DEVELOPMENT OF TEMPORAL PROPERTIES IN THE SPEECH OF ONE CHILD BETWEEN ONE AND THREE YEARS OF AGE

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1. INTRODUCTION

In the literature on early language development few data are found on the development of prosody, and especially few on the development of temporal properties of speech. The development of the timing of whole utterances of very young children has not been addressed. However, durational analyses of child speech can be appropriate to give information about the coordination of articulation at a certain age, and about developmental changes in articulation, possibly as a result of language development. In this paper we want to investigate what is happening in the temporal domain from the moment a child starts to speak 'words' with referential meaning until the moment at which the child has obtained the *essential* prosodic structures, which is supposed to happen at about the age of three (Konopczynski, 1975).

The general question raised in the present study is whether the coordination of articulation changes in relation to changes in the use of meaningful speech. It is supposed that durational properties of the speech will reflect these changes, and will show a relationship with the increasing grammatical difficulty of the speech used by the child and/or with other factors like the growing length of utterances.

Crystal (1986) hypothesizes that the early development of timing runs in the following way. First, the child uses independent single-element utterances with their own prosodic structures. Then single-element utterances are brought into relationship, retaining their prosodic autonomy, with the pause between them becoming reduced. The next step is the prosodic integration (at the age of about 1;6). Crystal remarks that this process of concatenation is not a simple one. Allen and Hawkins (1980) found that the speech rate of English pre-school children is very slow and lacks the adult speech rhythm. The early utterances of children should best be described as so called 'syllable-timed' (every syllable having equal prominence); they see it as the major task of the child to learn how to reduce the unstressed syllables in their speech. From the moment the child starts to use meaningful speech, it will use linguistically unstressed syllables (although it is not known whether the unstressed syllables are acoustically unstressed). The number of possibly unstressed syllables will sharply increase, at least for the so-called stress-timed languages, with the grammaticality of the language, introducing unstressed bound morphemes (e.g. the Dutch plural morpheme /ən/) and function words, like prepositions, articles and conjunctions. It seems reasonable to assume that this may have an effect on sentence planning, as well as on the temporal properties of speech. Van Bergem (1990) found that in adult Dutch speech word class and word stress have a clear influence on vowel duration. As an indication of a moment of change in sentence planning, Wijnen (1990) found for the two Dutch children he examined, a temporal increase in the production of disfluencies (hesitations, self-corrections, speech errors and the like) between the ages of 2;4 and 2;9. These disfluencies mostly occurred in function words and at the beginning of utterances.

Development of grammaticality may have an effect on the temporal organization of speech, but also the fact that the utterances get longer may be reflected in durations of syllables and phonemes. In adult speech, longer utterances are pronounced faster than

short ones (Malécot et al., 1972). It is not known whether this phenomenon also occurs in early child speech. It is possible that for children longer utterances simply mean that syllables are chained without shortening effects.
Summarizing, we hypothesize to find durational changes in the speech of a young child at the following moments in time:
1. When the child starts to use two-word utterances. It is assumed that pauses are introduced in speech at that moment. These pauses will get shorter and they will reduce in number when the child is accustomed to use more-word utterances.
2. When the child starts to use function words and morphologically complex structures which introduce unstressed syllables in his speech. It is assumed that mean syllable duration will gradually decrease, since the child learns to reduce unstressed syllables.
3. When the child starts to use longer utterances, measured in number of syllables. It is expected that shorter mean syllable durations will be found.

2. METHOD

2.1 Subject

One first-born boy (DH) was chosen as the subject of this study. From the moment the boy started to use 'words' (1;3), recordings were made every month at his home during two years. A normal birth history and a normal development were reported. His mother was the primary caregiver and she was at home with the child every day. The boy lived in the city of Utrecht during all but the last recordings, when his family had moved to a village near Amsterdam. The socio-economic status of his parents was high. At the age of two and a half his baby brother was born.

2.2 Procedure

The mother of DH was asked to contact us as soon as she was sure that the child had started to speak. This starting point had been defined as using three 'words' with referential meaning, except for mama "mommy" or papa "daddy". DH was one year and two months when this point was reached. From the next month onwards monthly recordings were made. The recordings took place in a free-play situation at the child's home. In nearly every recording session book-'reading' was involved. Both video and audio recordings were made. Video recordings were necessary to establish the context of an utterance. High-quality audio recordings were used for the acoustic analysis of the utterances. The audio recordings were made with a Marantz CP-430 cassette recorder and two Sennheizer MD21 microphones. Mother and child were always seated on the ground and the microphones were placed at a distance of about 50 cm in front of them.

2.3 Analyses of the data

From each recording, which lasted about one hour, twenty minutes of the mother-child conversation were transcribed. We decided that there had to be at least 100 utterances of the child in these twenty minutes.
The utterances of the child were analysed both pragmatically and acoustically. For the pragmatic analysis the video recordings were used. The classification of the utterances was based on the classification made by Flax (1986) and includes categories such as Commenting, Naming, Questioning, Giving, Getting Attention, and Answering a

Question. We tried to exclude intonational cues in categorizing utterances and looked at the context as much as possible.
The acoustic analysis consisted of an intonational and a temporal part. The results of the intonational part will be reported elsewhere. For the durational analysis, the total duration of an utterance was measured together with the duration of possible pauses within an utterance. Durational measurements were performed by means of a computer-based segmentation program with auditory feedback. A problem to be solved here was the formulation of a working definition for 'utterance'. It is not always possible to establish whether a string of speech contains one or more utterances on semantic-pragmatic grounds, since the speech may contain pauses and/or may not be understandable. This is especially true for the early recordings. Therefore, we used objective criteria (Branigan, 1979) to establish the number of utterances in the early recordings. Branigan says that the presence of silences of more than 1100 ms means that there was more than one utterance and that the presence of silences between 200 and 1100 ms indicates that there was one utterance. Silences of less than 200 ms in the speech stream were not considered to be pauses. For the later recordings (after the age of 1;8) the number of utterances was established on semantic-pragmatic grounds.
We started to measure durations for every monthly recording, but since very little variation between the early recordings was observed, we decided to skip every other recording, and to analyse the data bimonthly. However, the durations belonging to the age of 2;4 showed a deviant behaviour. Therefore, we also analysed the recording belonging to the age of 2;3 to investigate more precisely the beginning of this change. Thus, there are 13 data points for the nearly two years we studied. In table 1 the age and the number of utterances of the child in 20 minutes of transcription are given.

Table 1: Age and number of child utterances per 20 minutes transcription of every recording used in this study.

Recording	Age	Number of child utterances
1	1;3;14	171
2	1;4;15	150
3	1;6;15	126
4	1;8;12	108
5	1;10;7	132
6	2;0;7	109
7	2;2;1	125
8	2;3;8	146
9	2;4;5	107
10	2;6;8	145
11	2;8;9	144
12	2;10;5	119
13	3;0;22	139

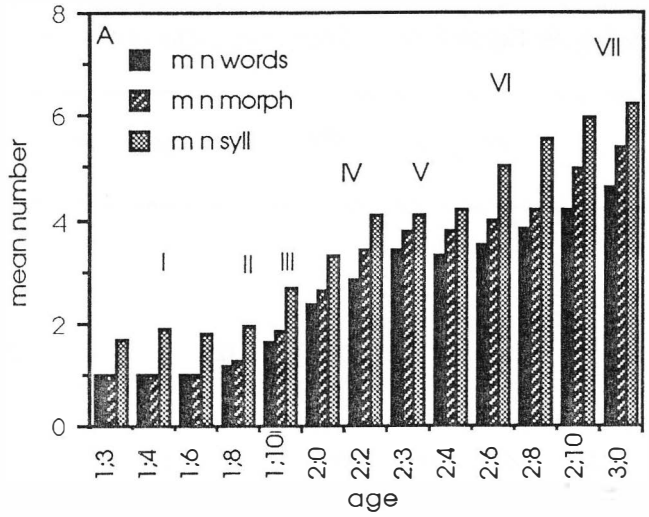
Fifty utterances were measured in every recording (not more than three times the same utterance; e.g. if in a recording the utterance auto "car" occurred ten times, only the first three occurences were measured). These 50 utterances consisted of the first 25 utterances of the transcription to give a general impression of the stage the child has reached, together with the 25 longest utterances (expressed in the number of syllables) from the *remaining* part of the transcription to give an impression of the optimum of what the child is capable of. In this way the records can be optimally compared in our opinion. The

longest utterances turned out to be very informative on the development of articulation principles. Therefore, they are presented separately. For all 50 utterances per recording we established the following variables: number of words, number of morphemes (as indicated by Bol and Kuiken, 1988), number of syllables, number of phonemes, number of pauses. The establishment of the number of syllables and phonemes is based on the transcriptions and is always concerned with actual realisations. Furthermore, we established total duration, mean syllable duration (= total duration without pause duration divided by the number of syllables), mean phoneme duration (= total duration without pause duration divided by the number of phonemes), and pause duration. In the following sections, we will first deal with the variables which indicate language complexity (number of words, morphemes, and syllables) and then we will look at the durations, pauses, and hesitations.

3. RESULTS AND DISCUSSION

3.1 Language complexity

As measures of growing complexity of the language used by the child, we investigated the mean number of words, morphemes, and syllables per utterance. These data are presented per age, for all utterances (figure 1A) and for the 25 longest utterances (figure 1B), respectively.
It can be seen that the mean number of words per utterance gradually increases from 1.0 to 4.6 (50 utterances) and 5.8 (25 longest utterances) at the age of three. The child was in the one-word stage during the first three recordings. At the age of 1;8 the first two-word utterances were observed. The word stage was established for every recording, in order to give an impression of the number of words the child is able to use in one utterance. This measure was defined as follows: the child had to use at least 5 (10%) utterances with at least the number of words belonging to the stage. For example, when the child entered the three-word stage, he used at least five utterances with at least three words. The measure gives more precise information about language development than the measure of mean number of words. In figure 1 the word stages are indicated by roman figures. We see a gradual increase in the number of words the child is able to use.
The mean number of morphemes runs from 1.0 to 5.4 and 6.8, for 50 and 25 utterances respectively. Here, too, a more or less gradual increase can be observed. As an indication of grammatical and morphological complexity of the language used at a certain age, the difference between the mean number of morphemes and words per utterance was established. This measure is also a rough indication of the increase of unstressed short syllables in the speech of the child. Although a slight increase in the difference between the mean number of morphemes and words per utterance may be observed, it stays statistically constant until the age of 2;10. At the age of 2;10 and 3;0 there is a greater grammatical complexity of the language than before. The question remains whether this increase is accompanied by an increase in the number of unstressed syllables, which may have an effect on mean durations. It is possible that a number of new morphemes used by the child do not introduce new syllables, but may even increase the complexity of syllables making them longer (e.g. singular molen "mill", plural molens "mills"). In table 2, the number of function words and function morphemes which are also syllabic and may be reduced are given per recording, as well as those morphemes which increase syllabic complexity. There were also a number of inserted schwa's which did not belong to a morpheme (e.g. /kɑnə, ɪsə, hevə/) and also a number of diminutive (especially in proper names) and plural forms which were not counted as morphemes. However, these were incorporated in table 2 between brackets, since they introduced an unstressed syllable.



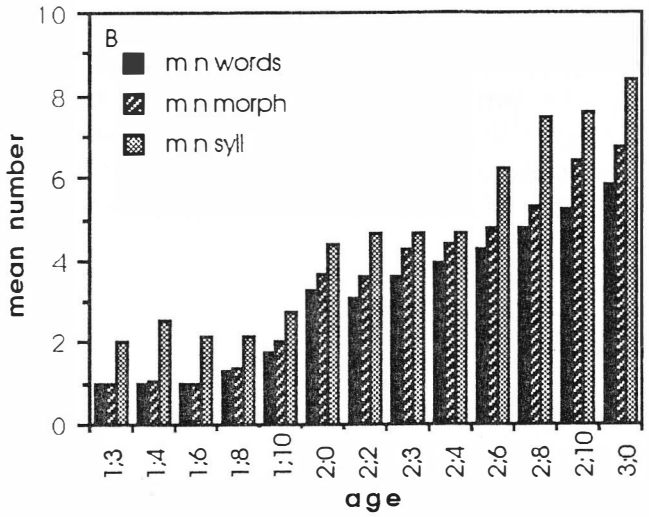


Figure 1A and 1B: Mean number of words, morphemes, and syllables per age, for all 50 utterances (A) and the 25 longest utterances (B). Word stages are given in roman figures.

Table 2: Number of syllabic functions words or morphemes per recording; inserted schwa (insert), prepositions (prep), pronouns (pro), articles (art), adverb er (er), conjunction (con), adjective (adj, /ə/), diminutive (dim./jə/), plural (pl./ən/), participium (part, /xə/), morphemes that increase syllabic complexity (sc) Total number of unstressed syllabic morphemes, between brackets the number of unstressed syllables which were not counted as morphemes, see the text (tot unstr morph), overall number of morphemes per recording, with percentage unstressed syllabic morphemes, including the figures between brackets (ov. alln. of morph).

	insert	prep	pro	art	er	con	adj	dim	pl	part	sc	tot unstr morph	ov.all n. of morph	
1;3													48	
1;4													47	
1;6													48	
1;8		4						2 (3)	0 (2)		1	6 (5)	64	9%
1;10		1		1		1	0 (1)	8 (1)			1	11 (2)	89	12%
2;0	(1)	12	3	1 (2)		2	1	4 (3)			3	23 (6)	127	19%
2;2	(5)	8	5	5	4	4	1	6		1	10	34 (5)	166	24%
2;3		8	12	20				4 (1)	4	1	6	49 (1)	181	27%
2;4	(2)	10	7	21		1	2	5			9	46 (2)	185	26%
2;6	(4)	9	16	11	1	1	3	10 (2)		1	5	56 (2)	200	28%
2;8	(1)	8	14	18	1	2		4		1	4	48 (1)	210	23%
2;10	(5)	18	9	19		16	3	6 (8)	5	1	12	76 (13)	248	33%
3;0		21	21	20	1	16		3	5	5	5	92	268	34%

When the first two-word utterances appear at the age of 1;8, the first unstressed morphemes also appear. It can be remarked that the *relative* number of unstressed morphemes increases until the age of 2;3, to stay more or less constant until the age of 3;0, although we see a slight increase for the last two recordings due to the increase of conjunctions. Regarding the number of morphemes that increases syllabic complexity (sc) there is no clear increase.

3.2 Utterance length in syllables

In figures 1A and 1B, utterance length expressed as the mean number of syllables is also presented. The mean number of syllables runs from 1.7 until 6.2, and from 2 until 8.4 for all 50 and for the 25 longest utterances, respectively. Here, no gradual increase can be observed, but three levels can be seen. Post-hoc analysis on the number of syllables indicates that for all utterances the first five recordings belong together, followed by the next four and then the last four. Results of the post-hoc analysis for the 25 longest utterances indicate the same levels. During the first five recordings, when the child is going from the one-word to the three-word stage, there is no statistical increase in the mean number of syllables per utterance. This means that most of the one-word utterances already contained more (mostly two) syllables, and that in the recordings at the ages of 1;8 and 1;10 there must be relatively few two-and three-word utterances, respectively. When the child is going from the four-word to the six-word stage (2;0-2;4), there is no significant increase in mean number of syllables per utterance either. From age 2;6 onwards, there is an increase in mean number of syllables per utterances; however, the child is only going from the six-word to the seven-word stage. This implies that the child starts to use more more-syllabic words. In the following section we will look at mean

syllable and phoneme durations to see whether relationships between durations and language complexity and utterance length can be observed.

3.3 Durations

3.3.1 Mean syllable duration

In figure 2A mean syllable duration (mean syllable duration is established per utterance, and this value is averaged over all 50 utterances per recording) is presented for the ages of 1;3 until 3;0. A one-way analysis of variance was performed with 'age' as the independent and 'mean syllable duration' as the dependent variable. Results indicated a significant effect. Post-hoc analysis (Tukey HSD) showed that the mean syllable duration at age 2;4 significantly differed from the other data.

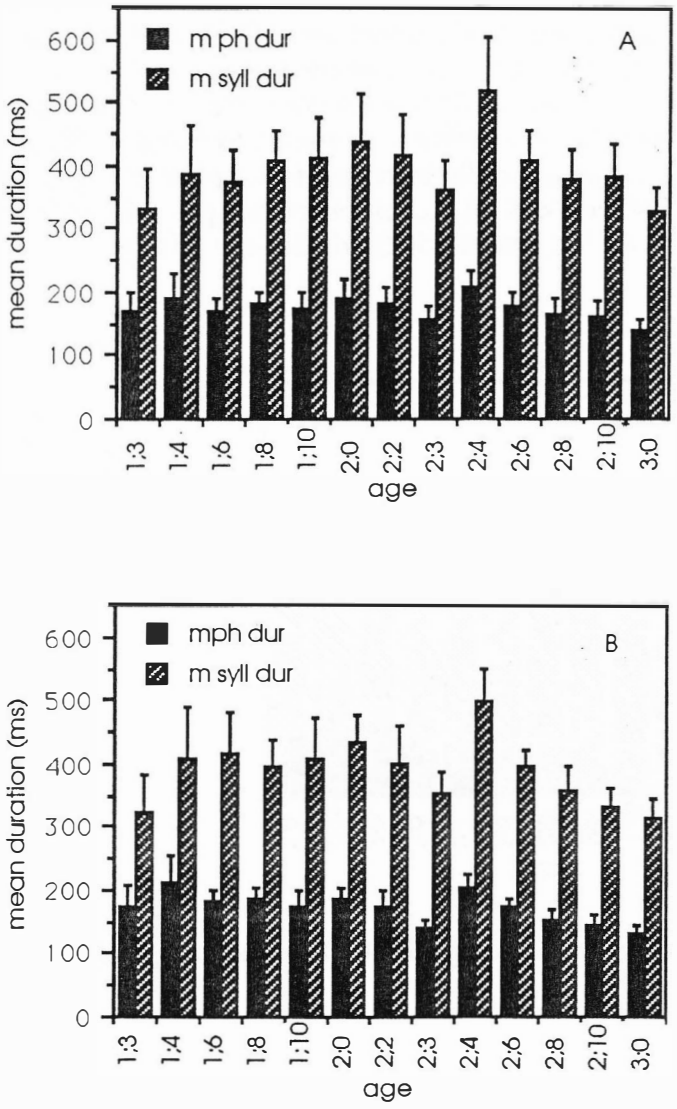


Figure 2A and 2B: Mean syllable duration and mean phoneme duration per age, for all 50 utterances (A) and for the 25 longest utterances (B).

Figure 2B shows the mean syllable duration for the 25 longest utterances per recording. Globally, the same picture can be seen as for all 50 utterances. The one-way analysis of variance shows a significant effect, and also here the post-hoc analysis indicated the age of 2;4 as deviating from the rest. We can see that mean syllable duration after the age of 2;4 gets shorter, although this is not statistically significant.
If we convert mean syllable duration into articulation rate, the child speaks with an articulation rate of about 3 syllables per second in most recordings, and with less than 2 syllables per second at the age of 2;4. Normal adult articulation rate varies between 5 and 6.5 syllables per second (den Os, 1988).

3.3.2 Syllabic complexity

In the measure of mean syllable duration, no distinction has been made between syllable types used by the child. It is clear, however, that in the course of language development the child will use more and more complex syllables. In Dutch adult speech there is a direct relationship between the number of phonemes per syllable and syllable duration (den Os, 1988). In figure 3 the mean number of phonemes per syllable is given per recording, for all 50 utterances and for the 25 longest utterances. In the first recording (1;3) the mean number of phonemes per syllable amounted to about 2 (the child uses mainly CV-syllables) and this figure gradually increased to 2.4 phonemes per syllable at the age of 2;4. At the age of 2;4 the mean number of phonemes per syllable is relatively high and this can partly explain the long mean syllable duration at this age.

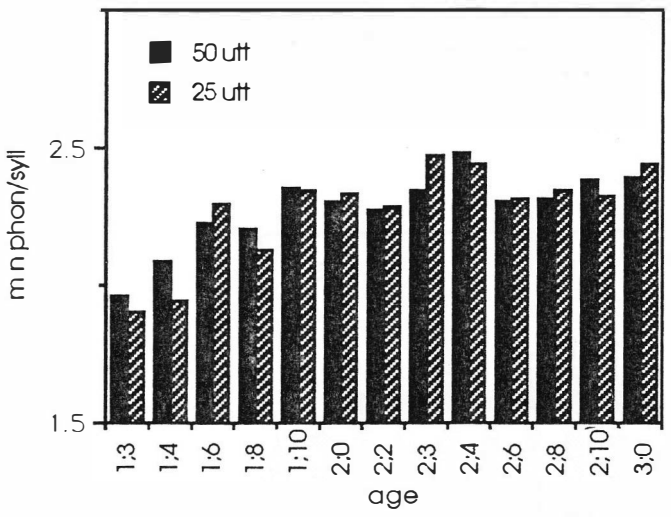


Figure 3: Mean number of phonemes per syllable per age, for all 50 utterances and the 25 longest utterances.

3.3.3 Mean phoneme duration

Mean phoneme durations can also be seen in the figures 2A and 2B. Again, analyses of variance were performed, indicating significant effects. Post-hoc analysis for all 50 utterances showed that mean phoneme duration at the age of 2;4 significantly deviates from most other recordings, but also that the last recording (3;0) deviates from most other ones, mean phoneme duration being shorter. The analysis of variance on mean phoneme

duration on the 25 longest utterances also turned out to give a significant effect. However, post-hoc analysis shows that now mean durations belonging to the ages of 2;3 and 3;0 differ from the other ones, being shorter. Although there is an increase in the mean number of phonemes per syllable until the age of 2;4, we see no clear effects on mean phoneme or mean syllable duration. This may be explained by the fact that also during this period there was an increase in the relative number of unstressed syllabic morphemes, which are supposed to have relatively short durations. These morphemes may cause the mean syllable durations to be shorter than would have been expected on the basis of increasing syllabic complexity.

3.3.4 Relationship between durations and language complexity and utterance length

Although language complexity increases during the first year of using meaningful speech, no changes in mean syllable duration are observed. There seems to be no direct relationship between mean syllable durations and the number of unstressed syllabic morphemes. From the age of 1;8 onwards, we see an increase of the relative number of unstressed syllables (see table 2), but no shortening of durations. This suggests that the possibly unstressed syllabic morphemes were not phonetically unstressed. The long mean syllable duration at the age of 2;4 cannot be explained by the morphological composition of the language used, since then we would have found fewer unstressed morphemes than at the age of 2;3 or 2;6. However, we saw that syllabic complexity increases during until the age of 2;4 and this may have caused relatively long mean durations.
When there is a rather instable period in mean durations (2;3-2;4), there is no increase of utterance length or grammatical complexity. However, there is an increase in the maximal number of words that the child is able to use (from five to six). After the age of 2;4 there is no clear increase in grammatical, morphological, nor syllabic complexity. However, there is an increase in utterance length, suggesting that the child starts to use longer words. During this period we see that mean durations tend to shorten, especially for the 25 longest utterances. We assume that the durational shortening is the result of compensatory shortening (longer words resulting in shorter durations). Another indication for compensatory shortening is that up to the age of 2;3 a comparison of the mean durations of all utterances and the 25 longest utterances per recording shows that mean durations of the 25 longest utterances are not shorter than those containing all utterances. We assume that the child is simply chaining syllables until this age. After the age of 2;4 mean durations of the 25 longest utterances are somewhat shorter than those containing all utterances.
In conclusion, until the age of about 2;4 language complexity increases and utterances get longer, but mean durations stay approximately the same. After the age of 2;4 language complexity (measured in word stages) does not increase very much, whereas the mean number of syllables per utterance increases. After the age of 2;4 we see a tendency of shortening of mean syllable durations, suggesting compensatory shortening. This means that the child starts to plan his speech. Other indications in the data have been observed that point into the direction of a change in the planning of articulation. In the following sections we will see that the child uses relatively many pauses after the age of 2;4 and that the number of hesitations increases.

3.4 Pauses

Two measures were used to get an idea of the development of pauses within the utterances. First, the time used for pausing compared to total utterance duration was

established. The presence of relatively long pause durations might indicate that language production is difficult for the child. In table 3 relative pause durations are given. Pauses within utterances emerge when the first two-word utterances are used by the child at the age of 1;8.

Table 3: Pause durations relative to total utterance duration (in %) for all 50 utterances.

age	% pause duration
1;8	44
1;10	14
2;0	23
2;2	21
2;3	23
2;4	30
2;6	21
2;8	23
2;10	22
3;0	26

At the age of 1;8, when the first two-word utterances emerge (the 50 utterances contain 8 two-word utterances), the child uses relatively long pauses in nearly all of his two-word utterances. Apparently, the child needed this time to utter the difficult utterances. The time spent in pauses is much less at the age of 1;10. After the age of 2;0 the time spent in pauses stays about the same, about 25%, (although utterances get longer). We find the same results for the 25 longest utterances.
As a second measure the number of pauses per utterance was established. Since the number of possible pauses depends on the number of words in an utterance, the number of pauses must be normalized for utterance length. It is assumed that between every two words of an utterance there might be a pause. We counted the number of pause positions which were actually used by the child (percentage pause positions used by the child). In this measure it cannot be incorporated that there may be pauses within words, since then everywhere within an utterance there may be possible pause positions. In figures 4A (50 utterances) and 4B (25 utterances) we see the percentage of used pause positions per recording. The reason why the percentage used pause positions for all 50 utterances reaches beyond 100% is, that at this age the child also paused within a word. It becomes clear that when the child starts to use two-word utterances, there are almost always pauses between the two words. After this period, the number of pauses drops to a more or less constant level of 20% pause positions used. A deviation occurs at the age of 2;3 and 2;4 when relatively few pauses can be observed. We assume that the pauses before this period are the result of the fact that the child is not able to articulate longer utterances and has to take a breath. The pauses can occur within words. After this period the pauses are used for planning, they no longer occur within words and they are much less used to take a breath.

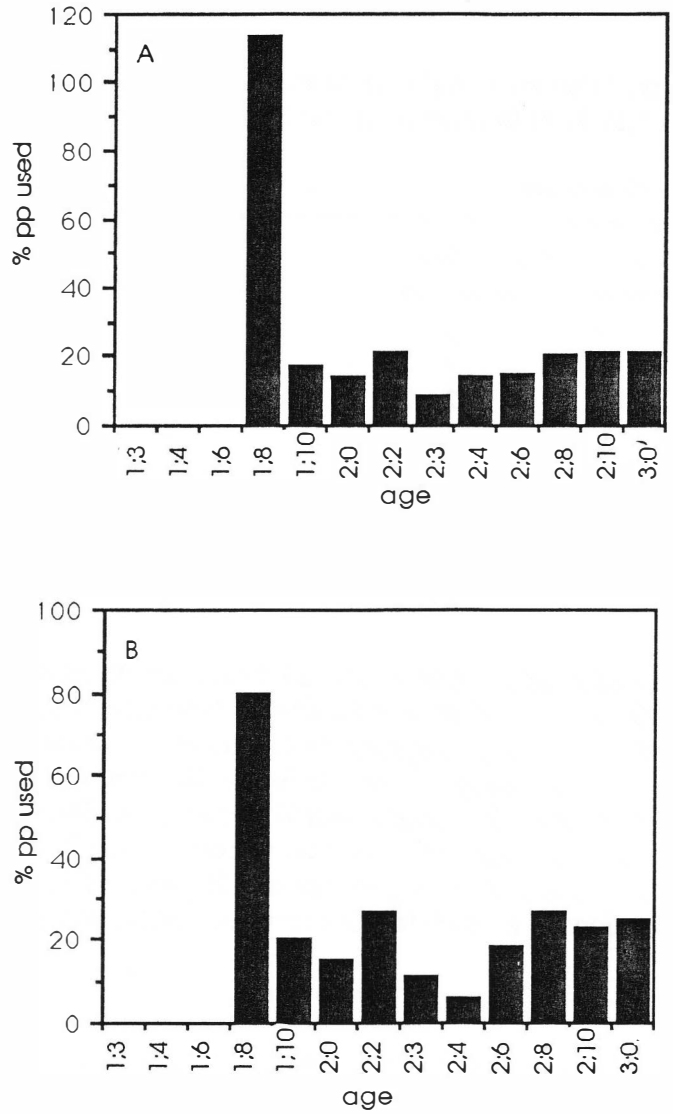


Figure 4A and 4B: Percentage pause positions used per recording, for all 50 utterances and the 25 longest utterances

3.5 Hesitations

In table 4 the total number of hesitations per recording are given for all 50 utterances and for the 25 longest utterances. Hesitations can be of the following types: self-corrections, repetitions, long sounds, and filled pauses (uh, mm), (see Wijnen, 1990). Until the age of 1;10 no hesitations have been observed, and until the age of 2;4 the child is not hesitating very much. After this period the number of hesitations starts to increase. This is very clear from the data for the longest utterances: given the 25 utterances per recording, a number of 18 hesitations (at the age of 3;0) means that in two third of the utterances, hesitations are heard (there may be more than one hesitation per utterance). Wijnen (1990) also found an increase in the productions of, what he calls, disfluencies between the ages of 2;4 and 2;9. We suppose that this increase of number of hesitations is a sign that planning of speech starts to appear. In table 4, we also present results for

the different types of hesitations (self-corrections, repetitions, long sounds and filled pauses (uh, mm)).

Table 4: Number of hesitation types. Selfcorrections (S), Repetitions (R), Filled Pauses (FP), and Long Sounds (LS) for all 50 utterances and the 25 longest utterances.

	50 utterances					25 longest utterances				
Age	S	R	FP	LS	Tot	S	R	FP	LS	Tot
1;10	1				1	1				1
2;0		1			1		1			1
2;2		1	1		2		1	1		2
2;3		2	1	1	4		1		1	2
2;4	6	3	2	2	13	2	1	2	1	6
2;6	1	2	6		9	1	2	3		6
2;8	6	3	4		13	5	2	4		11
2;10	2	7	6	3	18	2	6	2	2	12
3;0	7	10	3		20	6	9	3		18

From table 4, it can be seen that after the age of 2;3 all hesitation types occur more frequently, while repetitions become the dominant hesitation type after the age of 2;8. In connection with the idea that planning of speech is developing, it is interesting to look in detail at the self-corrections. This type contains forms like /tun mɑχ...mɔχ jɛi/ "then you may...might...", which are clear grammatical corrections. There are also forms that show that the child first chooses the wrong word, but already "knows" what is coming. This implies that the child is planning the speech. It would be interesting to look for this type of selfcorrections in a much larger corpus of hesitations. See table 5 for some examples.

Table 5: Examples of selfcorrections with glosses if possible, which show that the child knows what will come. The concerning sounds and words are underlined.

Age 2;4	
de hond doet op....ook op de stoep poepen, he?	"The dog does on...also on the street pooh, does n't he?
Ik zo zo m zo moet ie	"I so so m so must it
Age 2;8	
moet..je moet daarna anders praten	"have..you have to speak differently
Is...dit is toch geen helicopter	"Is....this is not a helicopter"
daar moet n af nog	
Age 3;0	
Toen we naar Aoma..Annie gingen	"When we went to Agrandma Anne"
was wat was daaruit gekomen?	"was what was coming out?

4. CONCLUDING REMARKS

Since the speech of only one child is examined, we must be very careful in generalizing the results. Furthermore, there is very little comparable information about adult speech in free conversation. How often do adults pause and how long are the pauses, how many and what type of hesitations do they make? As long as this is not known, we can only

discuss the *development* in the utterances of the child, without addressing the question what the final stage in development must be. The measurements show that the speech of the child is very slow in comparison with adult speech. Kowal et al. (1975) examined the development of speech tempo of children from four until twelve years old. They found that speech tempo is still increasing from about 2 syllables per second at the age of four until 4 syllables per second at the age of twelve.

Returning to our hypotheses in the introduction, we remark the following:

1. When the child started to use two-word utterances, there were relatively long pauses between the two words and nearly all two-word utterances contained pauses. This indicates that these utterances were difficult for the child. After two months the number and duration of the pauses were much smaller, and stayed about the same the rest of the time. We assume that after the age of 2;4, the child is using the pauses to plan his speech, and that before the age of 2;4 the pauses are mainly used to take a breath.
2. Although there was an increase in the number of unstressed function words and unstressed syllabic morphemes used by the child, there was no clear reduction of the mean durations of syllables and phonemes. It might be assumed that the child has not yet mastered the way to reduce these types of morphemes, and is still using full forms. A study of Tingley and Allen (1975) examined the development of timing control in the speech of 5, 7, 9, and 11 year old children and they concluded that even at these ages timing control was improving. However, in our data a great many reduced forms were already observed at early age. These reduced forms could not be counted as separate morphemes since there were no signs that the child knew that there was more than one morpheme , e.g. dɑts "that is", dɑtəokəmɑma "that (is) also (a) mother" (both at the age of 1;10), while he is not using ə for is "is" and ən"an" elsewhere. Thus the child already masters reduced forms from the very beginning. This does not change during the period we studied. However, these forms cannot be related to morphemes.
3. When the child started to use longer utterances at about the age of 2;0, there was no sign of a decrease of mean durations of phonemes and syllables. At about the age of 2;3-2;4 the maximal complexity of the syllable has been reached. After this period there is again an increase of utterance length, and the durations of syllables and phonemes tend to shorten. This is most clear for the longest utterances. This finding, together with the observation that the number of hesitations increases after this period and that some self-corrections showed that the child knew what was to come at a later point in the utterance, suggest that the child starts to plan its speech at about the age of 2;4.

Future research should incorporate many more children, to see whether the present picture holds for other children. DH learned his language in an analytical way, 'word by word' so to speak. There are also children, who start with rather long 'babbling-like' utterances, in which one by one real words appear (Peters, 1983). It is probable, that the durational development will be quite different for this type of children.

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