PHONOLOGICAL CHANGES IN SYLLABLE DURATION AND FILLER SYLLABLES IN EARLY CHILD LANGUAGE

by

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ABSTRACT

This study investigated the development of prosody in American English and its relationship to segmental phonology and morphology with a focus on the acquisition of stress patterns. The data were collected from a male child by his father from 1;4 to 4;4 biweekly. Of these, twelve data points between 18 and 23 months were analyzed (approximately 30 minutes each). All utterances were coded into one of the following categories using transcriptions, notes, and audio data: Monosyllabic, Filler plus Monosyllabic, Disyllabic, Filler plus Disyllabic, Multisyllabic, and Filler plus Multisyllabic.

The total number of utterances and syllables per utterance increased from 18 to 23 months. At 18 months, only 35% (84/236) of the child's utterances were multisyllabic, while 72% (612/851) such utterances were produced at 23 months. At 18 months, 20% of the utterances (48/236) contained filler syllables. Between 21_2 and 22_0 months, the number of filler syllables decreased suddenly. At 22 and 23 months, the child produced filler syllables again, but this time with disyllabic and multisyllabic words.

The disyllables were coded into one of the following: trochaic, iambic, or evenly stressed, then acoustic analysis was conducted on duration of those disyllables. A total of 160 utterances were measured. The results indicate that the second syllable was in general longer than the first syllable and the difference between first and second syllables was not significant at 21 months, whereas it was significant at 18 and 23 months.

These findings suggested that 21 months was an important milestone in language development for this child. At 21 months, the number of filler syllables decreased and the duration of syllables showed a different pattern from 18 and 23 months. These data suggested that there may have been a change in this child's phonology at 21 months.

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CHAPTER I

REVIEW OF LITERATURE

To study the development of prosodic aspects in a child's speech, one needs to consider suprasegmental as well as segmental aspects of that child's speech. Suprasegmentals can be divided into categories that include features of pitch, quantity or duration, and loudness (Snow, 1997). They can be further thought of as aspects of speech including rhythm, fillers (Peters, 2001), intonation, syllable timing and metric form (Snow, 1997). In particular, this study focused on the acquisition of stress patterns. The data were from a longitudinal case study on the development of speech and language of one male child, Seth. The data analyzed were from the time frame of age 18 months to 23 months.

Prosody

In the study of phonological development, researchers have focused their attention more on segmental, rather than suprasegmental aspects of speech (Archibald, 1995; Bernhardt & Stemberger, 1998; Vihman, 1996; Waterson, 1971). Suprasegmentals are the features in addition to the phonemes, segments, syllables, words, and sentences that add information for the listener (Snow, 1997). Pitch, loudness and duration are examples of suprasegmentals (Snow, 1997).

Allen and Hawkins defined rhythm as a "structure", which is an arrangement of a series of units (1980: 227). Those units can be features, segments, syllables, words, phrases, or paragraphs. According to Allen and Hawkins (1980), the role of the rhythmic structure is to organize the information. They suggested that, for example, the stressed syllable let the listener know when the rhythmic unit begins in English. This allows the listener to focus his/her attention to that unit (Allen & Hawkins, 1980).

The stressed syllable in adult English speech is usually marked by increased magnitude of fundamental frequency (pitch), increased syllable duration (length), increased amplitude (loudness), and changes in the quality of the vowel (Ladefoged, 2001). Fry (1955, 1958) and Morton and Jassem (1965) found that pitch is the most important aspect of stress, outweighing duration and loudness in adult speech.

The Acquisition of Prosody

Snow (1998) studied 11 children's productions of rising and falling intonation between 1:7-2:2 months of age. The goals of the study were to determine if children had more difficulty imitating the intonation of rising tones compared to falling tones. It was found that children do not imitate sentence-final rising tones as accurately as sentence-final falling tones (Snow, 1998). It was also found that, in syllables with rising tones, words were lengthened, as compared to syllables with falling tones where words were shortened. Snow proposed that the children's imitation of rising tones was related to speech timing. He concluded that poor timing during the rising tones could account for the word lengthening that he observed. The word lengthening could in turn have affected the pitch changes that were observed as well (Snow, 1998).

Snow (1997) investigated the acquisition of speech timing in children between the ages of 1:6 and 2:0 who were acquiring English. He examined distinctions in timing in both segmentals and suprasegmentals. Voice onset time (VOT) was examined as a segmental feature that indicates the timing of stop consonants, and final syllable vowel lengthening (FSVL) was investigated as a suprasegmental feature that typically distinguishes final vowels from non-final vowels (Snow, 1997). Snow proposed two competing hypotheses. One hypothesis was that children would be able to control the vowel duration contrast earlier than the consonant duration contrast (the motoric hypothesis). In other words, children would acquire adult-like FSVL before VOT. The other hypothesis was that children would be able to control the contrast represented on the segmental level earlier than the suprasegmental level, or VOT before FSVL (the representation hypothesis) (Snow, 1997). It was found that VOT and FSVL in children's speech were not adult-like until around the age of two. At the age of two, VOT and FSVL were similar to adult speech (Snow, 1997). Snow found that children acquired speech timing skills at varied points of development. He claimed that before age two, children may not be able to control these two distinctions in timing (Snow, 1997). He also found that children usually acquired VOT about the same time as other lexical skills. As the children's lexical development accelerated, their acquisition of VOT accelerated as well (Snow, 1997). The data suggested that FSVL appeared to develop later than VOT (Snow, 1997).

Stress usually refers to the prominence given to a syllable in a word or to a word in a sentence (Ladefoged, 2001), and is associated with many acoustic features (Kent &

Read, 1992). In a trochaic stress pattern, the first syllable is stressed (e.g., *APple,* also referred to as strong/weak). In an iambic stress pattern the second syllable is stressed (e.g., *girAFFE,* also referred to as weak/strong). In English, the predominant stress pattern is trochaic (Cutler & Carter, 1987).

The trochaic, or strong-weak pattern, is reported to play an important role in the early stages of acquisition of the English language. It was demonstrated that English-learning infants have a listening preference for a strong-weak pattern around the age of 9 months (Jusczyk, Cutler, & Redanz, 1993), and English-learning infants also rely on the strong-weak pattern to segment words in fluent speech (Jusczyk, Houston, & Newsome, 1999). Allen and Hawkins (1980) suggested young children are aware of differences between stressed and unstressed syllables and hypothesized that the natural metric form of children's words is trochaic, or the stressed/unstressed pattern (e.g., *APPle, DAddy, COOkie)* (Allen & Hawkins, 1978; 1980). This hypothesis is referred to as the "trochaic bias hypothesis" (Allen & Hawkins, 1980; Vihman et al., 1998).

Vihman, DePaolis, and Davis (1998), however, suggested that children are provided examples of stress patterns other than the trochaic pattern in adult speech and the trochaic pattern is not necessarily dominant in child speech. They pointed out that phrases in English are typically iambic (e.g., *with LIGHT*), although words in English tend to be trochaic (e.g., *COOkie*) (Vihman et al, 1998). Vihman et al., (1998) suggested the target language, rather than a universal trochaic bias, influences the children's preference for either trochaic or iambic patterns. The results of the study indicated that four of five French-learning infants produced more iambic utterances (Vihman et al., 1998). It was also found that there was no uniform "trochaic bias" effect among English-learning infants. The study showed that out of 9 English-learning children, only five produced more trochaic words than iambic words, three children produced more iambic words than trochaic and one child produced an approximately even number of each stress type (Vihman et al., 1998).

Allen and Hawkins (1980) also claimed that the speech of English-speaking children is syllable-timed, and that duration is not used to differentiate between stressed and unstressed syllables. Pollock, Brammer, and Hageman (1993) examined duration contrast between stress and unstressed syllables in children between the ages of 2 and 4 years. It was found that the duration of unstressed syllables was reduced when produced by these children. It was also found that 2-year-olds do not differentiate stressed and unstressed syllables by fundamental frequency, but by duration and intensity. Therefore, duration may play a more important role in differentiating stressed and unstressed syllables than was suggested by Allen and Hawkins (1980).

Measuring stress contrasts

There are several problems when selecting a stimulus to measure the stress contrasts of young children (Kehoe, Stoel-Gammon, & Buder 1995). First, the noun-verb pairs that differ only in stress placement, such as *REcord*, used as a noun, and *reCORD*, used as a verb, are typically not in the vocabularies of young children. Disyllabic words that are in the vocabularies of young children such as *baby, monkey, shampoo*, and *giraffe* do not have minimal pairs that are identical except for the stress placement. This makes it difficult to measure stress contrast optimally (Kehoe et al., 1995).

As a potential solution to this problem, Kehoe et al. (1995) conducted an interword comparison using words such as *MONkey* and *KEY.* /ki/ is the unstressed syllable in the disyllabic word *monkey,* and it is the stressed syllable in the monosyllabic word *key*. Another solution they proposed was to conduct an intraword comparison using the stressed and unstressed syllable within the same word such as *MON* and *key* in the word *MONkey* (Kehoe et, al., 1995). According to Kehoe et al., both of these solutions have advantages and disadvantages. The advantage to using the interword comparison is that it achieves close phonetic matching and control over phrase position, since both syllables can occur in the phrase final position. The disadvantage is that the comparison consists of a monosyllable and a disyllable. The advantage of the intraword comparison is that it captures the relative notion of stress. The disadvantage is that control over the segmental factors will be compromised (Kehoe et al., 1995).

Case studies

Davis and MacNeilage (1990) studied a typically developing child for 6 months, between 1:2 and 1:8. Data were recorded on a weekly basis in two-hour sessions until the female child produced about 50 words. The data were then recorded twice a week. All data were recorded in natural interactions at home with her mother. The child's monosyllabic and disyllabic productions were analyzed over the 6-month time frame (Davis & MacNeilage, 1990). These two syllable types were virtually the only type of output produced by this child during this time frame. Davis and MacNeilage (1990) analyzed the babbled utterances as well as the child's meaningful output (words). They also compared the child's speech output with the adult target word that she was attempting to produce (Davis & MacNeilage, 1990). It was found that there were approximately four times as many meaningful utterances as babbled utterances. Davis and MacNeilage (1990) concluded that the child produced more monosyllables than disyllables in this period. The format of the Davis and MacNeilage (1990) study closely resembles the format that will be employed in this study.

Fillers

The child in this study, Seth, produced syllables that did not have a clear target, which Peters (1987, 1994, 2001) called fillers. Fillers are schwas or nasals that fill in for a word (e.g., *n kick it*) (Peters, 1987; Vihman, et al., 1998). Fillers are unglossable syllables and have been found in many different languages. Filler syllables in Seth's speech developed into functor words (e.g., the, an, a) (Peters, 1994; 1999). Data from Seth showed a very gradual shift, over the age range 1:7 to 2:3, from the use of fillers (e.g., schwa or a syllabic nasal) to the use of identifiable closed–class morphemes (e.g., articles, pronouns, and prepositions) (Peters, 1999). Some fillers were also multisyllabic (e.g., *umma, didja*) (Peters, 2001).

It is difficult to integrate these filler syllables into the theory of language for four main reasons (Peters, 2001). First, they do not fit neatly into categories of language. Second, prosody and rhythm are closely related to fillers, and there are few ways to describe and analyze or evaluate prosody and rhythm (Peters, 2001). Third, fillers vary from user to user and language to language. Fourth, fillers are used by different children for different purposes (Peters, 2001).

Peters (2001) states several views on fillers. Fillers show partial learning of grammatical categories or development. The assumption can be made that children do or do not have the functional categories as in adult syntax at any given point (Peters, 2001).

Peters (2001) stated two main theoretical positions on fillers. Position I is that fillers are influenced by prosodic patterns. This position claims that fillers have no connection to the child's development of adult grammar. Evidence to support this position is fillers do not fit into any functional category in the adult language and there is no direct correlation between the length of time the filler is absent and the emergence of the adult target. Position II states that fillers are phonological evidence of a language learner's early awareness of some precursors of categories of language (e.g., inflection, determiners) (Peters, 2001). Evidence to support this position includes the fact that over time, the child's production more closely approximates the adult model. (Peters, 2001). Position II can be divided into two subdivisions: the nativist and the constructivist. The nativist position states fillers are evidence of innate syntactic elements. The constructivist position states fillers are evidence of syntactic elements under construction (Peters, 2001).

Vihman and Velleman (2001) studied the number of syllables and phonological shape of the syllables, rather than vowel quality to categorize the initial syllables as a potential premorpheme in young children's speech. They referred to "fillers" as “premorphemes”. To be considered a premorpheme, a syllable could not potentially represent a target syllable (i.e., the premorpheme had to be something in addition to the target word), or begin with a supraglottal consonant. They found French children produced the most preposed syllables and the fewest onsetless word tokens (Vihman & Velleman, 2001). This finding actually surprised the authors of the study because the requirement that the premorphemes lack a supraglottal onset should swing the analysis in the other direction; that the French children would have produced the most onsetless word tokens. The initial syllable that was onsetless might indicate grammatical characteristics of the target language (Vihnam & Velleman, 2001). Vihman and Velleman (2001) considered this onsetless syllable production in French-speaking children to be used for morphological reasons.

Veneziano and Sinclair (2000) referred to fillers as Prefixed Additional Elements (PAEs). They outlined several hypotheses about the kind of language knowledge underlying the child’s production of PAE’s. The first hypothesis is called “the devices to lengthen single-word utterances (DLS) hypothesis” (Veneziano & Sinclair, 2000; p. 463). This hypothesis is based on the observation that children seem to know when something is missing from their utterance, so they add a made-up syllable (e.g., PAEs). The hypothesis implies that children are not yet able to use grammatical morphemes. The next hypothesis is called the “syntactic slots hypothesis” (Veneziano & Sinclair, 2000; p. 464). This hypothesis is that fillers represent placeholders where a grammatical morpheme would exist; suggesting that the child is aware of that grammatical unit. The third hypothesis is referred to as the “selectivity of occurrence hypothesis” (Veneziano &

Sinclair, 2000; pp. 464-465). It proposes that the occurrence of fillers varies in position such as prenomial position (i.e., *the* or *a*) or the preverbal position (i.e., proper name, noun phrase, prepositions) (Veneziano & Sinclair, 2000). Veneziano and Sinclair's analysis did not support any of the first three hypotheses. Systematic changes were observed in the child's language which led Veneziano and Sinclair to a fourth hypothesis (Veneziano & Sinclair, 2000). The fourth hypothesis is referred to as the "organization of surface regularities (OSR) hypothesis" (Veneziano & Sinclair, 2000; p. 465). This hypothesis states the child organizes surface structure properties first, then moves on to the deep structure properties at a later time (Veneziano & Sinclair, 2000).

Fillers were one of the suprasegmental aspects of speech that were addressed in this study (Veneziano & Sinclair, 2000). Rhythm, intonation, syllable timing and metric form are other suprasegmentals that help make up the prosodic aspect in children's speech. Understanding how these separate aspects fit together will help us understand how prosodic aspects develop in an English-speaking child.

Research Questions

Rhythm, fillers, intonation, syllable timing, and metric form comprise a few of the suprasegmental aspects of speech that were addressed in this study. The goal of this study was to investigate the development of prosodic aspects in child speech.

Specific research questions of this study included the following;

1) How is English prosody acquired in a typically developing child?

1a) What are the characteristics of the child's speech in terms of numbers of syllables?

2) What is the relationship of number of utterances to filler syllables per session?

2a) Do the filler syllables decrease as the utterance lengths increase?

2b) What is the role of fillers during this period?

Hypothesis

It was predicted that the number of Seth's utterances would increase as he became older (between 18 and 23 months). His utterances would become longer as his language ability increased. Several subquestions were proposed to help answer the main question, "how is English prosody acquired in a typically developing child?"

1a) What are the characteristics of the child's speech in terms of numbers of syllables? Based on the Davis and MacNeilage (1990) study, it was predicted that Seth would produce more monosyllabic and filler-monosyllabic (i.e., monosyllables preceded by a filler) patterns because these forms might be easier for a child in the age range of 14 to 18 months; therefore, those patterns would be easier for a child of 18 to 23 months to produce than the more adult-like forms that are expected to emerge later in the developmental process. Between 18 to 23 months, rapid phonologic, syntactic, and semantic growth is expected. For example, average expressive vocabulary size is around 50-100 words at 18 months, and reaches 200-300 words by 24 months (Paul, 2001). Two-word utterances begin to emerge, speech is about 50% intelligible and CVC word combinations are most common. Two-syllable words being to emerge around 22-24 months (Paul, 2001). Since disyllables only begin to emerge during this time, it was expected that Seth would produce more monosyllabic and filler syllabic patterns.

2) What is the relationship of number of utterances to filler syllables?

2a) Do the filler syllables decrease as the utterance length increases? It was hypothesized that as the number of utterances increased the number of filler syllables would decrease. This was based on Peters (1999), who reported that the filler syllables changed position in the utterance (e.g., *n dada* at 18 months, to *talk on □ phone* at 23 months) as Seth became older.

2b) What is the role of fillers during this period? It was hypothesized that the fillers are evidence of syntactic elements under construction (Peters, 2001). Peters (2001) stated two main theoretical positions on fillers. Position I states that fillers are influenced by prosodic patterns. Position II states that fillers are phonological evidence of a language learner's early awareness of some precursors of categories of language. Position II supports this hypothesis.

CHAPTER II

METHODS

The Seth data

The data of the study were from a large longitudinal case study on the development of speech and language of one male child. The data was collected from Seth by his father, Dr. Bob Wilson, from the time Seth was 1:4 to 4:4 (Wilson, 1985). Seth was born with an underdeveloped optic nerve and was totally blind during his first year of life, but at 28 months he was able to discriminate boldly written 2 inch high letters (Peters, 1987; 1999). When Seth was about 40 months old, he was assessed as having no central vision, but a small tunnel of peripheral vision in his left eye (Peters 1987).

According to Peters (1987), Seth's language was not delayed, although there were some characteristics that were idiosyncratic to Seth's speech and language, perhaps due to his visual impairments. For example, he used adult questions as requests (e.g., *"D'ya want a cookie?"* which meant *"Get me a cookie"*) (Peters, 1987: p. 293). Seth sorted out the correct use of *you* and *we* before he was able to correctly use *I,* and used "I" for "you" (Peters, 1987). He often said, "Whatta *I'm* doing?" instead of "whatta *you* doing?" The development of these unusual question forms may be due to Seth's father's use of more casual speech when speaking to Seth (e.g., *didja* for *did you)*, Seth beginning to use questions early, Seth's visual impairment, and his imitation of his father and other conversation partners (Peters, 1987). Children who are visually impaired will have less data available to them because they cannot see what is going on around them. The language development of Seth, a visually impaired child, relied heavily on imitation. Seth first imitated many adult utterances, then later produced specific segments of language (Peters, 1994).

Memorization strategies were used in a number of interactive routines by Seth and his father (Peters, 1987). Peters suggested that his father adopted the technique of talking about recent past experiences with Seth. This technique seemed to have two purposes. First, his father wanted to make sure Seth remembered the events. Second, the memorization strategies helped compensate for the fact that Seth could not share a common gaze with his father (Peters, 1987). She also suggested that Seth had difficulty discussing events that took place in the "here and now." This may be because of his visual impairment. The conversations between Seth and his father often consisted of shared knowledge between Seth and his father, and they were usually rooted in past experiences (Peters, 1987).

Peters (1987) suggested that when certain situations arise, individuals are forced to use utterances before they have fully analyzed them. This is what she said seemed to have occurred in Seth's case. It appears that his need to communicate forced him to use the phrases before he analyzed them (Peters, 1987). His language development seemed to be affected by his visual impairment in at least three ways. First, Seth had a great deal of situation-specific language available to him from his father (Peters,1987: p. 202). Second, Seth seemed to "compartmentalize" the language, or use it in ways that he was comfortable with. Third, Seth was eager to interact in social settings (Peters, 1987).

Analysis

As stated earlier, the data were recorded from Seth by his father from 1:4 to 4:4 biweekly. Twelve data points between 18 and 23 months were analyzed. Approximately 30-minute-long recordings were analyzed at each data point, 6 hours total. The data points are labeled as 18_0, 18_2, 19_0, 19_2 and so on. In this study, 18_2 refers to 18 months and 2 weeks, and 19_0 refers to 19 months and 0 weeks and so on. The original audio recordings were digitized at 8 bit and 11025 Hz by Dr. Ann Peters. The data were previously transcribed and are available through the Child Language Data Exchange System (CHILDES) (Peter/Wilson Corpus, MacWhinney, 2000). Computerized Language Analysis (CLAN) software was used to analyze the transcription data.

All the child's utterances were coded into one of the following six categories using both audio and transcribed data:

a) monosyllabic utterances (e.g., *tree)* (M)

b) disyllabic utterances (e.g., *lady)* (D)

c) utterances with more than two syllables (e.g., *give me oatmeal*) (O)

d) filler-monosyllable (e.g., *n tree*) (FM)

e) filler-disyllable (e.g., *n daddy*) (FD)

f) fillers with more than two syllables (e.g., *n answer the phone*) (FO)

The total number of utterances analyzed between 18 to 23 months was 3,400.

The purpose of this analysis was to determine the type and number of different syllables that Seth used. The syllables were coded based on Seth's production of the word rather than the adult model of the word. For example, Seth said *corder* for *recorder*, so the utterance was coded as (D) rather than (O) because his actual production of the word was disyllabic. Next, the utterances with two syllables (D) were divided into the following categories: a) evenly stressed, b) stress on the first syllable, (trochaic) and c) stress on the second syllable, (iambic). There were 40 syllables (i.e., 16 trochaic, 16 iambic and 8 evenly stressed syllables) that were analyzed from 18 months. At 21 and 23 months, 60 syllables (i.e., 20 trochaic, 20 iambic, and 20 evenly stressed) were analyzed.

Finally, acoustic analysis was conducted on the disyllabic utterances to investigate the acoustic nature of stress in child speech, and how it changes over time (Davis, MacNeilage, Matyear & Powell, 2000). Specifically, the duration of vowels (excluding the glide + vowel combination (e.g., *Wake-up)* in disyllables was examined to investigate the properties of stress of each disyllable. The coder selected 30 disyllables from each month. Those syllables were analyzed using Pitchworks. Broad band spectrographic analyses were conducted to measure the duration of the vowels. The duration measurements were compared with the perceptual coding of stressed versus unstressed or evenly stressed syllables. Of the 527 disyllables Seth produced, 160 disyllables were acoustically analyzed.

CHAPTER III

RESULTS

Utterances were coded as one of the following categories: monosyllabic (M), filler monosyllabic (FM), disyllabic (D), filler disyllabic (FD), other (O), and filler other (FO). Chart 1 illustrates the syllable inventory overall, while Table 1 illustrates the tokens in each category for each month. In the charts and tables, 18_0 refers to 18 months and 0 weeks, while 18_2 refers to 18 months and 2 weeks. This format was used for all the recordings analyzed. Table 1.1 illustrates the total number of tokens in each syllable type (e.g., Monosyllabic, Disyllabic) from 18 to 23 months that were produced biweekly.

As Table 1.1 illustrates, Seth produced more Monosyllabic and Disyllabic patterns than any other syllable pattern between 18_0 and 23_2 months. Of the 3,400 syllables produce, 1119 (33%) of them were Monosyllabic and 931 (27%) were Disyllabic. As Paul (2001) states, there is a rapid phonologic, syntactic, and semantic growth in children between 18-23 months. As the utterances length increased, the complexity of the syllables also increased. For example, at 18_0 months, Seth produced 86 (52%) utterances that were Monosyllables, and at 23_2 months, he produced 116 (35%) utterances with more than two syllables (O).

Between 18_0 and 18_2 the total number of utterances decreased from 164 to 72. At 19_0 and 19_2 the total number of utterances increased from 196 to 394 %. Between 20_0 and 20_2 the total number of utterances once again decreased from 261 to 221.

Between 21_0 and 21_2 the total number of utterances decreased from 391 to 140, and between 22_0 and 22_2 the total number of utterances increased from 259 to 451. From 23_0 to 23_2 the total number of utterances decreased from 516 to 335.

The analysis of syllable type revealed that as Seth became older, the percentage of Monosyllables decreased as the percentage of the more complex syllable types (e.g., Disyllables, Filler Disyllables) increased, as Charts 1.2 – 1.4 illustrate. For example, at 18 months Seth did not produce any utterances that had more than three syllables and a filler (Filler Other category). At 21 months Filler Other syllables begin to appear, and at 23 months, the percentage of Filler Other syllables (FO) is greater than the percentage of filler monosyllables (FM), (i.e., FM 1% vs. FO 6%). While the filler syllables decreased in proportion, the Monosyllables, Disyllables and multisyllabic syllables (O) began to increase in overall percentage. At 18 months Seth produced twice as many Monosyllables as Disyllables when at 21 months Seth produced an almost equal number of Monosyllables and Disyllables and at 23 months he again produced almost the same number of Monosyllables as Disyllables but at this stage he also produced 111 in the Other category that contained 3 or more syllables. At 18 months these Other syllables were almost nonexistent (i.e., 2 at 18 months).

Seth's production of Monosyllables also decreased between 18_0 and 18_2 (i.e., 86 to 22 or 52% to 30%). From 19_0 to 19_2 the percentage of Monosyllablic utterances produced decreased from 57% to 43%. However, the total number of utterances increased from 196 to 394 as did the total number of Monosyllabes (i.e., from 112 to 171, or 18% at 19_0 and 28% at 19_2). Between 20_0 and 20_2, they decreased from 77 to

50 or 29% to 22%, and from 21_0 to 21_2, they decreased from 119 to 34 or 30% to 24%. At 21 months the total number of utterances decreased from 391 at 21_0 to 140 at 21_2. From 22_0 to 22_2, the number of monosyllables increased from 81 to 142, as did the total number of utterances, 259 to 451. The percentage of Monosyllabic utterances remained the same at 22_0 and 22_2 (i.e., 31%). From 23_0 to 23_2 the Monosyllabic utterances decreased from 164 to 61 or 31% to 18%, as well as the total number of utterances (i.e., 516 to 335 which is a decrease of 64%).

Between 21_0 and 21_2 there is a decrease in every syllable type resulting in a decrease in the total number of utterances. This pattern was unique to 21 months. During the other months while there was a decrease in one syllable type there was an increase in another. For example at 22 months the number of Monosyllables, Filler Monosyllables, Filler Disyllables, Other, and Filler Other syllables all increased as the disyllables decreased. Twenty-one months was the only month that this pattern did not continue.

The number of Monosyllables increased from 86 at 18 months to 119 at 21 months, then to 164 at 23 months. While Filler Monosyllables increased from 28 at 18 months to 85 at 21 months, then decreased to 11 at 23 months. The Disyllables increased from 46 (28%) at 18 months to 105 (27%) at 21 months and 157 (30%) at 23 months. The Filler Disyllables increased from 2 (1.2%) at 18 months to 31 (7.9%) at 21 months and to 40 (7.8%) at 23 months. Syllables with more than two syllables (Other) increased from 2 (1.2%) at 18 months to 48 (12%) at 21 months and to 111 (22%) at 23 months (see Table 1.1 for changes between 18-23 months).

Between 18_0 and 18_2, the number of filler syllables (i.e., FM, FD, and FO combined) decreased in number (i.e., 30 vs. 18). While the number of utterances also decreased (164 vs. 72 or 43%), the percentage of filler syllables increased from 18% at 18_0 months to 25% at 18_2 months. However, the number of filler syllables increased from 19_0 to 19_2 (29 vs. 143) as the number of utterances increased (196 vs. 394 or 49%). The overall percentage of filler syllables increased from 14% at 19_0 to 36% at 19_2 months. At 20_0 and 20_2 the number of Filler Monosyllabic words increased (50 vs. 68) while the number of utterances decreased (261 vs. 221 or 84%). The overall percentage of increase was 19% at 20_0 months to 30% at 20_2 months. While the number of Filler Disyllabic words and Filler Other utterances at 20 months decreased (62 vs. 38 and 4 vs. 3), the number of utterances decreased (261 vs. 221).

Twenty-one months seemed to be a milestone in Seth's language development. The number of filler syllables in general was decreased as compared to the other months. The number of filler syllables decreased dramatically from 21_0 to 21_2, as did the number of utterances. The number of utterances decreased from 391 to 140. At 22_0 and 22_2, the number of filler syllables increased from 15 to 111 or 5% to 24% as the number of utterances increased (i.e., 259 vs. 451. From 23_0 to 23_2, the number of filler syllables decreased in number once again (84 vs. 53) as the number of utterances also decreased (516 vs. 335).

Acoustic analysis of duration of the syllables

The disyllabic utterances Seth produced were acoustically analyzed and coded as either Sw (strong weak) wS (weak strong) or ee (even). The syllable duration of 160 disyllables was calculated (see Table 1.2-1.4). Descriptive statistics for the average duration of first and second syllables are presented in Table 2. At 18 months, the average length of the first syllable of trochaic syllables was 154 ms while the second syllable was 251 ms. The average length of the first syllable of iambic syllables was 151 ms while the second syllable was 241 ms. The first syllable of the evenly stressed syllables was 155 ms while the second syllable was 254 ms. The second syllable was longer than the first regardless of stress pattern at 18 months (see Table 1.2).

At 21 months the average length of the first syllable of trochaic syllables was 167 ms while the second syllable was 170 ms. The first syllable of iambic syllables was 137 ms while the second syllable was 159 ms, and the first syllable of evenly stressed syllables was 111 ms while the second syllable was 139 ms. The first syllable was shorter than the second at 21 months regardless of stress pattern (see Table 1.3).

Finally, at 23 months the average length of the first syllable of a trochaic syllable was 128 ms while the second syllable was 182 ms. The fist syllable of an iambic syllable was 127 ms while the second syllable was 199 ms, and the first syllable for evenly stressed syllable was 122 ms while the second syllable was 160 ms (see Table 1.4).

In general, the syllable duration became shorter as Seth became older. At 18, 21, and 23 months the second syllable was longer than the first regardless of syllable type (i.e., trochaic, iambic, or evenly stressed). At 18 months there was a wider gap between the first and second syllables. For example, there was a 97 ms difference between the first and second syllables on the trochaic stress pattern at 18 months. At 21 months, the first and second syllable of the trochaic stress pattern were approximately the same duration on the average.

Three-way analysis of variance (ANOVA) was performed on the syllable durations. The independent variables were stress (trochacic, iambic, evenly stressed), position (first or second), and age (18, 21, and 23 months). Chart 1.2 Age x Position illustrates the length of the first and second syllable for 18, 21, and 23 months. Chart 1.4 illustrates that regardless of age, the second syllable was always longer than the first syllable. The analysis yielded a non-significant main effect of Stress ($F(2, 151) = 1.64$, $p > 0.1$). The main effect of Age was significant ($F(2,151) = 14.3$, $p < 0.01$). The effect of Position was also significant ($F(1, 151) = 69.6$, $p < 0.01$). The 2-way interaction Age x Position was significant ($F(2, 151) = 10.4$, $p < 0.01$). All other 2-way interactions, was well as the 3-way interaction, were non-significant. These results indicate that the second syllable was in general longer than the first syllable (mean 195 ms. vs. 139 ms). Tukey's post hoc tests indicated that the syllables at 18 months were longer than syllables at 21 months and 23 months (mean 201 ms vs. 147 and 153 ms $p < 0.05$). The 2-way interaction (Age x Position) was significant because the difference between first and second syllables was not significant at 21 months ($p > 0.05$, 138 vs. 156 ms), whereas it was significant at 18 and 23 months ($p < 0.05$, 153 vs. 249 ms at 18 months and 126 vs. 180 ms at 23 months).

In summary, the second syllable was significantly longer than the first syllable at 18 and 23 months. At 21 months, the average duration of the first and second syllables was not significantly different. Syllable duration was longer at 18 months than at 21 and 23 months, indicating faster speaking rate at this time. Stress was not a significant factor in determining syllable duration at this age.

CHAPTER IV

DISCUSSION

The findings of this study suggested that 21 months was an important milestone in language development for this child. At 21 months, the number of filler syllables decreased and the duration of syllables showed a different pattern from 18 and 23 months. These data suggested that there may be a change in this child's phonology at 21 months.

As mentioned previously, Seth produced mostly monosyllabic and disyllabic utterances. Paul (2001) states that disyllables typically emerge around 22-24 months. However, Seth produced disyllables at 18 months. In fact, 46 (28%) of his 164 utterances at 18_0 months were disyllabic (see Table 1.1 for syllable inventory). Since Seth produced disyllables at an earlier age than typically seen, it stands to reason that he would produce more disyllables at 22 and 23 months than typically seen, therefore, increasing the number of disyllables produced overall.

The syllable duration of 160 disyllables was calculated and coded as either Sw, wS, or ee (see Table 1.2-1.4). The findings of this study also suggested that regardless of trochaic, iambic, or evenly stressed syllables, the second syllable was longer in duration that the first. As Davis and MacNeilage (1990) found, the position of vowels has a strong effect on the phonetic production of the word. They found that their subject produced a longer vowel in monosyllables than had been reported in pre-speech babbling in their study (Davis & MacNeilage, 1999).

At 21 months, the number of filler syllables decreased and the duration of syllables showed a different pattern from 18 and 23 months. These data suggested that there may be a change in this child's phonology at 21 months. In Davis, MacNeilage, Matyear, and Powell (2000), they found that even though the prosodic elements of the child's speech seem to be controlled, that does not mean that those elements are established and under control. This seems to support one of Peters' positions on fillers (i.e., Postion II). As discussed earlier, Position II states that fillers are phonological evidence of a language learner's early awareness of some precursors of categories of language (e.g., inflection) (Peters, 2001). Evidence to support this position includes the fact that the child's model is closely related with the development of an adult target (Peters, 2001). Most of Seth's fillers later developed into functor words. For example, the target "*pink and red*" was produced by Seth as *"pink n red"*.

As the complexity and length of the utterance increased, the placement of the filler syllable seemed to change. For example, at 18 months, when monosyllables and disyllables were the main syllable type produced by Seth, the utterance length remained short and simple. The filler syllables were at the beginning of the utterance (e.g, *"n teddy")*. However, when Seth began to produce more multisyllabic words and the utterance length became longer and more complex, for example, at 23 months, the filler syllables began to appear in the middle of the utterance (e.g.,*"pink n red")*. For example, Seth said, "*n crocodile"* at about 19 months, while at 23 months he said, "*talk on [□] phone"*.

Position and age significantly affected the length of the syllable Seth produced. In fact, significant differences were not found between stressed and unstressed syllables at this age. The second syllable was, in general, longer that the first syllable regardless of syllable type (i.e., trochaic, iambic, or evenly stressed). At 18 and 23 months the difference between the first and second syllable was significant but the difference was not significant at 21 months. Both the first and second syllables at 18 months were longer than the first and second syllables at 21 and 23 months. Snow (1994) suggested that children's final syllable, the second syllable in disyllabic utterances, will be longer than the nonfinal syllable, or the first syllable in disyllable utterances. At 21 months, the difference between first and second syllables was not significant. Snow suggests that when the difference between final and nonfinal syllables becomes smaller, that children are beginning to reorganize their language (Snow, 1994). Snow also suggests that as children begin to acquire final syllable lengthening, they are also acquiring other aspects of language, such as syntax development. Therefore, phonology and syntax may be linked by prosodic features such as rhythm. The important fact that speech can have meaningful units that are longer than single words is beginning to be realized by children as their rhythm, syllable timing, and syntax begin to change as they reach the two-word stage (Snow, 1994).

Vihman et al. (1998) stated that, at about 23 months of age, their subjects, clearly had an emergence of knowledge of grammatical morphemes; however, they seemed to be produced as filler syllables. As Seth's understanding of grammar and ability to control his language increased, the filler syllables began to disappear and the adult target was produced. This is consistent with Vihman et al. (1998). In their study, as the subjects' knowledge of the grammatical morphemes increased, the subjects began to omit the filler syllables (Vihman et al. 1998).

Lahey (1972) (cited in Bloom, 1973) observed that her participant used adult-like phrases at 16 months and at 28 months. During the time between 16 and 28 months, Lahey observed a transitional period at about 21 months when the participant was acquiring syntax. During this time the stress contrasts produced were not as clear as the stress patterns in earlier and later months. The trochaic and iambic patterns were replaced by more evenly stressed patterns (Lahey, 1972).

Snow (1997) found that FSVL is only one of the suprasegmental components that control vowel and syllable length. In this study, age and stress are two other factors that affected syllable length. Since FSVL begins to emerge at about 21 months for English-speaking children (Snow, 1997) this is yet another factor that indicates that 21 months is an important milestone in language and prosodic development in children. Snow (1997) suggested that in adult speech, stress and FSVL sometimes occur together. In that case, the final syllable would be almost 2 ½ times longer than the non-final syllable. In the case that the stress and the FSVL do not occur together, the final syllable is only 1/3 times longer than the nonfinal syllable (Snow, 1997). In any case, the final syllable (i.e., the second syllable in this study) was still longer than the nonfinal syllable (i.e., the first syllable in this study).

Vihman, et al. (1998) suggested that children are provided examples of different stress patterns through adult speech other than the trochaic pattern. For example, French-speaking children seem to have a bias for iambic stress patterns rather than trochaic stress patterns as in English. Nevertheless, they observed that children's utterances, in both French and English, have longer second syllables than the first (Vihman, et al. 1998). The findings of this study are also consistent with Vihman, et al. (1998).

At 21 months, changes were found in both number of syllables and syllable duration. At 21 months, not only did the difference between syllable lengths decrease, but the number of filler syllables decreased from 260 at 20 months to 120 to 21 months. The number of fillers increased again to 131 at 22 months and 137 at 23 months. During the 22 and 23 months, the total number of words increased from 531 at 21 months to 710 at 22 months and 851 at 23 months. As the number of words increased the number of fillers decreased. Since the fillers decreased as the words increased, it appeared that the fillers were no longer needed once Seth produced an approximation of the adult target that he could produce for the target word he was trying to produce. This was interpreted to mean that fillers are evidence of syntactic elements under construction which follows Peters' Position II constructivist position theory.

The findings from this study on filler syllables and prosody can be applied clinically. A suggestion shared by Chapman (1981), Fey (1986), and Hubbell (1981) is that adults should model a sentence slightly longer and more complex than the sentence that the child can actually produce. Seth could not actually produce the adult target, yet he seems to be aware of some elements of the target. The presence of a filler syllable produced by a child acquiring language is considered as evidence of elements under construction. Therefore, it is important to incorporate those pregrammatical markers, or function words into the utterance. In Seth's case, this provides a rhythmic frame that lets the child know there is a gap in that utterance that needs to be filled.

Chapman (1981) suggested that if the clinician is modeling utterances that are a step above the child's language ability, and the child is not ready to produce the model, the child will simply omit that portion of the utterance. It is important for the clinician to produce grammatically well-formed utterances. These models will not hinder language, but can in fact help encourage language development (Chapman, 1981).

CHAPTER V

CONCLUSION

In conclusion, 21 months was an important milestone in language development for this child. During this period of 18 to 23 months, Seth produced mostly Monosyllabic and Disyllabic utterances. Research from this stud conclude that the filler syllables provided scaffolding for Seth to develop language during the 18-23 month period.

As Seth began to polish the syntactic elements of his speech, the fillers began to disappear. This shows that as he began to comprehend more of the adult model, less of the utterance had to be filtered out. The rhythmic elements of the adult model provided by his father gave Seth a standard to follow. As Seth's vocabulary grew, he was able to fill in the rhythmic elements with words that had meaning to Seth, instead of fillers to simply be a place holder.

As the utterances Seth produced became more complex, the position of the filler syllables changed in the utterance. For example, the fillers shifted from the beginning of the utterance to the middle of the utterance as the utterance length increased. It was found that position and age significantly affected the length of the syllable Seth produced at 18, 21, and 23 months regardless of syllable type (i.e., trochaic, iambic, or evenly stressed).

These findings suggest that 21 months was a milestone marker for Seth. The researcher investigated the development of prosody in American English and its relationship to segmental phonology and morphology with the acquisition of stress patterns

Table 1.1 Syllable inventory from 18_0 to 23_2 months

	M	FM	D	FD	O	FO	total
18_0	86 52%	28 17%	46 28%	2 1.2%	2 1.2%	0 0%	164
18_2	22 30%	16 22%	30 41%	2 2.7%%	2 2.7%	0 0%	72
19_0	112 57%	26 13%	54 27%	3 1.5%	1 .5%	0 0%	196
19_2	171 43%	98 24%	42 11%	41 10%	38 9.6%	4 1%	394
20_0	77 29%	50 19%	61 23%	62 24%	7 2.7%	4 1.5%	261
20_2	50 23%	68 31%	44 20%	38 17%	18 8.1%	3 1.4%	221
21_0	119 30%	85 22%	105 27%	31 7.9%	48 12%	3 .77%	391
21_2	34 24%	0 0%	75 53%	1 .71%	30 21%	0 0%	140
22_0	81 31%	5 1.9%	114 44%	8 3.1%	49 19%	2 .77%	259
22_2	142 31%	24 5.3%	98 22%	85 19%	95 21%	7 1.5%	451
23_0	164 32%	11 2.1%	157 30%	40 7.8%	111 22%	33 6.4%	516
23_2	61 18%	3 .9%	105 31%	27 8%	116 35%	23 6.9%	335
Total	1119 33%	441 13%	931 27%	340 10%	517 15%	79 2.3%	3400

Table 1.2 Syllable Duration at 18_0 to 18_2 months

Sw1	Sw2	wS1	wS2	even1	even2
148.8	291.5	154.9	276.3	80.3	220.7
142.8	186.8	197.0	164.1	190.4	214.4
224.3	481.5	184.8	126.5	193.1	125.9
180.0	277.2	96.2	348.2	99.8	464.0
160.5	199.4	164.0	283.8	154.3	331.8
127.7	124.0	160.0	288.6	187.1	271.3
154.1	219.8	183.1	202.6	157.2	209.6
131.5	412.1	166.0	419.9	181.5	194.6
200.1	131.9	100.1	266.1		
117.5	138.5	181.3	267.3		
130.7	119.6	237.6	261.9		
179.4	223.4	90.2	147.4		
153.8	432.1	91.1	144.8		
184.9	331.4	154.3	161.1		
94.0	227.9	127.7	304.3		
139.7	234.5	136.2	198.1		
AVERAGE				AVERAGE	
154.4	252.0	151.5	241.3	155.5	254.0

Table 1.3 Syllable Duration at 21_0 to 21_2 months

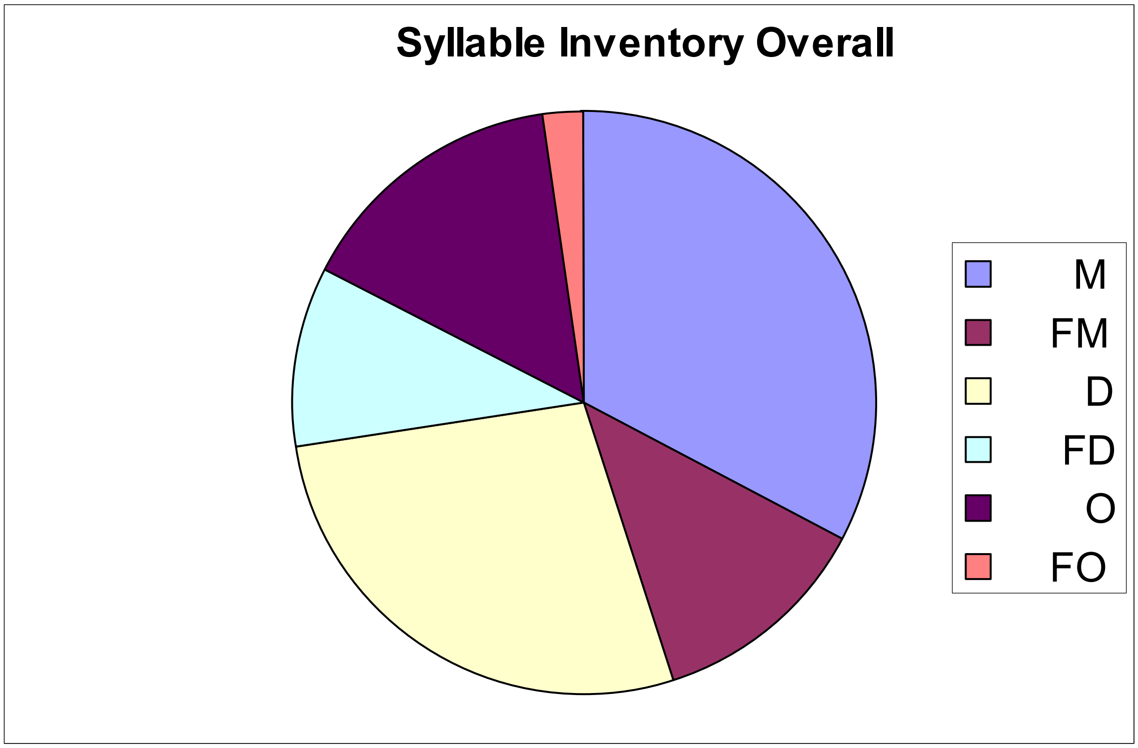
Sw1	Sw2	wS1	wS2	even1	even2
151.2	185.7	132.3	243.1	150.9	269.4
320.1	218.6	206.8	211.7	153.8	145.4
101.5	78.1	156.6	193.4	137.9	183.1
253.1	149.2	134.1	142.6	63.3	100.2
249.5	177.3	122.2	100.2	90.7	155.8
172.3	157.6	236.9	81.8	98.2	144.7
227.8	97.6	168.7	216.3	108.5	95.6
138.6	155.5	110.2	127.2	85.2	205.4
120.0	169.0	175.4	222.0	74.9	173.1
138.2	226.9	179.8	234.0	69.2	120.6
139.5	319.0	86.7	150.7	91.8	99.3
104.0	131.8	102.3	130.2	154.1	145.2
258.0	223.1	97.3	138.5	84.5	68.6
114.9	162.3	145.7	136.4	190.8	155.9
141.2	199.4	58.9	83.7	136.2	176.5
253.2	192.7	230.7	220.9	125.3	109.6
129.6	112.5	100.8	125.1	127.9	63.9
187.4	175.2	93.0	110.1	125.9	203.0
77.0	157.7	121.7	181.6	65.9	69.8
79.5	127.8	81.1	146.4	99.3	99.3
Average duration 167.8	170.9	137.1	159.8	111.7	139.2

Table 1.4 Syllable Duration at 23_0 to 23_2 months

Sw1	**Sw2**	**wS1**	**wS2**	**even1**	**even2**
180.7	147.1	100.9	390.9	158.9	151.3
116.6	132.4	181.8	192.5	142.3	244.7
88.9	129.3	174.9	289.0	72.8	78.0
112.4	311.0	159.1	167.0	116.1	305.2
215.2	180.0	199.1	174.2	121.7	129.4
165.6	407.8	127.8	95.8	151.9	306.9
118.2	99.3	94.1	169.8	124.4	89.1
149.2	240.4	119.2	162.9	110.0	162.6
148.3	217.5	156.2	199.0	64.2	139.1
195.1	312.2	119.2	246.0	165.1	334.7
60.9	189.1	123.0	137.1	133.0	103.2
117.6	200.6	182.3	309.2	201.7	162.0
126.8	192.2	55.9	62.6	192.6	64.2
76.3	189.2	123.0	176.6	135.3	194.9
176.1	73.0	182.1	316.1	96.9	51.8
140.0	97.1	78.7	245.8	59.8	121.0
94.4	53.7	68.9	128.4	121.5	271.4
144.9	236.6	174.8	200.7	82.6	91.2
60.0	140.5	85.4	174.8	88.1	97.1
75.6	107.8	53.1	151.2	108.1	111.2
Average duration128.1	182.8	128.0	199.5	122.4	160.5

Table 2 Mean Syllable Duration from 18_0 to 23_2 months

18_0 to 18_2months	**Sw1**	**Sw2**	**wS1**	**wS2**	**even1**	**even2**
Average duration	154.3625	251.975	151.5313	241.3125	155.4625	254.0375
21_0 to 21_2months	**Sw1**	**Sw2**	**wS1**	**wS2**	**even1**	**even2**
Average duration	167.83	170.85	137.06	159.795	111.715	139.22
23_0 to 23_2months	**Sw1**	**Sw2**	**wS1**	**wS2**	**even1**	**even2**
Average duration	128.14	182.8375	127.975	199.48	122.35	160.45



M= monosyllabic

FM= filler followed by a monosyllable

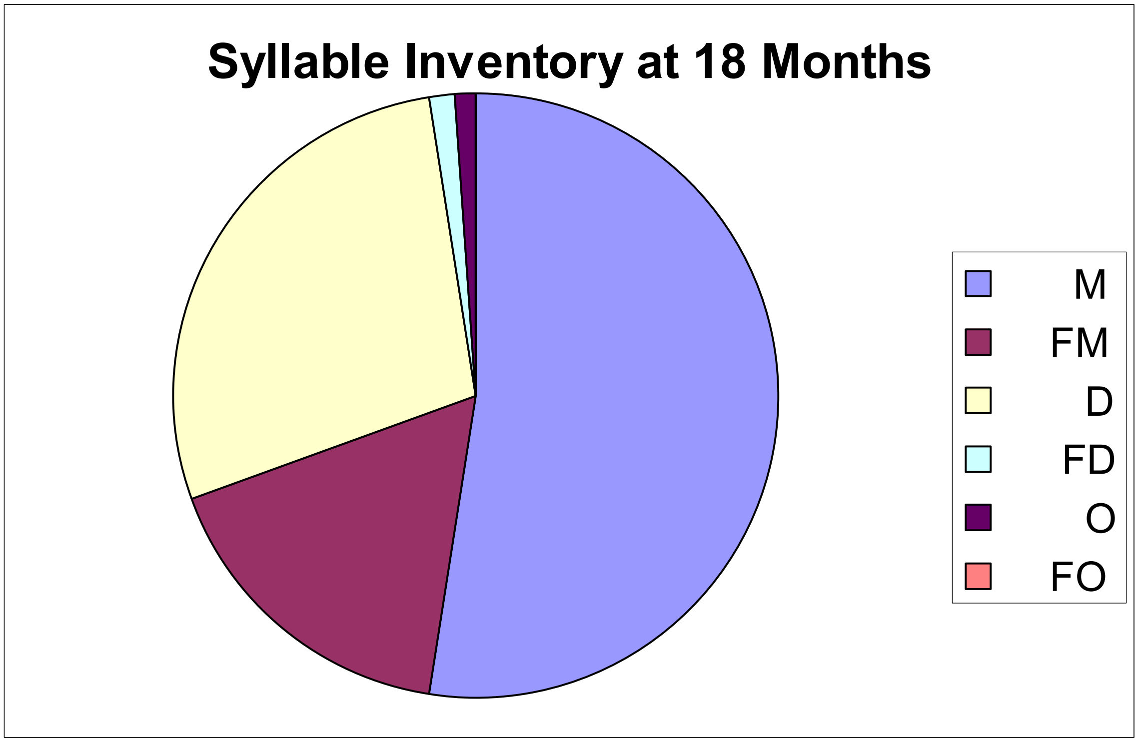
D= disyllables

FD=filler followed by a disyllable

O= other (syllables with more than 2 syllables

FO= filler followed by a syllable with more than 2 syllables

Chart 1.1—Syllable Inventory: Overall



M= monosyllabic

FM= filler followed by a monosyllable

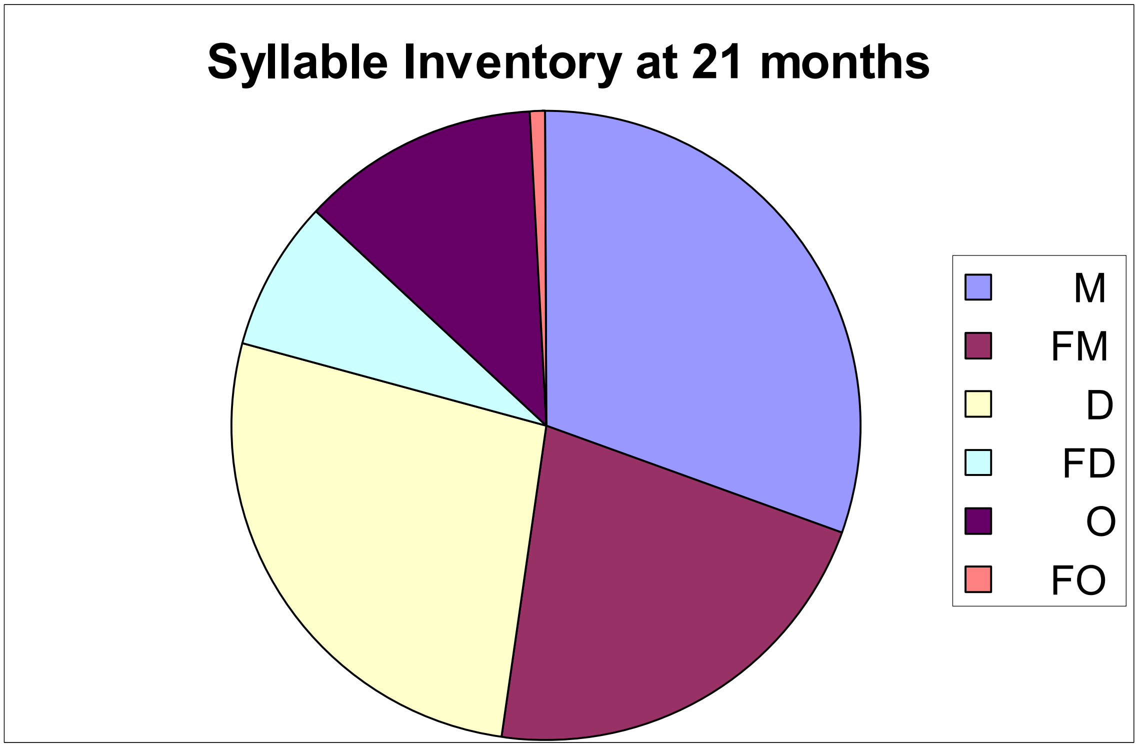
D= disyllables

FD=filler followed by a disyllable

O= other (syllables with more than 2 syllables

FO= filler followed by a syllable with more than 2 syllables

Chart 1.2 Syllable Inventory from 18_0 to18_2 months



M= monosyllabic

FM= filler followed by a monosyllable

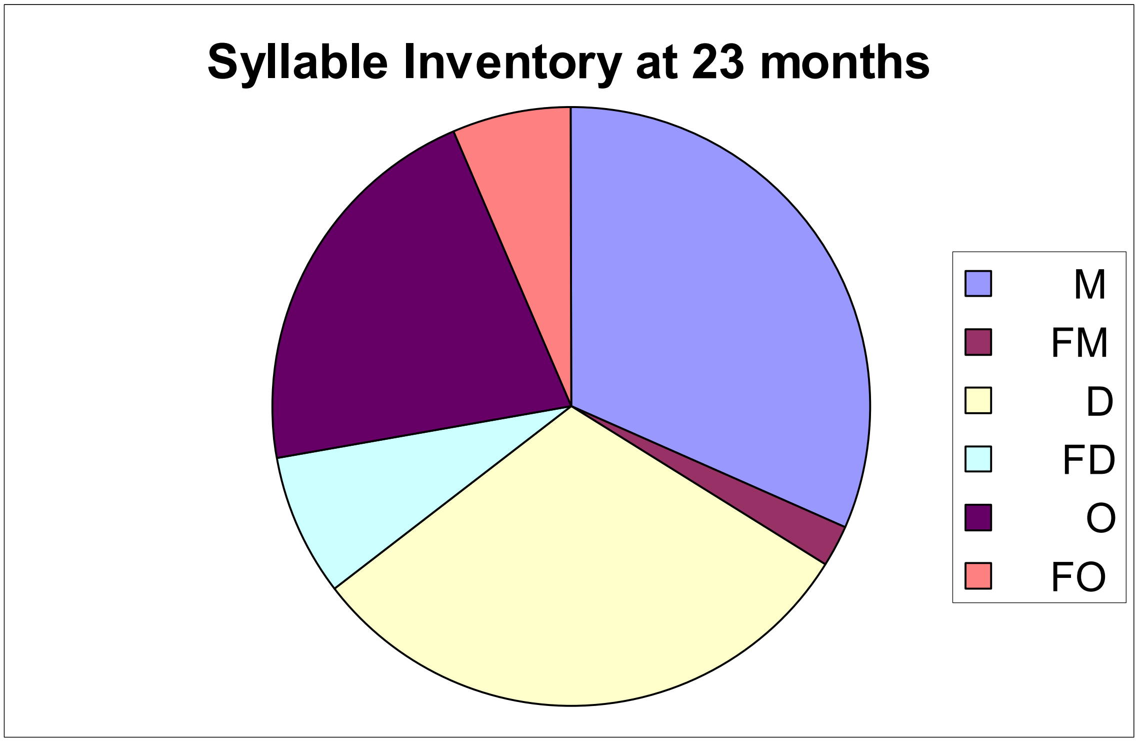
D= disyllables

FD=filler followed by a disyllable

O= other (syllables with more than 2 syllables

FO= filler followed by a syllable with more than 2 syllables

Chart 1.3 Syllable Inventory from 21_0 to 21_2 months



M= monosyllabic

FM= filler followed by a monosyllable

D= disyllables

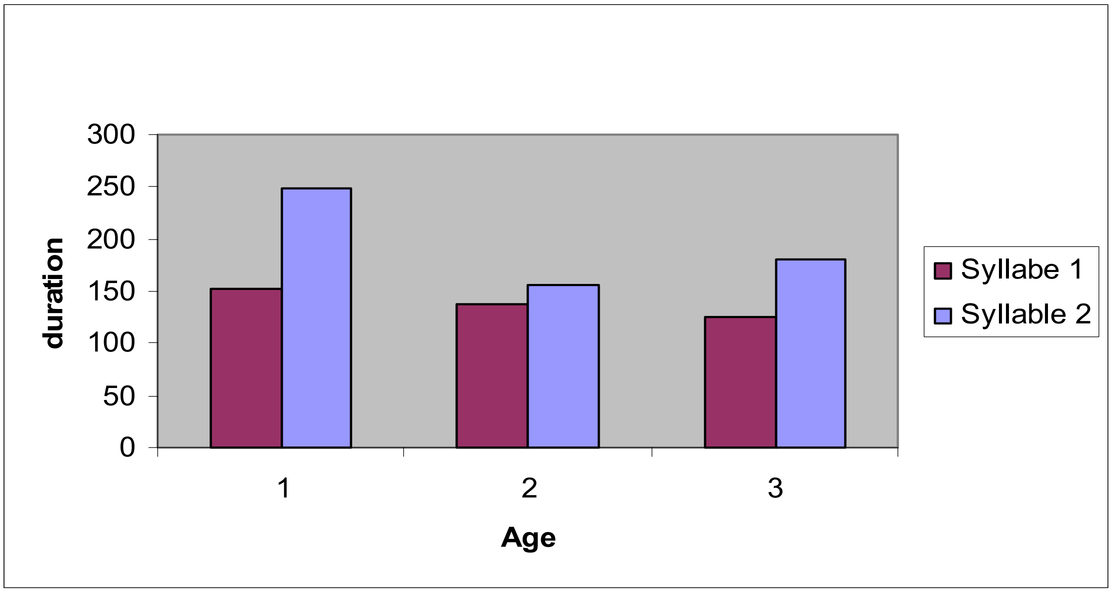
FD=filler followed by a disyllable

O= other (syllables with more than 2 syllables

FO= filler followed by a syllable with more than 2 syllables

Chart 1.4 Syllable Inventory from 23_0 to 23_2 months

Age X Position effect



1

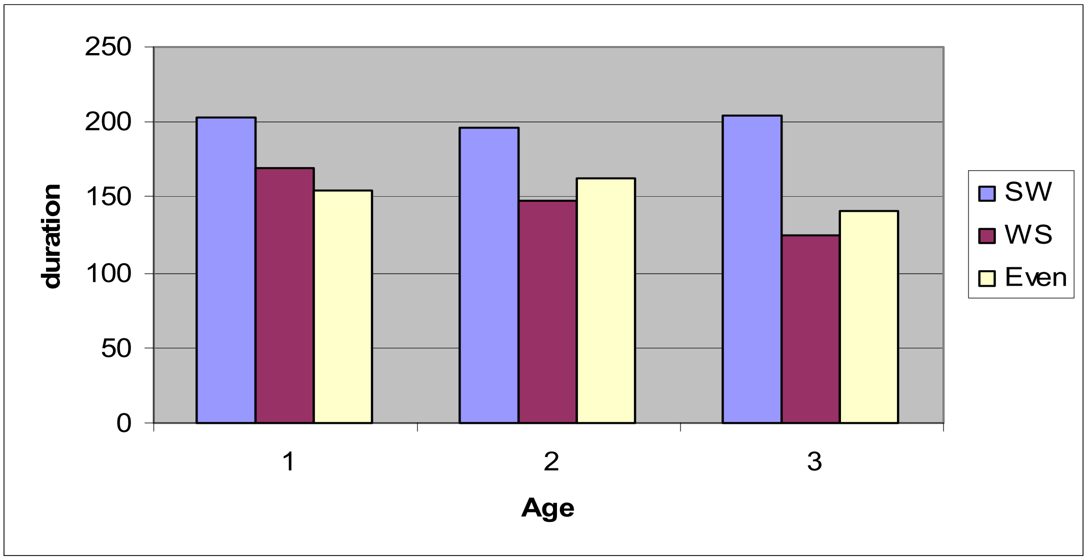
1= 18_0 to 18_2 months

2= 21_0 to 21_2 months

3= 23_0 to 23_2 months

CHART 1.5 Average syllable duration by age and position

Age X Stress effect

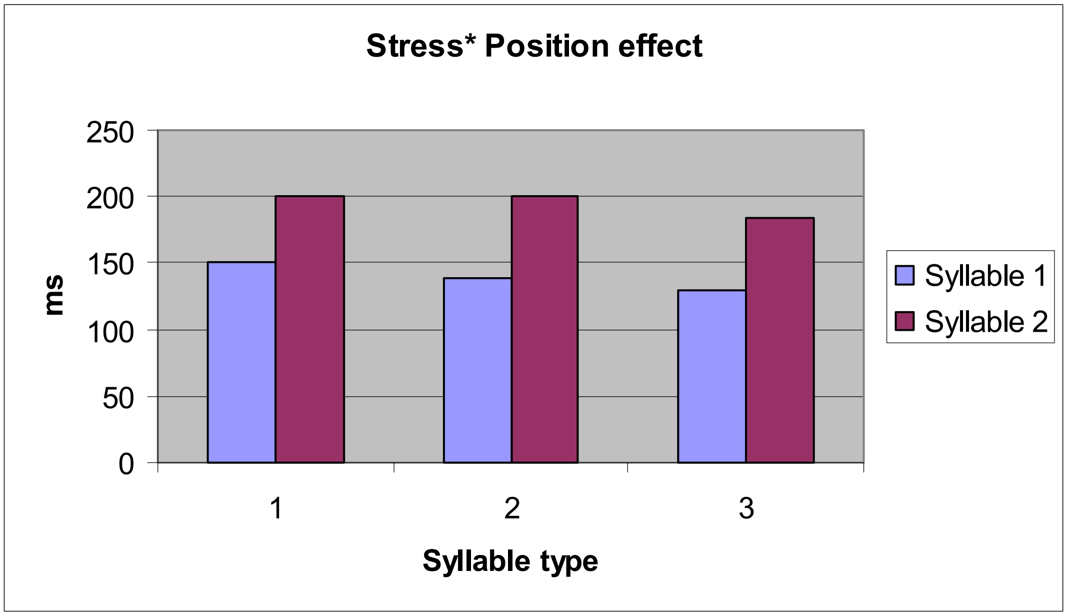


1= 18_0 to 18_2 months

2= 21_0 to 21_2 months

3= 23_0 to 23_2 months

CHART 1.6 Age X Stress effect

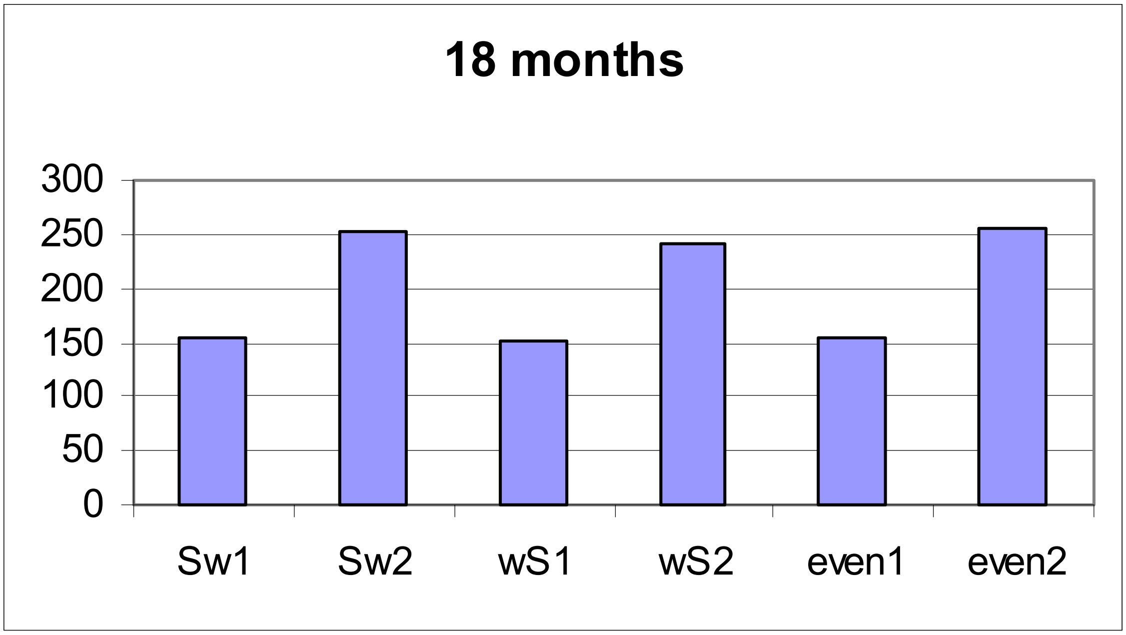


1=trochaic

2= iambic

3= even

CHART 1.7 Stress X Position effect



Sw1= 1st syllable of a trochaic syllable

Sw2= 2nd syllable of a trochaic syllable

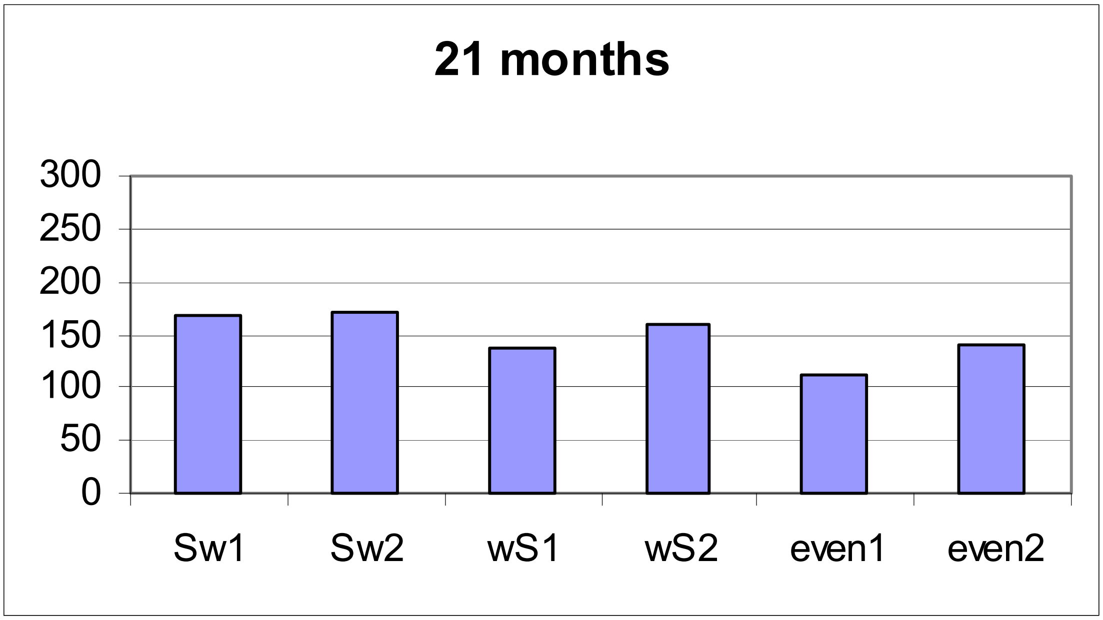
wS1= 1st syllable of an iambic syllable

wS2= 2nd syllable of an iambic syllable

even1=1st syllable of an evenly stressed syllable

even2= 2nd syllable of an evenly stressed syllable

CHART 1.8 18 months syllable length



Sw1= 1st syllable of a trochaic syllable

Sw2= 2nd syllable of a trochaic syllable

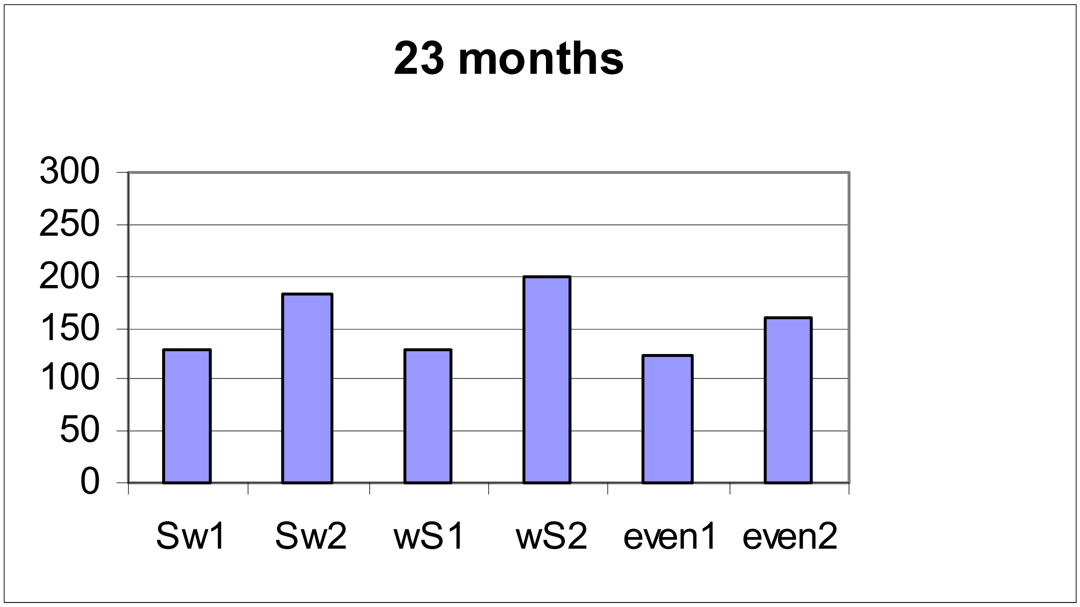
wS1= 1st syllable of an iambic syllable

wS2= 2nd syllable of an iambic syllable

even1=1st syllable of an evenly stressed syllable

even2= 2nd syllable of an evenly stressed syllable

CHART 1.9 21 months syllable length



Sw1= 1st syllable of a trochaic syllable

Sw2= 2nd syllable of a trochaic syllable

wS1= 1st syllable of an iambic syllable

wS2= 2nd syllable of an iambic syllable

even1=1st syllable of an evenly stressed syllable

even2= 2nd syllable of an evenly stressed syllable

CHART 1.10 23 months syllable length

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