A Longitudinal Case Study of Late Babble and Early Speech in Southern Mandarin*

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ABSTRACT

This paper studies the relation between canonical/variegated babble (CB/VB) and early speech in an infant acquiring Mandarin Chinese from 9 to 17 months. The infant was audio-and video-taped in her home almost every week. The data analyzed here come from 1,621 utterances extracted from 23 sessions ranging from 30 minutes to one hour, from age 00:09;07 to 01:05;27. The data was digitized, and segments from 23 sessions were transcribed in narrow IPA and coded for analysis. Babble was coded from age 00:09;07 to 01:00;00, and words were coded from 01:00;00 to 01:05;27, proto-words appeared at 11 months, and some babble was still present after 01:10;00. 3821 segments were counted in CB/VB utterances, plus the segments found in 899 word tokens. The data transcription was completed and checked by the author and was rechecked by two other researchers who majored in Chinese phonetics in order to ensure the reliability, we reached an agreement of 95.65%.

Mandarin Chinese is phonetically very rich in consonants, especially affricates: it has aspirated and unaspirated stops in labial, alveolar, and velar places of articulation; affricates and fricatives in alveolar, retroflex, and palatal places; /f/; labial, alveolar, and velar nasals; a lateral;[h]; and labiovelar and palatal glides. In the child's pre-speech phonetic repertoire, 7 different consonants and 10 vowels

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were transcribed at 00:09;07. By 00:10;16, the number of phones was more than doubled (17 consonants, 25 vowels), but the rate of increase slowed after 11 months of age. The phones from babbling remained active throughout the child's early and subsequent speech. The rank order of the occurrence of the major class types for both CB and early speech was: stops, approximants, nasals, affricates, fricatives and lateral. As expected, unaspirated stops outnumbered aspirated stops, and front stops and nasals were more frequent than back sounds in both types of utterances. The fact that affricates outnumbered fricatives in the child's late babble indicates the pre-speech influence of the ambient language.

The analysis of the data also showed that: 1) the phonetic characteristics of CB/VB and early meaningful speech are extremely similar. The similarities of CB/VB and speech prove that the two are deeply related; 2) The infant has demonstrated similar preferences for certain types of sounds in the two stages; 3) The infant's babbling was patterned at segmental level, and this regularity was similarly evident in the early speech of children. The three types being coronal plus front vowel; labial plus central and dorsal plus back vowel exhibited much overlap in the phonetic forms of CB/ VB and early speech. So the child's CB/ VB at this stage already shared the basic architecture, composition and representation of early speech. The evidence of similarity between CB/VB and early speech leaves no doubt that phones present in CB/VB are indeed precursors to early speech.

Key Words
a longitudinal case study, Southern Mandarin, late babble, early speech development

1. Introduction

1.1 Background of this Research

There exist two kinds of opposing views as to the roles of babble in language acquisition. Before the 1970s, quite a number of researchers assumed discontinuity between babbling and speech (Jakobson 1941/1968; Lenneberg 1967; quoted from Oller 2000: p.44). According to Jakobson, "phonetic abundance" is replaced by "phonemic poverty" at the onset

of speech. Phonemic principles cannot be invoked as long as infants do not have any lexical items. He also claimed that the babbled sounds are 'wild sounds' (pp.25-26) and babbling does not relate to phonological development in any functional sense. He even surmised that infants pass through a "silent period". Muteness totally separates babbling from the first words. Some psychologists like Lenneberg (1967) and Moskowitz (1970) also postulated a total discontinuity between babbling and speech. In Lenneberg's opinion, phones from babbling were erratic and discoordinated until the beginning of speech.

However, since the 1970s, the discontinuity claims have incurred lots of criticisms. Ferguson & Farwell (1975) said their data cast doubt on the Jakobsonian assumptions of 1) a strict separation between phonetic and phonological development; 2) simultaneity in lexical and phonological parameters of the break between prelanguage and language (p.434). Oller et al. (1976) employed data from the children in English-speaking homes to show that "Jakobson was in error about the nature of babbling"(p.2). They said they have obtained evidence that babbled utterances are not "random vocalizations" but are rather a systematic expression. Boysson-Bardies et al. (1981) remarked that different kinds of studies run against such "a radical view". In Menn's (1983) opinion, the "silent period" advanced by Jakobson is "a rare phenomenon"(p.6).

Today, the notion of continuity between babbling and early speech is widely supported by empirical studies. A large body of researchers are interested in exploring the continuity relation on the phonetic level. A number of longitudinal investigations of infant vocalizations have been conducted , and all of them have assumed that babble is a key precursor to early speech (Oller et al. l976, 1982,1988 ; Oller 1980,1995, 2000; Elbers 1982; Ferguson and Macken 1983; Menn 1983; Vihman et al.1985; Elbers and Ton 1985; Kent & Bauer 1985; Vihman 1996; Boysson-Bardies et al. l981, 1984, 1992; Boysson-Bardies 1999).

Some researchers found similarities between babbling and speech .On

the basis of studying10 infants (5 infants at 00;06;00-00;08;00, 5 infants at 12-13 –month-old), Oller et al. (1976) found some similarities: 1) more singleton consonants than consonant clusters, (2) more initial than final consonants, (3)more initial stops than fricatives and affricates, (4) a greater proportion of fricatives and affricates relative to stops in final positions than in initial positions, (5) more unaspirated than aspirated initial stops, (6) more voiceless than voiced final obstruents, (7) more prevocalic glides than liquids, (8)more apical than dorsal obstruents. The research shows that the phonetic content of babbled utterances exhibits many of the same preferences for certain kinds of phonetic elements and sequences that have been found in early speech. Boysson-Bardies et al. (1981) studied the late babbling of a French child named Sébastien (01;06;00-01;08;00), the findings support their proposition that babbling is relevant to the study of linguistic performance. Scarcity of liquids, scarcity of clusters, deaspiration, final devoicing and frequency of initial and final consonants are characteristic of both late babbling and the first words.

Some other researchers demonstrated a continuity between babbling and early speech from cross-linguistic perspectives. Boysson-Bardies et al. (1981) found two kinds of studies hard to reconcile with the position of a radical discontinuity between the phonetic structure of babbling and the earliest speech. In the first group of studies adults are shown to be able to discriminate between the babbling of children from different language communities (Weir 1966; quoted from Boysson-Bardies 1981: p.512). Boysson-Bardies et al. (1984) collected samples of babbling productions of 6-, 8- and 10-month-old Arabic, Cantonese and French infants were presented to adult judges whose task was to identify the infants from their own linguistic communities. The results show that certain language-specific metaphonological cues make the identification possible. The second group of studies on babbling argued that the babbling stage is a period in which the child's repertoire is shifted in the direction of the language to be learnt, babbling is greatly influenced by ambient language (Lewis

1936; Leopold 1947; Weir 1966; Cruttenden 1970; quoted from Boysson-Bardies 1981:512; Bloom 1988; Levitt and Utman 1992). After a cross-linguistic analysis of children's production of vowels, Boysson-Bardies(1992) reported that adult English speakers have more front vowels, /i/, /I/, /Q/; French speakers more rounded vowels /Q/, /O/; Cantonese speakers more back vowels /□ /, /A/. And Algerians have only three in their phonological system, the realizations of which are more central than front or back vowels. The distribution of vowels is quite different for the four groups. The English children have a tendency to produce high front vowels /i/ and /I/, while the Cantonese, at the opposite extreme, favor the low back vowels /□ /and /o/. The vowels produced by the children in the four linguistic communities observed display the tendency toward the characteristics of their local languages. They concluded that it is seen cross-linguistically that babbling and early speech are phonetically related, in contradiction to the claims of Jakobson(1941/1968, p.576).

Our paper will support the continuity claim by analyzing the data of canonical/variegated babble (CB/VB) and early speech. Babbling is defined as reduplicated sequences of consonants and vowels .According to Oller et al. (1976), if a vocalization consists of a consonant and a vowel, it means infants have entered the babbling stage. They also made a distinction between marginal and canonical babbling, the former refers to the infant's first attempt to produce syllables, the latter refers to the reduplicated /variegated babble (RB/VB). CB is characterized by the production of well-formed syllables that have adultlike spectral properties (Kent and Bauer 1985; Oller 1986). However, researchers differ on the durations of CB: 6-10 months (Oller 1980); 8-10 months (Stark 1980); 7-12 months (Koopman -van Beinum & van der Stelt 1986); 7-12 months (Roug et al. 1989). As for our subject (AJR), she was already in CB stage when we began data collecting at her 00;09;07. B is characterized by phonetic concatenations and mixing, resulting in sentencelike strings of babble with alternating consonants, vowels and patterns of stress (Roug et al.

1989; Elbers 1982).Others have used the term“ Jargon” (Menn 1978; quoted from Roug et al. 1989:39). Reseachers also differ on durations of VB: 10-12 months(Oller 1980); 10-14 months (Stark 1980); from 12 months on (Roug et al. 1989). VB occurred in our subject (AJR) at 00;10;00 and lasted until she was 16 months old.

Several studies have suggested that CB/VB and early speech development is closely related. According to Oller (1980:99, quoted from Roug et al. 1989:38), this is the first stage in which the child produces syllables that conform to natural language restrictions, the syllables that could be accepted from a phonological point of view. “The onset of canonical babbling is a landmark event in infants' vocal development for spoken language” (Ejiri 1998:226). Oller and Eilers(1988, quoted from Ejiri 1998:226) compared the phonological characteristics of the vocal behavior of 9 deaf infants with that of 21 hearing infants. They found that CB is produced in hearing infants but not in deaf infants by ten months of age. A case study of a tracheotomized infant by Locke and Pearson (1990) suggests that scanty CB is rather detrimental to later speech development. These correlations further support the view that babbling serves as a foundation of early speech development.

1.2 Research Questions

In our paper, three questions would be addressed: 1) What phones are present in CB/VB and continue to be used in early speech? 2) Does the infant have the same preference for some sounds in both late babbling and early speech? 3) Is there any similarity of syllable types between CB/VB and the first words? The purpose of this study is to show that CB/VB is closely related to early speech, and that babbling plays a very important role in language acquisition

2. Methodology

2.1 Subject

The Changsha infant from 9 to 17-month old was audio-and video-taped at home one hour almost every week under natural observation by investigators. She is the first born and the only child in the family. Her parents have received higher education, her father is anassociate professor at a university and her mother is a doctor. Mandarin Chinese is the medium of communication at home. The recordings were digitized. Parts of the digitized material were labeled. Utterances were segmented into syllable-sized units. The data for analysis consisted of 1,621 utterances extracted from 23 sessions ranging from 30 minutes to one hour.

2.2 Phonetic Transcription

The narrow IPA was used. The vocalizations in late babbling were divided into utterances. The following are the working criteria: 1) the vocalization minimally contains a voiced vocalic element or a voiced syllabic consonant; 2) the vocalization strikes the ear as speechlike rather than as a vegetative sound (cough, hiccup, and burp); crying, loud shrills and imitation (or repetition) are excluded from the data; 3) a long string of sounds is still considered an utterance if the change of breath is hardly noticeable.1,621 utterances were transcribed for one child. The transcription was completed by the author and was checked by two other researchers who majored in Chinese Phonetics in order to ensure the reliability, we reached an agreement of 95.65%.

2.3 Equipment and Software

The camcorder model is Sony DCR-PC120E; the recorder is Sony Stereo Cassette- Corder TCS-100DV, Cool Edit 2000 is used in dealing with

the sound document.

3.Results and Discussion

3.1 Phonetic Approach

Phonetic approaches characterizing the nature of acquisition as being motivated by physiological and perceptual influences focus on relationships among articulatory, respiratory and phonatory components of the speech production system as well as the potential impact of perceptual development in babbling.

In this part, I'd like to have a look at the similarities and differences between the phones in both canonical/ variegated babbling and early speech.

3.1.1 Some Common Features of Canonical/Variegated Babble and Early Speech

In this paper, the infant's canonical and variegated babble is hypothethized to be continuous. The former is the basis of the latter's development. Some research (Vihman 1992) showed that whether the infants enter the canonical babbling stage or not is rather critical for early speech. Those who are deaf and mute babble far less than normal infants during the canonical babbling stage. We also maintain that some of the features in babbling are shared by early speech. Next we'd like to compare the relative frequency of the sounds of both babbling and early speech in the following:

Table 3.1 Relative Frequency (%) of Consonantal Phones in Canonical / Variegated Babble (00;09;07-00;01;00)

[n]1.9	[k] .88	[m] .19	[§].02	[f].01
[j]1.3	[tþ].89	[r].19	[ts^h].01	[l].005

[t]1.3	[Z].31	[tþ^{h}].16	[tr].01	[p^{h}].005
[p]1.3	[k^{h}].27	[þ].09	[ts].01	
[h] 1.1	[w].26	[t^{h}].03	[N].01	

In terms of manner of articulation:
Stops(3.7) nonaspirated stops(3.4) aspirated stops(.31) front stops (2.6) back stops:1.15
Nasals(2.1) front nasals (2.09) back nasals(.01)
Glides (1.58)
Fricatives including the glottal [h](1.22); fricatives excluding [h] (.12)
Affricates (1.08)
Liquids (.19)
In terms of place of articulation: front consonants(4.9) back consonants(1.4)
Coronal (6.3) Glottal(1.23) Dorsal(1.1) Labial (.95)

In order to have a comparison of the frequency of the consonants in early words, the data is shown in the following:

Table 3.2 Relative Frequency (%) of Consonants in Early Words (01;00;14-01;05;27)

[j]2.3	[t].73	[ts^{h}].11	[f].04
[p]1.4	[k].72	[l] .10	[§].04
[m] .91	[tþ].61	[ts].08	[t^{h}].04
[n].90	[h].41	[w].08	[N].04
[tþ^{h}].82	[þ].21	[p^{h}].08	
	[k^{h}].20		

In terms of manner of articulation:
Stops (3.17) nonaspirated stops(2.85) aspirated stops(.52) front stops (2.25) back stops(.92)
Glides (2.38)
Nasals (1.85) front nasals (1.81) back nasals(.04)
Affricates (1.62)
Fricatives including glottal [h] (.87); fricatives excluding the glottal [h](.46)
Liquids (.10)

In terms of place of articulation: Front consonants (6.09) back consonants (1.91)
Coronal (5.98) Labial (2.47) Dorsal (.96) Glottal (.41)

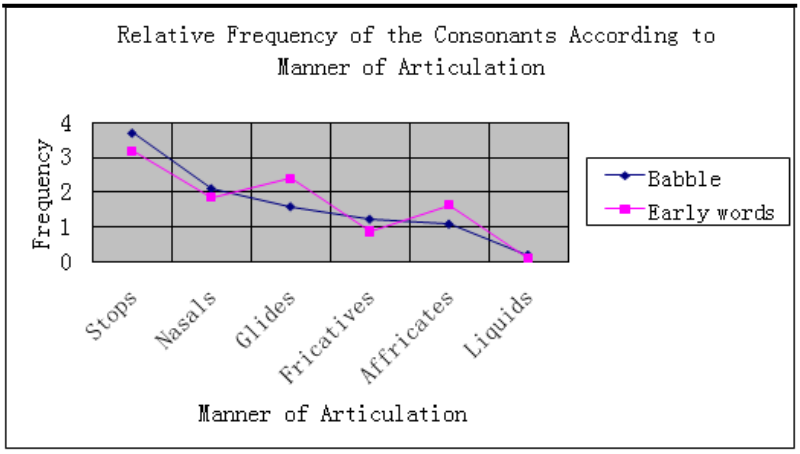

Figure 3.1 Relative Frequency (%)of the Consonants in Manner of Articulation

According to manner of articulation, in CB/VB and early words, the number of the stops is the highest and that of the liquid is the lowest. As to babbling, of the stops, nonaspirated stops are much more often in occurrence than the aspirated ones. Front stops outnumber the back stops. Of the nasals, the front nasals occur more frequently than the back nasal. If the glottal [h] is excluded from the fricatives, the frequency of the fricatives will be .12 which will be the lowest among all the types of the consonants. This shows a fact that [h] is a frequent sound in babbling. In early speech, the rank order within the types of stops and nasals is the same as that in babbling. There are more nonaspirated stops than the aspirated ones, front stops are more, the back stops are fewer. The infant produced more front nasals than back nasals. There also exist some differences. In canonical /variegated babbling, the second highest is nasals, the third is glides; while in early speech, the second highest is glides and the third is affricates as is indicated in the figure above. Whether

the glottal [h] is included or excluded from fricatives, the frequency is still low. It means [h] in early speech does not appear as often as it does in babbling. Stop consonants constitute the most frequent manner class in both initial and final positions. Phonological acquisition data show that stops are acquired early in phonological acquisition and often serve as substitutes for target fricatives according to Jakobson (1941/1968).These discrepancies show an important fact that manner of articulation leads to differences in the frequency of consonants.

Other researchers have also demonstrated children's common preference for labial and coronal stops, nasal, and glide consonant types in both babbling and early speech (Irwin1947; Fisichelli 1950; Pierce and Hanna's 1974; Blake 2000; Locke 1983; Roug et al. 1989; Stoel-Gammon 1985). On the whole, aspirated stops, fricatives and liquids, tend to have lower frequency of occurrence from onset of babbling to early speech. Irwin (1947) observed 62 infants at 11-12 months, Fisichelli (1950) observed 20 infants at 12 months, Pierce and Hanna's (1974) recorded 42 12-month-old infants(quoted from Locke 1983:p.5), they are unanimous in showing that 12 consonants are more frequent than other protoconsonants ([h], [d], [b], [m], [t], [g], [s], [w], [n], [k], [j], [p]). Among them, there are 6 stops, two glides and two of the three nasals. In the babbling of our subject, the 12 more frequent consonants are [n] ,[j], [d], [b], [g], [tþ], [Z], [k^h], [w], [m], [p], [r]. Four stops, two nasals and two glides are among them. Inbabbling, infants produce more front vowels and central vowels, the number of the back vowels is the least. The same preference is also shown in the infant's early words: [j], [b], [m], [n], [$tþ^h$], [d], [g], [tþ], [h], [þ], [ts^h], [l]. The three unaspirated stops, two nasals and one glide are present in the infant's early words. If we classify [uA] as glides rather than diphthongs, then the glide [w] would be included within the 12 more frequent consonants. Blake(2000:pp.21-23) compared the phonetic preference of one boy and one girl from the younger English–Canadian group and one boy and one girl from the Parisian–French

group, she also listed the relative frequency of several infants for the age periods 9-14 months, 13-17 months, she found that these infants consistently preferred stops, glides and labial[m].

Table 3.3 Relative Frequency (%) of Consonantal Categories

	English-Canadian				Parisian-French			
	Female		Male		Female		Male	
Age in months	9-11	12-14	9-11	12-14	9-11	12-14	9-11	12-14
Phonetic categories								
b/p	**.02**	**.02**	**.03**	**.03**	**.10**	**.05**	.01	.004
m	**.19**	**.38**	**.30**	**.15**	**.05**	**.12**	**.21**	**.12**
f/v	.005	.003	.01	0	.01	.004	.005	0
d/t	**.07**	**.03**	**.11**	**.17**	**.04**	**.04**	**.03**	**.09**
g/k	**.02**	**.03**	**.04**	**.05**	**.04**	.02	**.03**	**.02**
n	.01	.003	.01	**.03**	.002	.01	.02	.004
l	.003	.001	.01	.02	.01	.008	.003	.006
s/z	0	.004	**.02**	.01	.01	.004	.002	.01
w	.01	**.03**	0	0	.03	**.06**	.005	.004
j	**.04**	**.02**	.04	**.04**	.07	**.06**	**.02**	**.09**
r	.003	.001	0	0	0	.008	.003	0

Source: From Blake (2000: p.21)

Table 3.4 Relative Frequency (%) of Consonantal Categories for Older English-Canadian Infants

	Nic			Kar		San	
Age in months	13-15	15.5-17	17.5-17.9	13-15	16-18	14-15.5	16-17
Phonetic categories							
b/p	**.03**	**.05**	**.05**	**.05**	**.11**	.04	.04
m	.02	.01	.03	.01	.04	.02	.04
d/t	**.27**	**.33**	**.19**	**.17**	**.09**	**.20**	**.26**
g/k	.02	.05	.03	**.04**	**.13**	.02	**.07**
n/l	0	.03	.01	.03	.01	.02	.01

s/z	.02	0	0	.01	.04	.01	0
w	.03	.04	**.08**	**.07**	**.07**	**.13**	.05
j	.03	.02	.03	**.07**	.01	.14	**.13**
r	0	0	0	0	0	0	0

Source: From Blake (2000: p.26)

From her data, we can see that we can find a lot in common between CB/VB and early speech. Infants show their preference or dispreference for certain sounds in CB/VB and early speech, for example, they prefer producing stops, they disprefer fricatives and liquids. Oller et al. (1976) studied 10 infants(5 infants at 00;06;00-00;08; 5 infants at01;00;00-01;01;00), for all the infants, the number of stops is the largest. There are fewer fricatives and liquids. Stoel-Gammon and Cooper (1984) studied 3 children (Daniel00;11;02-01;00;02, Sarah 00;10;00-00;11;00, Will 00;11;02-01;00;02) , they reported in both CB/VB and early speech, stops and nasals occur more frequently than fricatives. Roug, Landberg and Lundberg's data of the four Swedish infants(00;01;00-01;05;00)show that the percentage of stops, nasals and fricatives is 91%, the glides, liquids and thrills are 4%, 3% and 2% respectively. Kent and Bauer (1985) investigated 5 infants (01;01;00) and reported that of all the data of the 5 infants: stops have the highest occurrence. Of which 85% is voiced stops. Of the 369 CV syllables, the number of the stops is 74%, fricatives: 11%.

On the other hand, we find that features of CB/VB are also characteristic of early speech especially in terms of place of articulation. The following figure shows the similarities between babbling and early speech.

In terms of place of articulation, there is a surprising similarity between CB/VB and early speech. Overall rank order remains quite similar across the age periods: most frequent are front consonants, less frequent are back consonants; coronal consonants are predominantly more than the other types of the consonants such as glottal, dorsals and labials. In babbling,

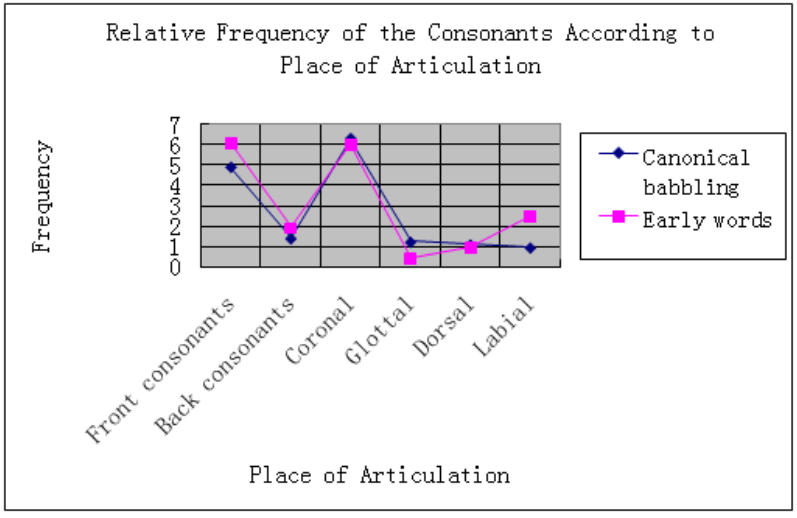

Figure 3.2 Relative Frequency (%)of the Consonants in Place of Articulation

glottal and dorsal sounds are more prevalent than the labial type, but in early speech the labial type prevails over the dorsal and the glottal type, the second highest is labials. Bilabial and alveolar consonants occur more frequently than velars. Phonological acquisition data show that bilabials and alveolars are acquired earlier and that alveolars often serve as substitutes for velars.

In terms of place of articulation, infants don't show much difference between canonical babbling and early speech. Roug, Landberg and Lundberg's data(1989) indicate that four places of articulation are of high frequency (in descending order): bilabial, dental/alveolar, velar and glottal, their percentage is 92%, the percentage of palatal, uvular is 3% and 4%, labiodental is 1%. There is a total absence of retroflex, alveo-palatal, palato-alveolar, pharyngeal. Davis and MacNeilage (1995) also found little change in relative frequency of consonant place categories. Our result confirms the conclusion that canonical/variegated babbling and early words have been shown to be generally similar in consonant place of production

(which is similar to the findings of Vihman et al.1985;Vihman & Greenlee 1987). However, dentals and glottals are more associated with babbling, labials are more associated with words.(Stoel-Gammon & Cooper 1984; Vihman et al.1985). Furthermore, the consonants that occur most often in canonical babbling-stops, nasals, and glides are those that typically appear in early word productions; consonant classes that are infrequent in babble-liquid, fricatives, and affricates-are precisely those that appear later in meaningful speech (Robb et. al.1994; Stoel- Gammon 1985). Next shows the vowel frequency.

Table 3.5 Relative Frequency (%)of Vocalic Phones of the Subject in Canonical /Variegated Babble (00;09;07-00;01;00)

[A]2.5	[F].59	[ei].17	[iE].08	[Ã].023
[i]1.61	[Q].47	[iA].12	[uA].04	[ ].01
[ai]1.0	[E].41	[y].11	[uo].029	[i].01
[e].98	[«].30	[Au].068	[iou].028	[A].01
[ou].65	[u].20	[o].08	[i«].004	

Front vowels(4.29), central vowels(3.8), back vowels (1.61)

Table 3.6 Relative Frequency (%) of Vocalic Phones in Early Words (00;09;07-00;01;00)

[A]2.13	[iou].59	[ou].32	[uA].14
[i]1.67	[E].59	[«].23	[uo].14
[ai]0.99	[e].36	[Q].18	[F].14
[Au].68	[iE].36	[u].18	[uai].09
[ei].63	[o].36	[iA].14	[Ã].09

Front vowels(4.52), central vowels(2.45), back vowels (2.14)

In CB/VB , the 12 more frequent vocalic phones are:[A], [i], [ai], [e], [ou], [F], [Q], [E], [«], [u], [ei], [iA]; in early words , the more frequent 12 sounds are: [A], [i], [ai], [Au], [ei], [iou], [E], [e], [iE], [o],

[ou], [«]. The three sounds [A], [i], [ai] have the highest frequency in both babbling and early speech. We can still find other sounds that are present in the two stages:[e], [ou], [E], [«], [ei]. What is more, front vowels are more than central vowels, and central vowels are more than back vowels. It can be concluded that infants enjoy producing front and central vowels.

Roug, Landberg and Lundberg (1989) said that in the first half of the year for an infant, it mainly produces non-high and non-low vowels like [«], [Q] lacking back vowels. For the second half of the year, it produces more vowels including the back vowels such as [i], [e], [Q], [a] . Kent and Murray (1982; quoted from Roug et al. 1989: p. 29) did an acoustic study of the 21 infants (0;3, 0;6, 0;9) and reported that infants mainly produce mid-front or central vowels. Cruttenden (1970; quoted from Roug et al. 1989: p. 29) found that his twin daughters produced [«], [Q] and [a] the most frequent in babbling. Kent and Bauer (1985) stated that the dada of the 5 infants(1;1) showed that they produced more central and front vowels than back vowels, more low vowels than high vowels. Blake (2000) also studied the frequency of the vowels in the four infants 9-11 months and 11-14 months. She found that vowel preferences containing only a single vowel type were mid-/low-front or central vowels [E],[Q],[«] [Ã],[a],[A] , as has been found in other studies (Irwin 1947; Buhr 1980; Davis & MacNeilage 1995; Vihman1992; quoted from Blake 2000). She also said that infants rarely produced high front vowels [i/I] .Our result did not offer support for this conclusion. The data shows that our subject likes producing front and central especially low central vowels in both CB/VB and early speech.

We can see now by 01;00;08, the infant has got a rich phonetic repertoire though the phonological system is far from complete at this stage. On average, the infant has a phonetic inventory containing voiced and voiceless labial, alveolar, and (usually) velar stop consonants; labial and alveolar nasals; glides [w] and [j]; and some fricatives usually [f] (Paynter &

Petty, 1974; Prather, Hedrick, & Kern, 1975; Stoel-Gammon, 1985, 1987,1989,1992). Those sounds are the most prevalent in both babbling and early words which can be regarded as the primitives of language.

3.2 Phonotactic Structures

Davis and MacNeilage(1990) reported three consonant- vowel (CV) co-occurrence preferences were found: coronal consonants with front vowels, dorsal consonants with back vowels, and labial consonants with central vowels. The two lingual patterns (coronal-front and dorsal-back) seemed to result from an extremely basic property of matter of all kinds. It was predicted that these patterns would also be observable in babbling as they seemed to represent basic aspects of the vocal production system, and did not seem to be a result of perceptual experience (Davis and MacNeliage 2000). The data of one subject from 00;09;07-01;00;00 is provided in the following table:

Table 3.7 The Result of the Three Types of CV Co-occurrence in Babbling

Age	Dorsal front	Dorsal +central	Dorsal +back	Coronal +front	Coronal +back	Coronal +central	Labial +front	Labial +central	Labial +back
00;09;07		1		1	3	2	1		
00;09;25	5	1		15	3	13		1	3
00;10;04	16	1		58	7	8	1	1	
00;10;11	1			3		1		3	1
00;10;16		5	31	100	10	11	3	9	7
00;10;25		6		23	3	12	4	6	5
00;11,06	5	10	3	66	16	69	2	10	1
00;11;15	4	3	8	19	13	14		4	4
00;11;22	6	7	11	48	10	43	1	21	2
01;00;00		1	2	14	4	9		6	2
Total	37	35	55	347	69	202	12	61	25

Table 3.8 Relative Frequency (%) of the Three Types of CV Co-occurrence in Babbling

Consonant	Vowel		
	front	central	back
Coronal	.44	.22	.07
Labial	.01	.06	.02
Dorsal	.04	.03	.02

Table3.9 Relative Frequency of Three Types of CV Co-occurrence in Early Words

Consonant	Vowel		
	front	central	back
Coronal	.36	.08	.01
Labial	.03	.16	.06
Dorsal	.009	.04	.07

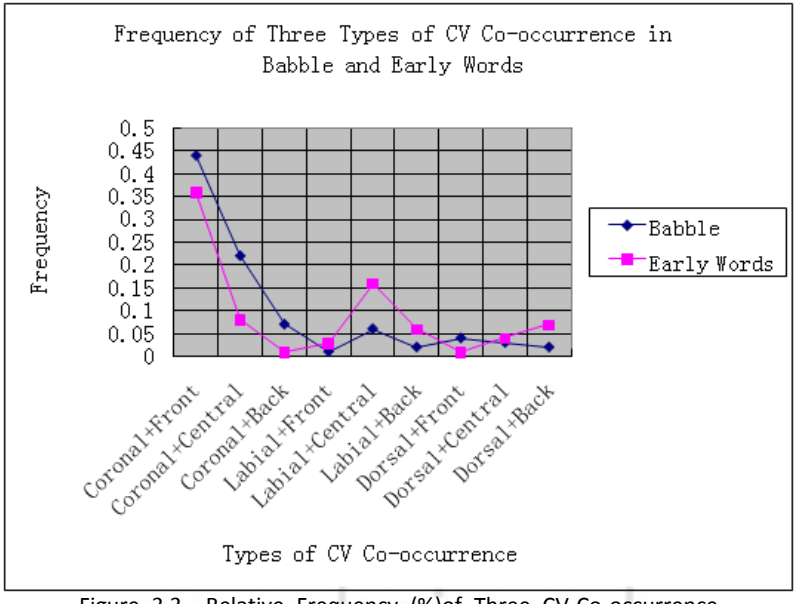

Figure 3.3 Relative Frequency (%)of Three CV-Co-occurrence

Our data have confirmed the existence of the three basic types in both babbling and early speech. If arranged in descending order of frequency, they are: coronal , dorsal and labial plus vowels . Of the coronal type, coronal front is the most predominant; of the dorsal and labial type: dorsal back and labial central are more predominant. However, all of them constitute CV syllables which occur frequently in both canonical babbling and early speech.

4. Conclusion

There is a basic continuity of output patterns from babbling to first words. The progression in early word repertoire does seem to stem from CB/VB. Indeed quite a number of phones are first seen in babbling and subsequently in words. We have mutual intelligence when the infant babbles, for example, when the infant says [papa], [mmA], usually its parents will respond to this kind of babbling, providing the infant the context needed to relate sound and meaning. As a consequence of these interactions, the nonmeaningful production [papa], [mmA] has a good chance to enter the child's lexicon as true words. The most frequent phones in babbling are "available to be programmed into a lexical unit"(Locke 1983: p.55). Vihman (1992) said early words were "primarily drawn from the repertoire of practiced syllables" from their pre-speech vocalizations (p.406). A number of longitudinal investigations of the transition from babble to speech showed that phonetic features of an infant's prelinguistic vocalizations are often carried forward to the first words (Stoel-Gammon & Cooper 1984; Vihman, Ferguson, & Elbers 1982).

The analysis of our data showed that 1) the phonetic characteristics of CB/VB and early meaningful speech are extremely similar. The similarities of CB/VB and speech prove that the two are deeply related; 2) The infant has demonstrated similar preferences for certain types of

sounds in the two stages; 3) The infant's babbling was patterned at segmental level, and this regularity was similarly evident in the early speech of children. The three types : coronal plus front vowel; labial plus central and dorsal plus back vowel exhibited a good deal of overlap in the phonetic forms of CB/ VB and early speech. So the child's canonical and variegated babble at this stage already shared the basic architecture, composition and representation of early speech. The evidence of similarity between CB/VB and early speech leaves no doubt that phones present in CB/VB are indeed precursors to early speech.

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