.1. Disfluency Rates

At 2;4, T produces an average of 2.7 repetitions per 100 words. H is slightly more disfluent with an average of 4.2 repetitions per 100 words. In both children the repetition rate increases in the subsequent months. When disfluency is at its peak, at age 2;8, T is still very mildly disfluent, with an average of 4.5 repetitions per 100 words. H's repetition rate reaches a maximum of 29.5 repetitions per 100 words at age 2;7, which amply exceeds the normal limits. It may not come as a surprise that H's mother consulted a speech therapist, who nevertheless advised not to interfere. In both children disfluency rapidly declined. At age 3;0, T had 2.7 repetitions, and H 5.9 repetitions per 100 words. Both children are now normally fluent speakers.

3.2. Disfluency Types

In the remainder of the Results section, two segments of the observation period will be singled out, viz. the first month, around age 2;4, and a period of roughly one month around the time when disfluency was at its peak, corresponding to age 2;8 in T and 2;7 in H.

Table I shows a breakdown of the *repetitions* according to the size of the utterance fragment involved. Collapsed over both periods, T appears to have much more word and word-string repetitions than H. In H, on the other hand, the word-part repetitions are predominant. Ignoring the category of indeterminate repetitions, this difference reaches significance ($\chi^2 = 27.29$, df = 2, $p < .001$).

TABLE I. Distribution of repetition types in T and H. WST = Word string repetitions; WRD = word repetitions; W-P = word part repetitions; IND = indeterminate. Percentages in parentheses.

Corpus	*WST*	*WRD*	*W-P*	*IND*	*Total*
H 2;4	3	22	18	-	43
	(7)	(51.2)	(41.9)	(-)	(100)
H 2;7	4	48	165	16	233
	(1.7)	(20.6)	(70.8)	(6.9)	(100)
H Tot	7	70	183	16	276
	(2.5)	(25.4)	(66.3)	(5.8)	(100)
T 2;4	3	17	38	1	59
	(5.1)	(28.8)	(64.4)	(1.7)	(100)
T 2;8	14	61	46	-	121
	(11.6)	(50.4)	(38)	-	(100)
T Tot	17	78	84	1	180
	(9.4)	(43.3)	(46.7)	(0.6)	(100)

Note however that the developmental pattern differs between the two children. T shows a transition from a predominance of word-part repetitions to a predominance of word and word-string repetitions. By contrast, an opposite development can be witnessed in H. H's pattern accords with the 'classical' observation that repeated elements are progressively truncated in the developmental course of stuttering [4].

Under the assumptions made above, this finding suggests a difference in character of the planning difficulties underlying the observed discontinuities. In particular, it may be expected that H experiences more problems in constructing the phonological shape of words than T. A first, indirect piece of supportive evidence for this conjecture can be derived from a quantitative analysis of *sentence incompletions*. These disturbances can be considered to result from a failure at the level of sentence planning. If H's disfluencies are reflective of phonological encoding processes at word level, whereas T's discontinuities reflect sentence planning, one would expect less sentence incompletions in H than in T. This is precisely what Table II indicates. Collapsed over both periods, the ratio of incomplete to complete sentences is significantly lower in T than in H ($\chi^2 = 9$, df = 1, $p < .005$). An inspection of the figures in Table II suggests that this difference is primarily determined by the figures relating to the late periods.

TABLE II. Sentence incompletions (SI) and fully interpretable, non-interrupted sentences (NS)(≥ 1 word; *yes*'s and *no*'s excluded). Percentages in parentheses.

Corpus	*SI*	*NS*	*Total*
H 2;4	8	457	465
	(1.7)	(98.3)	(100)
H 2;7	16	295	311
	(5.1)	(94.9)	(100)
H Tot	24	752	776
	(3.1)	(96.9)	(100)
T 2;4	24	1284	1308
	(1.8)	(98.2)	(100)
T 2;8	127	1162	1289
	(9.9)	(90.1)	(100)
T Tot	151	2446	2597
	(5.8)	(94.2)	(100)

3.3. Self-Repairs

A final piece of evidence can be derived from an analysis of the kinds of *speech repairs* that are made by the subjects. Speech repairs involve the interruption of an ongoing utterance, some delay, and a retracing that encompasses an alteration of the original utterance [3]. According to the nature of the alteration the repairs were classified as *phonological*, *lexical*, or *syntactic*. It seems reasonable to expect that if a particular type of planning problem is predominant, the number of errors related to this problem that penetrates into overt speech, where they may be monitored and repaired, should also be relatively large. Table III shows the number of different types of repairs in T and H. It is clear that the distribution of repair types differs between subjects ($\chi^2 = 13.85$, df = 2, $p < .001$, disregarding the 'other' category). The difference is concentrated in the categories of phonological and syntactic repairs. Proportionally, H has approximately twice as many phonological repairs as T, whereas T has almost 9 times as many syntactic repairs as H. This outcome supports the previous conjecture that the sources of planning trouble underlying disfluency differ between T and

H.

TABLE III. Self repairs involving phonological (PHO), lexical (LEX), syntactic (SYN), and other (OTH) alterations. Percentages in parentheses.

Corpus	*PHO*	*LEX*	*SYN*	*OTH*	*Total*
H 2;4	12	4	-	-	16
	(75)	(25)	-	-	(100)
H 2;7	13	3	1	-	17
	(76.5)	(17.6)	(5.9)	-	(100)
H Tot	25	7	1	-	33
	(75.8)	(21.2)	(3)	-	(100)
T 2;4	12	5	4	1	22
	(54.5)	(22.7)	(18.2)	(4.5)	(100)
T 2;8	16	16	17	4	53
	(30.2)	(30.2)	(32.1)	(7.5)	(100)
T Tot	28	21	21	5	75
	(37.3)	(28)	(28)	(6.7)	(100)

4. DISCUSSION

The results presented here support the interpretations in [6] and [7]. There appears to be a difference between T and H regarding the origin of speech disfluency. T shows a prevalence of word and word string repetitions, a relatively large amount of sentence incompletions and a relatively high number of syntactic self-repairs. H, by contrast, shows mainly word-part repetitions; he has relatively few sentence incompletions and his repairs mainly involve phonological alterations. Consequently, T's disfluency seems to be mainly related to planning operations at sentence level, whereas H's disfluencies appear to be associated with the programming of word forms.

Of course it is sensible to entertain some reserve with respect to this interpretation, in view of the fact that it is to some extent based on assumptions which are, although they appear quite plausible, in need of external validation. This will be an issue in further research.

According to one of these assumptions, disfluency results from a breakdown of planning processes. Alternatively, it has been suggested that disfluencies reflect *covert* repair operations, i.e. self-repairs which precede articulation, by virtue of the speaker's ability to monitor so-called 'internal speech' [2, 3]. This hypothesis suggests an even closer relation between repetitions and (overt) self-repairs than is proposed here. The confrontation of these opposing views should also be a topic in further research.

It seems fair to conclude that the DFH is too narrow an explanation of developmental disfluency. Apart from sentence planning, phonological encoding may also be associated with childhood fluency problems, which accords with certain views on adult stuttering [8]. It remains to be clarified, however, what developmental process affecting phonological encoding is responsible for the *reduction* of fluency.

5. REFERENCES

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