

**A STUDY OF THE PHONOLOGICAL STRUCTURE AND
REPRESENTATION OF FIRST WORDS IN ARABIC**

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ABSTRACT

This research studies the phonological structure and representation of first words in Hijazi Arabic. It investigates the representational nature of early words and the developmental stages of their syllable and word internal structure within the framework of the Prosodic Theory (McCarthy & Prince 1986, 1990). The issues raised relate to the relation between child and adult phonology, and whether the subjects follow a universal path or influenced by their language-specific phonology (Ferguson & Farewell, 1975; Vihman, 1991; Fikkert, 1994; Demuth, 1995; Ota, 2003; Lleo, 2006). The discussion has been accompanied by considering child-adult differences and cross-linguistic comparisons between child Arabic and child Germanic languages (English, Dutch), child Romance languages (French, Spanish, and Catalan), and child Japanese. Cross-sectional spontaneous data were collected from twenty two monolingual children (aged from 1;0 to 1;9) living in Jeddah, Saudi Arabia by recording their speech using the object-naming technique in near natural settings and analyzed using a qualitative approach.

The results show that the subjects' segmental inventories are very limited at the onset of speech, which determines the shape of their early words. The subjects often employ phonological processes (e.g. reduplication, consonant harmony, substitution, truncation) when their templates cannot accommodate all the segmental material of the target words. The data provide evidence that the phonological structure of their early words has the same organizational units of adult phonology and governed by its prosodic principles. The subjects go through similar stages of prosodic word development to those reported in the literature: a minimal word stage (1;0-1;6), where their outputs display bimoraic and disyllabic forms, followed by a maximal stage (between 1;7-1;9), where more complex structures are produced. Despite the universality of many aspects of word acquisition in child Arabic, the study emphasizes the importance of investigating the impact of the ambient language and the role of language specific phonologies.

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TRANSCRIPTION SYMBOLS

I. Consonants

- /b/ a voiced bilabial stop
- /t/ a voiceless dental stop
- /d/ a voiced dental stop
- /k/ a voiceless velar stop
- /t̪/ a voiceless alveo-dental emphatic stop
- /d̪/ a voiced alveo-dental emphatic stop
- /g/ a voiced velar stop
- /ʔ/ a voiceless glottal stop
- /f/ a voiceless labiodental fricative
- /s/ a voiceless alveolar fricative
- /z/ a voiced alveolar fricative
- /ʃ/ a voiceless palatal fricative
- /h/ a voiceless glottal fricative
- /s̪/ a voiceless alveo-dental emphatic fricative
- /ħ/ a voiceless pharyngeal fricative
- /ʕ/ a voiced pharyngeal fricative
- /ʁ/ a voiced velar fricative
- /x/ a voiceless velar fricative
- /dʒ/ a voiced palatal fricative
- /m/ a voiced bilabial nasal
- /n/ a voiced alveolar nasal
- /l/ a voiced alveolar lateral
- /r/ a voiced alveolar trill
- /w/ a voiced bilabial glide
- /j/ a voiced palatal glide

II. Vowels

- /a/ a low short front vowel
- /a:/ a low long front vowel
- /i/ a high short front vowel
- /i:/ a high long front vowel
- /u/ a high short back vowel
- /u:/ a high long back vowel
- /e/ a mid long front vowel
- /o/ a mid long back vowel

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CHAPTER ONE

Introduction and Background

1.0 Introduction

Child phonology, one of the important areas in language acquisition, has been of great interest to linguists, psycholinguists, and psychologists as well since the early 1960s. A range of developmental phonological models has been proposed and most of these are cross-disciplinary. Researchers draw on linguistic theories to understand and investigate the nature and complexity of the language structures to be acquired/learned, with focus on both perception and production. They also draw on psychological theories to understand the nature of acquisition or learning and cognitive development and processing.

Chomsky (1965), in his generative transformational theory, assumes that the child is innately endowed with a language faculty and he states that

the child must possess, first, a linguistic theory strategy that specifies the forms of the grammar of a possible human language, and, second, a strategy for selecting a grammar of the appropriate form that is compatible with the primary linguistic data. As a long-range task for general linguistics, we might set the problem of developing an account of the innate linguistic theory that provides the basis for language learning. (Chomsky, 1965: 25).

Chomsky's view attracted the attention of linguists in the area of phonological acquisition and shifted research focus from the order of acquisition and its universal aspects to other issues related to the child's abilities, his/her underlying system, and his/her role in language acquisition. Since Chomsky's revolutionary theory in the late 1960s, many approaches studying human language pointed to the system that underlies language knowledge. Fundamental questions have been raised about the nature and the location of the linguistic faculty, the nature of this underlying system and how it is represented in the mind, the origin of language, and its processing and development. There has been a growing interest in

the theory of Universal Grammar (UG) which links cross-linguistic and developmental phenomena and allows researchers to explain how children eventually achieve the grammar of their language, and why children from distinct language backgrounds show similar patterns of linguistic development. Many cross-sectional and longitudinal studies have been carried out to provide a clear picture of language acquisition, to show similarities and differences among languages, and to look for language universals.

Theories of phonological acquisition have contributed to the field of language acquisition. They have addressed two major issues: (1) the universal tendencies in children's phonological acquisition, and (2) the role language-specific features play in influencing the phonological development in a given language. Some of the controversial issues discussed in the previous three decades of intensive research in phonological acquisition are the following: (1) the relationship between perception and production, (2) the continuity vs. discontinuity view concerning the relation between babbling and the early word stage, (3) the relational (adult-model-based) vs. independent system accounts of the child's phonology, and (4) the role of the input or the relative influence of the ambient language on acquiring speech elements such as sounds and early words.

Most of the theoretical approaches that tried to account for phonological acquisition at first are based largely on individual case studies (e.g.(Piaget, 1951); Leopold, 1949; Stampe, 1969; Smith, 1973). Since the 1970s, intensive studies of small and large samples of children have begun to accumulate, many of which are longitudinal and/or cross-sectional. These studies provide informative data which, as Macken and Ferguson (1981:114) point out, "document the existence of significant, wide-spread individual differences between children acquiring the same language and show that the acquisition process, in certain aspects, is not a linear progression of unfolding abilities as assumed by the universalist model." Thus, the central concern of many studies is to reconcile universalist accounts with the pervasive evidence of variability.

Much of the work on early phonological development during the 1970s, 1980s, and the beginning of the 1990s (e.g. Smith, 1973; Ferguson & Farewell,

1975; Stampe, 1979; Macken & Ferguson, 1981; Yeni-Komshian, Kavanagh & Ferguson 1980; Ferguson, Menn, & Stoel-Gammon, 1992) mainly focus on issues at the segmental level/structure. They are largely concerned with the "phonetics of acquisition" (Macken, 1992). The focus of most of the observational studies was on the age and order of acquisition of sounds, the universality of sounds and features acquired, the influence of the ambient language, and the continuity vs. discontinuity view. Studies have been mainly concerned with the 1-year-old stage (Stark, 1978; Stark, Rose, & McLagen, 1975; Eimas & Miller, 1980; Cruttenden, 1970; Boysson-Bradies, Sagart, & Bacri, 1981; Boysson-Bradies, Sagart, & Durand, 1982) and the 2-year-old stage (Moskowitz, 1970; Smith, 1973; Bloom, 1973). These studies investigate the early stages of phonological acquisition (i.e. cooing and babbling). Then researchers' attention shifted to the period of transition to speech (Ferguson & Farewell, 1975; Locke, 1978; Bates et al., 1979; Vihman & Greenlee, 1987; Vihman, Ferguson, & Elbert, 1986; Boysson-Bradies & Vihman, 1991; Vihman & McCune, 1994, 2001).

Since the 1990s, research interest in answering questions about the underlying system and the origin of the child's language, has shifted toward the relational (adult-model-based) vs. independent system accounts of child's phonology, the continuity between child and adult systems, the divergence from child forms to adult forms, the representational levels of speech production, and how children's representational and symbolic capacities are developed. This is clearly manifested in studies investigating child's acquisition of words, the phonological structure and features of early and later word productions, their representations, and the phonological processes that yield them (Boysson-Bradies & Vihman, 1999; Demuth, 1993, 2003, 2006; Lleo & Prinz, 1996; Vihman, 1996; McCune & Vihman, 2001; Freitas, 2003; Lleo, 2006). Only recently have researchers begun to examine children's early words from the perspective of developing prosodic structure, focusing specifically on the level of syllables and words (e.g. Demuth 1994, 1995; Fee 1995; Ota, 1998, 2003; Prieto, 2006; Lleo, 2003, 2006).

The past decade has witnessed a growing research interest in the period of phonological acquisition called the "transition to speech" and a tremendous number of studies have been carried to investigate this area. This has revived interest not only in the phonetic inventories of children learning a variety of languages and the influence of their ambient language (Stoel-Gammon, 1991; Locke, 1994; Rice & Avery, 1995; Vihman, Ferguson, & Elbert, 1986; Bernhardt & Stemberger, 1998; Amayreh & Dyson, 1998, 2000; Vihman & McCune, 1994), but also in the emergence and development of first words, the prosodic word structure (i.e. syllable types, word shapes, stress), the constraints languages place on syllable and word structure, and the phonological processes that accompany word productions (Demuth, 1995; Lleo & Prinz, 1996; Vihman, 1996; Levelt, Schiller, & Levelt, 2000; Ammar, 2000; Ota, 2003).

During the 1990s, the interest in the prosodic features of words has also increased since languages differ a lot in this respect. Languages differ, for example, in the types of syllable structures, foot structures, the directionality of feet, the role of the moras, and the constraints they place on syllable and word structure. Some languages permit only CV syllable structure, whereas others allow more complex syllable structures with onset and coda clusters (e.g. CVCC, CCVC, CCVCC, CVCCC). Languages also differ in the word shapes they permit, with many showing limitations on prosodic word structure. As to foot structure, some languages permit binary feet at the level of the syllable (e.g. English and Dutch), but other permit only disyllabic feet (e.g. Sesotho). With regard to the directionality of feet, some languages exhibit strong weak trochaic feet (e.g. Dutch, English, and Sesotho), but some (e.g. French) exhibit iambic feet. Concerning moras, they play an important role in languages such as English and Dutch, for instance, where stress assignment is quantity sensitive for it generally falls on heavy syllables containing two moras of structure – for example, CVC or CVV (Lleo, 2003, 2006; Demuth, 1995, 2001; Demuth & Fee, 1995; Fee; Lleo & Demuth, 1999; Ota, 1998, 2003; Pater, 1997; Macken, 1978) (See section 2.1 for more explanation of the concept of mora).

This research will be concerned with phonological acquisition in Arabic in general, and early word productions in particular. It focuses on the developmental aspects of word acquisition in the area of prosodic phonology. It deals with how Arabic-speaking children acquire their first words and how these early words develop within the framework of the current prosodic theory (McCarthy & Prince, 1986, 1990) and moraic theory (Hayes, 1981). It mainly investigates the phonological structure of the child's first words and their phonological representation. It looks at the segmental inventories of the selected subjects, analyzes the prosodic structure of their early words (i.e. their syllable and word internal structure), and show the effect of some prosodic features such as stress and some prosodic constraints on the shape and size of early words. The study also refers to the role of phonological rules and strategies employed by these children to shed light on word representations and the relationship between child and adult forms. This chapter will be divided into four sections: Section (1.1) aim of the study, (1.2) rationale that explains the context and aim of study, (1.3) phonological acquisition background, and (1.4) an outline of the thesis.

1.1 Aim of the study

There has been a great interest in the period of phonological acquisition called the 'transition to speech' since the 1970s. Scarcity of Arabic studies in this area in particular and phonological acquisition in general is remarkable. This could be attributed to the difficulty encountered in collecting data from very young children, the difficulty and the accuracy needed in transcribing it, and the difficulty in interpreting children's early stages of sound production due to variability and individual differences. Very few studies have tackled the issue of language acquisition in Arabic and in particular its relation to the phonological theory. Some studies of first language acquisition dealt with Arabic morphology and syntax and specifically inflectional morphology (e.g. Omar, 1973; Abdou & Abdou, 1986; Ravid & Farah, 1999). In the area of phonology, very few studies dealt with the analysis of the child's acquisition of the Arabic sound system. Some of these studies are concerned with normal phonological development, and very few have

dealt with disordered phonological development (Omar, 1973; Bakalla, 1975; Ammar, 1992; Shahin, 1995; Amayreh & Dyson, 2000; Morsi, 2001). Most of the Arabic phonological acquisition studies have been mainly concerned with the phonetics or segmental structure of early phonology and the phonological errors in normally-developing children (Omar, 1973; Ammar, 1992; Amayreh, 1994; Shahin, 1995; Dyson & Amayreh, 2000; Morsi, 2001; Khattab, 2002, 2006) and very few studies with children's phonological disorders (Ammar, 1992; Morsi, 2001). They described and identified the characteristics of children's phonetic inventory, age and order of acquisition in order to provide support for language universals. To my knowledge, no study has tackled the early period of word production in Arabic. Therefore, the principal purpose of this research is to examine the acquisition of first words in Arabic, and in particular Hijazi Arabic, a dialect spoken in Jeddah, Makkah, and Medina in the western province in Saudi Arabia. The three main purposes of this research are the following:

- 1) To explore the phonological structure of early words in child Arabic, the extent to which Arabic-speaking children's first words follow the same universal path of phonological development reported in the word acquisition literature, and the extent to which their language-specific phonology influences their early word productions.

- 2) To consider the phonological representations of early words in child Arabic which clarify the relationship between child and adult phonology, explain the discrepancies between child and adult forms and shed light on the adult and child differences resulting from deviations from the adult model.

- 3) To examine the cross-linguistic differences in the development of prosodic word (PW) shapes between Arabic, a Semitic language and other languages investigated such as Germanic languages (e.g. English, Dutch, and German), Romance languages (e.g. French, Spanish, and Catalan), and Japanese.

To clarify the above points, this study aims to investigate the emergence and development of first words in the speech of Hijazi Arabic-speaking children

during the single-word period which begins from 1;0 till 1;9¹. It focuses on the phonological structure and representation of early words in child Hijazi Arabic and describes certain aspects of early word acquisition and stages of prosodic structure development in terms of the current phonological prosodic theory (McCarthy & Prince, 1986, 1990; Hayes, 1981). The study also addresses some of the issues reported in the phonological acquisition literature such as the existence of the prosodic organizational units of adult phonology in the child's system at the initial stages, the development of prosodic structure i.e. syllabic structure and word internal structure of early words. In other words, it examines how much of the phonological structure of early child phonology is composed of the same prosodic units and representational principles that govern the organization of prosodic structure of adult phonology. It attempts not only to describe the prosodic structure of early words but also to explain how and why the structures of early syllables and word forms differ from those of the adult targets. This research also considers word size constraints/restrictions that determine the shape of these words and the developmental stages of word production. Examining the cross-linguistic differences between Arabic and other languages would help in determining whether they reflect a similar course of PW development which can be partly explained by the frequent prosodic structures found in these languages. In this respect, Arabic provides a good test case for exploring these issues, as this language is prosodically distinct from English, and other Indo-European, Romance languages, and Japanese.

The model adopted for this research is the prosodic phonology model developed for adult phonology by McCarthy and Prince (1986, 1990) and Hayes (1981). In this model, the adult phonological grammar is seen to contain three sub-word level constituents (foot, syllable, and mora) hierarchically arranged in a Prosodic Hierarchy. The prosodic theory will be presented in detail in chapter two.

¹ Child age is given in 'years;months.days'. For example, 1;6.15 indicates one year, six months and 15 days.

1.2 Motivation of the study

Due to the lack of research investigating the acquisition of Arabic phonology and in particular lack of studies dealing with the acquisition and development of first words in Arabic, this particular area of phonology will be investigated. This study aims to provide more data to the linguistic literature of child language acquisition and to provide support for language universals too. It is also significant for the understanding of the universal principles of phonological acquisition and in particular the aspects of early word acquisition and development.

Studies of the phonological acquisition (e.g. Ferguson & Farewell, 1975; Vihman et al. 1985; Ingram, 1986; Vihman, 1993; Macken, 1978; Amayreh & Dyson, 2000) not only offer insight into the theory and nature of phonology within the languages studied, but also yield data of use by speech-language pathologists in diagnosis and remediation of children with sound production disorders. Little data is available to professionals in countries where Arabic is spoken or in centers where Arabic-speaking children with speech disorders are treated. In addition, most of the literature used to educate speech-language pathologists in Arab countries today is written in English or is about English and other Indo-European languages. Thus, this study will help in offering needed information of use to speech-language pathologists working with Arabic-speaking populations. It can serve as a guide in planning speech therapy and aid therapists in setting developmental articulation tests to help in assessing phonologically disordered children and in giving training sessions for children with articulation disorders.

The variety in the structure of natural languages is so great that more information is needed about language acquisition. Most hypotheses and theories about first language acquisition have been based on data gathered from children learning English and other Indo-European languages and very lately from children acquiring Japanese and Romance languages such as French, Spanish, and Catalan. Most of phonological acquisition studies have been complemented by comparisons among languages and differences in ages, rates and sequences of sound acquisition (Omar, 1973; Macken, 1980; Locke, 1983; Ingram, 1986; Amayreh & Dyson, 1998). Therefore, comparisons of the results of this study with those already

reported for other languages should be of interest in theoretical descriptions of phonological acquisition. The findings of this study will be used to elucidate the different models proposed to account for morpho-phonological structure of Semitic languages such as Arabic, a non-concatenative language, and how it is differentiated from Indo-European languages in that the canonical structure is based on consonantal roots and vocalic templates as opposed to the well known syllable hierarchy of syllable structure.² In English, for example, syllable structure and stress assignment are built by rule, and therefore only in very marked cases will elements such as syllables or stress be presented underlyingly. But in Semitic languages, such as Arabic, which have non-concatenative morphological systems, syllable structure is represented lexically, whereas linkings between the syllabic and melodic levels are added during the course of derivation (McCarthy & Prince, 1986, 1990).

1.3 Basic issues in phonological development

Linguists have tackled many issues related to the child's phonological development: the perceptual and productive abilities, the age, rate, and universal order of sound acquisition, the stages of phonological development, the nature of phonological representation in monolingual and bilingual context, and individual differences. This section provides a phonological acquisition background through presenting some relevant works in phonological theory and phonological acquisition research. It deals with some basic issues in early phonological development relevant to this research and reviews early previous studies dealing with children's perceptual and productive abilities during the phonological acquisition period (section 1.3.1). It also focuses on early word representation and the early arguments proposed and possible explanations for the differences between child forms and adult forms (section 1.3.2). It is also concerned with the researchers' arguments about the first unit of acquisition or the first unit in

² McCarthy and Prince (1990) provide an extended analysis of the templatic morphology of Standard Arabic.

phonological organization in child phonology and whether it is the word, the syllable, or the sound segment (section 1.3.3). This section tends to be comprehensive in its coverage of most of the aspects and all stages of phonological development during the ‘pre-linguistic’ and ‘linguistic’ period, but there will be focus on issues that lead to a better interpretation and clarification of the phonological structure and representation of first words.

1.3.1 The phonological acquisition period

Speech development has been divided into two periods: the ‘pre-linguistic/pre-phonemic period,’ (Anisfeld, 1984) or ‘preverbal’ (Vihman, 1996) which begins from birth till the child’s first birthday and the linguistic/phonemic period, from then on. Since the 1940s till the 1970s, research, whether based on diaries and later on observational experimental studies, focused on the characteristics of both periods, the child’s perceptual and productive abilities, and the nature and stages of phonological development. The following subsections will briefly deal with the child’s perceptual and production abilities during the first year (1.3.1.1), but there will be more focus on the production abilities and early word production during the one word stage (i.e. 1;0-1;9), the period dealt with in this study (1.3.1.2).

1.3.1.1 Early development: perceptual and production abilities

New born infants immediately start cracking the code and solving the challenges of both speech perception and production after birth. These two abilities develop, correlate, and reveal infants mapping to the sound system of the ambient language during the first year. Both also reveal cross-linguistic evidence of specific language grammars by six months, increasing thereafter.

During the pre-linguistic period children refine their perceptual sensitiveness to speech sounds through a fundamental cognitive mechanism known as “Categorical Perception.” This enables infants to discriminate and categorize speech sounds (Jusczyk, 1997; Kuhl, 1991, 1993; Eimas, Miller, & Jusczyk, 1987)

and gain practice in sound articulation through vocal activities (i.e. cooing and babbling), but during this period, speech does not yet function as a phonemic system. Some cross-linguistic studies suggest that infants are ‘universal perceivers’ (Mehler et al. 1988; Strange, 1995) in the sense that they have the ability to perceptually differentiate phonetic contrasts whether native and non-native, regardless of their phonological status or occurrence in adult language (Eimas, Miller, & Jusczyk, 1987). Despite this and according to some phonological acquisition theories (e.g. Jusczyk, 1993; Kuhl 1991, 1993), the child’s perception begins to shift in the first year of life from a language-universal pattern to a language-specific pattern of organization which reflects the phonological structure of the ambient language. Kuhl (1993) suggests the existence of a “native language magnet” (NLM) by which infants start demonstrating a “magnet effect” for the “prototype” sounds in their native language (e.g. vowels).

As to prosody during the prelinguistic period, some prosodic units/features (i.e. stress, pitch, juncture, and intonation contours) appear early and lead to the emergence of an intonational system. The child’s perceptual sensitivity to supra-segmental units develops over the first year and enables infants recognize some patterns very early and gradually attend to patterns/structures of their native-language phonetic sequences (Jusczyk, 1993; Vihman, 1996; Lust, 2006). Jusczyk & Aslin (1995:114) report that infants start exploring and discovering the phonetic patterning and organizing of their native language properties between the age of four and the age of nine months, and gradually their sensitivity to certain foreign language contrasts decline. Control of pitch increases and stabilizes throughout the first year of life and the predominant prosodic features of the adult system are reflected in infants’ productions within the one-word stage.

The child’s productive abilities and the nature and stages of phonological development during the pre-linguistic period have attracted the researchers’ attention for decades. Crosslinguistically, children go through similar stages of vocal development, despite individual variation. The timing of the stages of vocal production somehow differ from one model to another because of the individual differences among children, but the emergence of canonical syllables (or

‘templates’) is common to all models (Vihman, 1996: 118-120). Research has been concerned not only with the prelinguistic impulsive and unstructured vocalizations (i.e. vegetative and discomfort sounds) (Stark, Rose, & McLagen, 1975; Stark, 1978, 1980), but also with other vocal activities (i.e. cooing and babbling) in the period between 9 and 20 weeks for these are assumed to help in phonological development (Stark, Rose, & McLagen, 1975; Stark, 1978). Stark, Rose, and McLagen (1975) state that there is a natural hierarchy in the acquisition of pre-speech skills. Both the cooing and the babbling stages are richer in sound composition and they combine elements that make them close to proper speech, for they contain both consonant-like and vowel-like sounds (Cruttenden, 1970; Oller, et al., 1976; MacNeilage, 1979; Boysson-Bradies, Sagart, & Bacri, 1981; Boysson-Bradies, B., P. Halle, L. Sagart, & C. Durand; 1989; Boysson-Bradies & Vihman, 1991). Utterances, at these stages, become increasingly adult-like for children start producing identifiable CV syllables and clear intonation patterns (Ferguson & Macken, 1983; Boysson-Bradies, M. Vihman, L. Roug-Hellichius, C. Durand, I. Landberg, & A. F. Arao, 1992).

1.3.1.2 Early word production in the child’s second year

Speech as a phonemic system requires internal representation of phonemes and phoneme combinations. It begins developing in the fourth quarter of the first year and the first quarter of the second year till the stage of the sensorimotor period (Piaget, 1950) when the representational capacity emerges and becomes established in the last three quarters of the second year (Anisfeld, 1984: 20).

At the onset of speech, children start producing and using the language more productively due to the maturational change, the development of the cognitive and conceptual abilities, and the development of the vocal control mechanism. After twelve months, “[children set] up representations of what they see and know. They make use of these for recognition and recall [and] they summon them first with gestures and later with words.” (Clark, 2003:8). Gestural expressions (e.g. pointing, showing, and giving) emerge and precede the establishment of adult-based words (Vihman, 1996).

First words appear early, around the child's first birthday. At this stage, words emerge naturally from the sound system that the child has been developing in his babbling stage. Children produce approximations to adults' forms. According to MacNeilage (1979:30), "the child's first words can be seen as a matter of choosing from the babbling repertoire a set of approximations to adult word forms." They produce 'holophrastic' utterances for they express in single words meanings that adult express in full sentences. These words are identified when s/he starts producing existing phonetic patterns developed through babbling in situations similar to adult word patterns. First words may not appear to be phonologically related. They might result from an idiosyncratic match between a prelinguistic 'gestural score' or 'articulatory routine' and a salient adult word (Vihman & McCune, 1994).

This stage is marked by phonological systematization, in which one or more word templates are formed and used to assimilate growing numbers of adult forms. It is hypothesized that the maturational change provides the basis for this systematization (Vihman & McCune, 1994). Very early during the linguistic period, the child's capacity for internal representation develops and his/her symbolic capacity emerges. According to Piagetian view, the detached sensorimotor representation begins during the first quarter of the second year. Children develop representational notions of objects and the internal representation is established in the last three quarters (Anisfeld, 1984: 35).

During the linguistic/phonemic period, speech is integrally connected to meaning and it cannot be acquired independently of it. The comprehension and production processes work hand in hand till the child acquires a full phonemic system of the target language. The semantic anchor provides a basis for grouping sounds into phonemic categories and for determining distinctive sound differences. Thus, children develop a sound-meaning link of the adult-based words and those of their own 'protowords,' i.e. words that are created by the child. The referential and symbolic use of words is typically observed at this stage of phonological acquisition. First words are not used as symbols in the beginning, but as labels for open classes of referents. They have a sign character for they seem to be part of

certain behavioral routines and they are context-bound as well (Clark, 1979, 2003; Anisfeld, 1984). Bloom (1973:73) cites an example of a 1-year-old French-speaking child who used *nenin* (breast) to ask to be nursed, when he wanted a biscuit, in reference to a red button, and eye in a picture. Here the use of the word is extended on the basis of sustenance, color, and shape. It seems that children do not know words, but they merely use them as vocal stimuli and vocal responses. In other words, the words they produce may differ from the words they comprehend (Anisfeld, 1984: 70). At twelve months, Leopold's daughter, Hildegard used *Papa* for her father and her mother as well, and at fourteen months, she used it for any man. She used it with the right reference only at seventeen months (Leopold, 1949). Unlike adults, children do not use words to categorize objects and events, but rather as subjective associations. At a later stage in the second year, with the increase in maturity and cognitive functioning, children reach a level when they grasp a social principle of word use, namely that words become labels for socially defined objects and events. They accomplish a progress in the attainment of naming function and reach a satisfactory stage of internal representation. This is reflected in more systematic and productive use and extension of words and in an accelerated growth of vocabulary phenomenon called the 'vocabulary spurt.' Benedict (1979), studying eight children whose ages range from 9-10 months to 19-24 months, reported that her subjects acquired the first 20 to 30 words slowly, and from 19-24 months, their vocabulary increased to 200 words or more.

1.3.2 Word representation and the role of phonological rules

At the onset of speech, children begin accommodating adult forms which go beyond their production constraints by making systematic changes in the production of adult segments, sequences and syllable shapes. Vihman (1993a: 418) states that:

Phonologically, the first words show minimal accommodation to the adult language. They reflect instead perceived matches between pre-existing vocal schemata and adult word patterns, and constitute the desperate pieces of a system yet to cohere. An increase in variability accompanies the beginnings of systematicity, signaling the onset of a phase shift from

context-bound babble-as-words to more consistent and interrelated word forms alongside more flexible and established word use. As the shift... proceeds, one or more stable production patterns or “canonical forms³” emerge, reflecting the phonological interaction of prevalent adult patterns and the child’s developing vocal motor schemes. At the same time, the child attempts a wider range of adult word shapes and assimilates them more radically to fit the emergent production patterns leading to more relatedness (systematicity) among the child words but less accuracy in reproduction of adult models. Non-linearity or ‘regression’ in production accuracy marks emergent organization.

Most child-language phonologists have explained the differences between adult targets and children’s forms in terms of different phonological systems for adults and children. Early and recent studies (Smith, 1973, Stampe, 1979; Ingram, 1974,1986, Vihman, 1991; Fikkert, 1994) and current studies on acquisition in Optimality Theory (see Kager et al. 2004) have focused on phonological processes in child language (Ingram, 1974, 1986; Vihman,1991). The term used for these adjustments is ‘phonological rules’ (Smith, 1973; Menn, 1971; Ingram, 1979) or ‘processes’ (Oller, 1975; Stampe, 1979). Stampe (1969,1979), in his theory “Natural Phonology,” proposes that children’s early phonological systems are constrained by a set of natural phonological processes that represent the innate mental constraints on the child’s productive abilities. Menn (1971, 1978) also argues that phonological acquisition is the result of the child’s recognition of patterns in the input language, and it is the result of an interaction between the child’s inventory of the stored perceptual and productive strategies and the ambient language which serves both as input to the child’s strategies and as the source of new phonological discoveries. Similarly, Fikkert (1994:19) states that these “modifications of the target (or the base) are due to the fact that the child’s template is more constrained than that of the adult.”

³ In phonology, the normal syllabic combinations of sounds are often referred to as ‘canonical’, e.g. a consonant-vowel (CV) or (CVC) structure constitutes a ‘canonical syllable’ pattern.

For these adjustments, the child follows a number of strategies such as consolidation, carryover, exploitation, and avoidance, and employs a number of phonological rules to yield outputs dominated by canonical forms (Menyuk & Menn, 1979). Despite the fact that there is variation in the use of these processes among children, most of them occur in nearly all children's speech. Ingram (1974, 1986) divides these processes into three main types which have a number of subtypes:

I) Assimilation Processes: Some of the assimilatory processes are devoicing, consonant harmony (velar assimilation, labial assimilation), vowel harmony, denasalization, and progressive vowel assimilation (Ingram, 1974, 1981, 1986; Vihman, 1978, 1981). Examples of these processes are given below:

- 1) Devoicing: It is a process in which consonants tend to be devoiced when influenced by another voiceless sounds or at the end of a syllable (e.g. *bed* [bet̚]; *egg* [ek̚]) (Jennika1;6) (Ingram, 1986: 227).
- 2) Consonant harmony: In C1VC2 or C1V1C2V2 contexts, consonants tend to assimilate to each other in certain predictable ways. There are two frequent patterns:
 - a) Labial assimilation: Apical consonants assimilate to a neighboring labial consonant (e.g. *tub* [bʌb]; *table* [bʌbu]) (Menn, 1971).
 - b) Velar assimilation: Apical consonant assimilates to a neighboring velar consonant (e.g. *duck* [gʌk]; *sock* [gʌk]) (Ingram, 1986: 228).
- 3) De-nasalization: Nasal consonants are denasalized in the neighborhood of non-nasal consonants (e.g. French, *mouton* [pot] 'sheep,' *morceau* [baʃo] 'piece' (Ingram, 1986).
- 4) Progressive vowel assimilation: An unstressed vowel will assimilate to a preceding or following stressed vowel (e.g. *table* [du:bu]; *flower* [fa:wa]).

II) Substitution processes: Such processes involve sound substitution and they include the following:

1. Stopping: It is a process in which a fricative is substituted by a homorganic stop (e.g. *this* [di], *another* [nʌdə]) (Fee, 1995).

2. Fronting: It involves fronting the palatals and velars i.e. substituting alveolars for them (e.g. English, *shoe* [zu], *call* [ta:] (Velten, 1943).
3. Gliding: It is substituting the glide [w] and [j] for a liquid sound, [l] or [r] (e.g. English, *lap* [ja:p], *ready* [wedi] (Ingram, 1986), and Estonian, *raha* [jaha] ‘money’) (Vihman, 1971).

III) Syllable Structure Simplification processes:

1. Final consonant deletion: A CVC syllable is reduced to CV by deletion of the final consonant (e.g. *bib* [bi]; *bike* [bai]) (Ingram, 1986).
2. Unstressed syllable deletion: An unstressed syllable is deleted, especially if it precedes a stressed syllable (e.g. *banana* [nænə], *potato* [dedo]) (Ingram, 1986).
3. Consonant cluster reduction: a consonant cluster is reduced to a single consonant (e.g. *clown* [kawn], *train* [ten]) (Ingram, 1986: 230).

IV) Reduplication: It’s an early frequent process in which the child selects a CV or CVC syllable from an adult form and reduplicates it totally (e.g. Patrick [bæbæ]), or partially (e.g. Peter [bibə]), and it is often lost by the age of 1;6.

Some of these rules are common in child phonology, whereas others may be specific to individual children. For instance, many studies focus on the most frequently used processes such as reduplication, consonant harmony, and syllable reduction. Each of the above processes shows child-adult differences. Some of these processes affect the structure of whole words (e.g. consonant harmony, reduplication, final consonant deletion) and some affect specific segments or classes of segments (e.g. stopping of fricatives, gliding of liquids). The shift from the former type of processes to the latter may indicate the gradual emergence of segments as control units for the child (Vihman, 1996: 216).

The universality of these phonological rules has been emphasized, but then undermined due to the focus of many recent cross-linguistic studies on tackling individual differences and the role of the input. Investigating the speech of young children from different language backgrounds and aged 1;6 and 4;0, Ingram (1979) discusses the limitations of the concept of phonological rules. His findings show individual variations among the subjects; for example, gliding is more frequent in English than in French, whereas de-nasalization is more frequent in French.

Vihman (1978), investigating the use of consonant harmony in the speech of thirteen English and Chinese children, also yields similar results. She found out consonant harmony to range in its use, from 1% for a Chinese-speaking child to 32% for an English-speaking child.

Phonological development involves the use of a set of rules (e.g. reordering rules, simplification rules, or deletion rules) which constitute a part of the child's phonological system. Analyzing the phonological system of his son, Amahl, Smith (1973) assumes that input representations are essentially adult-like. He describes a set of ordered realization rules which have to be unlearned at later stages of development. This system of rules is child-specific, despite the fact that they have been argued to reflect universal tendencies. Kiparsky & Menn (1977) argue that the acquisition process is more complex and must have two types of rules: a set of rules which exist to simplify adult target forms to be produced by children and a set of rules that exists in adult phonology.

It is assumed that the input children receive corresponds to underlying representations, and because these input forms are often difficult to produce, and due to articulatory limitations or to processing problems, they sometimes employ certain rules that enable them produce these words. These child-specific rules appear early and gradually disappear as children become more competent. They capture the difference between adult and child forms, and they help in mapping between input forms and children's outputs in a systematic way (Ingram, 1979, 1986; Vihman, 1996).

1.3.2.1 Word Representation

At the phonemic period, the child's capacity for internal representation develops early and it becomes established in the last quarters of the second year (Anisfeld, 1984: 20). This period is also characterized by 'deformations' (Lust, 2006), or 'deviations' (Smith, 1973, 1978) from the adult form, or 'mismatches' (Ingram, 1979, 1986; Fee, 1995) between the child form and the adult form. It has been reported in early research that these mismatches are the result of either

articulatory inability or perceptual failure according to the “mushy mouth-mushy ear hypothesis” which refers to the production-perception discrepancy that occurs at the stage of early word production (Lust, 2006: 162). In fact, not all the deviations result from perceptual failure or articulatory inability. The “mushy mouth-mushy ear” hypothesis cannot alone explain them. This is confirmed by Smith (1973) who reports the “fis Phenomenon” and the “Puzzle-Puddle Phenomenon.” In the former, the child produces ‘fish’ as [fis] though he knows that the correct form is ‘fish’ when he tells the adult who has produced the child form: “say fis, not fis”. In the latter, the child deforms ‘puddle’ by producing it as [pʌgɫ], but produces ‘puzzle’ as [pʌdɫ]. Ingram (1979) and Fikkert (1994) have also distinguished between the child's perceived form, his underlying form, his spoken form, and the adult's produced form. Therefore, it is believed that children have representations for the adult form and/or their own form, and the latter might become resistant to phonological processes. By employing a selection strategy (Ferguson & Farewell, 1975; Menn, 1976; Schwartz & Leonard, 1982), the child can make a selection of certain elements of the input s/he first take into consideration for analysis. For instance, if the child's own system does not contain velar stops found in the adult input forms, the child can handle these input forms in two ways: (1) One is to simply avoid such forms and select forms that fit into his/her grammatical system at a particular stage, and (2) the other is to employ a repair strategy by which the child selects the input forms with velar plosives, but often deletes or replaces these sounds by some other place of articulation. The child then makes and tests hypotheses on the basis of his/her own reproduction of the input, the output forms. When the child compares his/her own output with the input from the environment and discovers a ‘mismatch’, the result may be that the next output form is closer to the input form.

These mismatches will be argued to be the result of mapping the adult target onto the child's template. The child's template at each stage of the development determines the relation between the input and the output and the phonological rules may play a role in mapping between the two. This section presents some of the

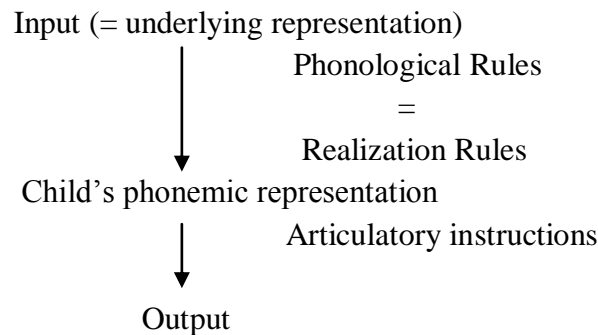
arguments and explanations offered to explain word representations and resolve child-adult discrepancies.

Since 1970s, linguists interested in phonological acquisition have adopted the Chomskian generative, innatist approach that assumes innateness of language principles, and in the 1980s, the importance of phonological underlying representations was emphasized when non-linear phonology dominated the field. In addition, to explain the complicated relation between the adult targets and children's productions, many linguists and psycholinguists have dealt with the sound and lexical representations and the relationship between the adult model (the input) and the child's output which explains early 'deformations.' Since then, the nature of children's underlying representations has been a debatable issue. Some linguists (e. g. Smith, 1973; Ingram, 1976; Menn, 1978; Stampe, 1979) have argued that children's underlying representations are identical or very similar to the adults', given that their perceptual abilities are in advance of production skills. Others (Braine, 1976; Macken, 1979; Vihman, 1991; Fee, 1995) have suggested that children's representations are not the same as adults' because their perception of adult forms is incorrect or incomplete. Moreover, some of them developed models of phonological development that focus on representations and the role of the phonological rules (e.g. Smith's Generative Model (1973) and Stampe's Natural Phonology (1979)).

Smith (1973,1978), analyzing the regularities of the phonological development and the lexical formations and deformations of his English-speaking son, Amahl, aged 2;2-4;0, assumes that input representations are essentially adult-like, and he describes a set of ordered 'realization rules' which have to be unlearned at later stages of development. This system of rules is child-specific, despite the fact that these rules may reflect universal tendencies. They operate on underlying lexical representation derived from adult surface forms, which are assumed to be accurately perceived and stored. They are hierarchically ordered and they function to effect consonant and vowel harmony, to bring about CV/CV canonical forms, and to effect simplification of phonological elements as well (Smith, 1978: 302). They also map the adult surface forms (i.e. the child's

underlying representations) to the child forms. Thus, Smith's UG-determined model "is not maturational, but recognizes the child mapping to the adult target." (Lust, 2006:165). The following figure illustrates this production model.

Figure 1.1 Smith's (1978) Model (p.260).



These realization rules are learned gradually as the child approximates more and more closely to the adult language. An example of these rules from Smith's study (Smith, 1978) is given below in (1.1).

- (1.1) [+ nasal] → ∅ / ---- [- voice]
 e.g. tent → [dɛt]
 pink → [bɪk]

Thus, Smith has not attributed children's deviations from the adult form to articulatory inabilities or motor problems, but to the 'structural pressure' the rules exert. For example, his model could account for "the puzzle-puddle phenomenon" in which children's deformations are not simply due to articulatory inabilities. His son, Amahl, was unable to produce a particular sound or sound sequence in the correct place, but was perfectly capable of producing it as his interpretation of something else; for example, he substituted [g] for /d/ before syllabic (dark or velar) /ɹ/ (/puddle/ → [pʌgɹ]), but [d] for /z/ in the same context (/puzzle/ → [pʌdɹ]) as shown below:

- | | | | |
|-------|--------|--------|--------------------|
| (1.2) | puddle | puzzle | Adult target |
| | ↓ | ↓ | (Realization rule) |
| | pʌgɹ | pʌdɹ | Child production |

Smith's model actually shows that the child has more knowledge about the adult surface forms of words though his/her early productions do not exhibit this directly.

Similarly, Menn (1971, 1978), has considered that phonological acquisition is a result of the child's discovery of the phonological rules that convert the underlying/phonological representations into surface/phonetic representations. This results from discovering patterns in the input language, storing them perceptually, and then producing them using productive strategies.

Stampe (1979), though rejecting Smith's idea that the child has a phonemic system of his own, proposes a similar model viewing children as biologically programmed with universal linguistic processes, and assuming the well-formedness of their early perception of adult forms. Similarly, his model assumes the existence of natural, 'automatic, unlimited, and unordered' phonological processes that are universal and innately available. Then s/he needs to 'suppress, limit, and order' these processes (Stampe, 1979: 307). He also proposes that the phonetic representations of child's productions are the result of the application of an innate system to an abstract phonological representation (Stampe, 1979: 310). Thus, the child's hypotheses are based on his/her observation of the adult output.

To Stampe, the child's word representations are close to the surface forms of adult words. He argues that this is shown by the fact that phonological oppositions appear suddenly and wherever needed in the child's speech (Stampe, 1979: 310). The mechanism by which the child abstracts and stores phonological representations is not specified by Stampe's model.

Other linguists have assumed that children's representations are not the same as adults' because their perception of adult forms is incorrect or incomplete. Commenting on Smith's model for his oversimplification of the arguments in favor of the child's "own system," and his view that child phonology consists of adult-like lexical representations plus realization rules, Braine (1976: 491) proposed two contrasting positions the first of which is close to that of Smith:

(1) The "articulation hypothesis" which states that adult forms are perceived accurately and represented in terms of adult articulatory features.

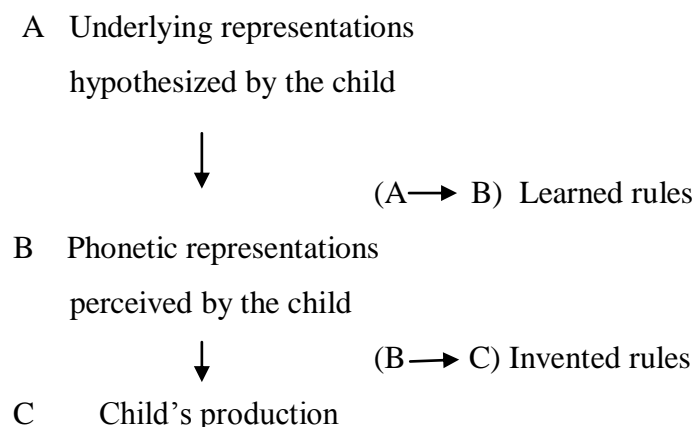
(2) The "perception hypothesis" which states that perception is represented in terms of auditory features, and a representation in terms of articulatory features is gradually added to the lexicon in the course of development.

Here perception may be assumed either to be accurate from the beginning or to contain systematic biases, leading to partially inaccurate initial auditory representation in the lexicon.

Macken (1980) actually supports Braine's arguments in favor of partially inaccurate representation of adult forms in some cases, but she is against generalizing from Smith's evidence of perceptual discrimination in a few cases (i.e. that of his son perceiving adult phonological contrasts that he could not differentiate in production as in the 'puzzle-puddle' example to the conclusion that the child can discriminate all instances of contrast. Following Braine, she proposes a two-level rule system that consists of: (1) perceptual-encoding rules that serve as a filter on adult forms, converting them into the child's lexical representation, and (2) output rules that function as an articulatory filter relating the lexical representation to the child's actual production forms. Both Braine and Macken argue that inaccurate perception offers a more satisfactory explanation for the child's phonological complexities in most cases rather than Smith's realization rules and the structural pressure they exert.

Following a cognitive approach and focusing on the relationship between perception and production, both Kiparsky & Menn (1977) propose another model with three levels (see Figure 1.2).

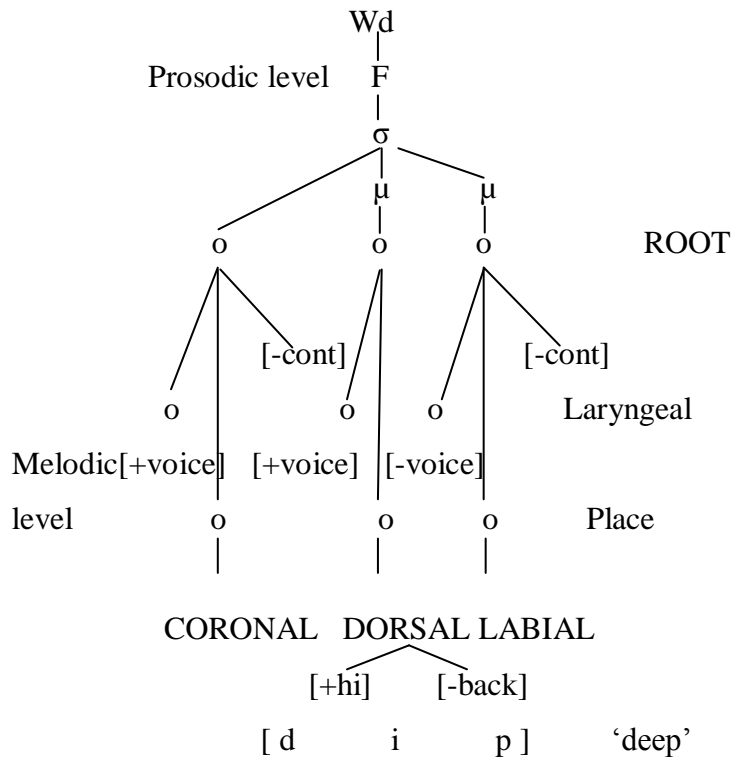
Figure 1.2 Kiparsky and Menn's (1977) Model. Adapted from Vihman (1996:30)



This model allows for the abstract underlying representations that will be learned as part of the adult system and for the storage of the child's pronunciation, which will cease being distinct from the adult surface forms. The phonetic representations perceived by the child, which may or may not differ from the adult surface or phonetic form, occur in an intermediate level as shown in Figure 1.2 given above.

Recently, researchers (e.g. Fee, 1995) have contributed to the debate about the nature of the child's early representations by proposing a theory of phonological organization. Within the framework of the prosodic theory (McCarthy & Prince, 1986), Fee attempts to integrate the components of a current nonlinear phonological theory: the melodic level, where featural information is represented and the prosodic level, where aspects of syllabification, stress, and word structure are represented into a theory of phonological acquisition, that of phonological organization (see Figure 1.3 showing the prosodic and melodic level in the representation of the word 'deep'). Her study focuses on the representations of children's earliest forms which are constrained by UG, and on the explanations for the differences between children's representations and those of adults. Her model suggests that children's representations may in many cases be different from those of adults because their phonological systems do not yet contain the language-specific mechanisms that are required for complete representations. Fee's theory makes testable predictions regarding the nature of children's early representations. It predicts that there may be mismatches between the target form and the child's representation of the same form, when the number of features sets and prosodic slots are not the same, and it also predicts that the set of phonological processes are simply descriptive devices detailing differences between child and target forms.

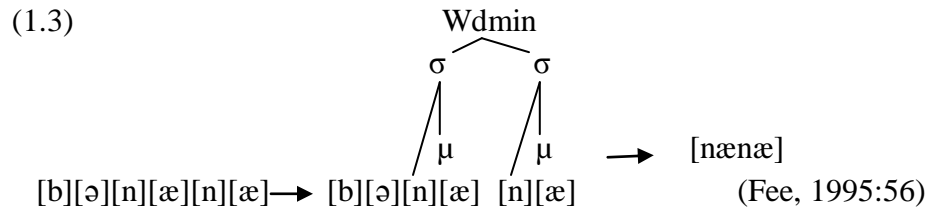
Figure 1.3 Fee's Phonological Organizational Model (1995: 48)



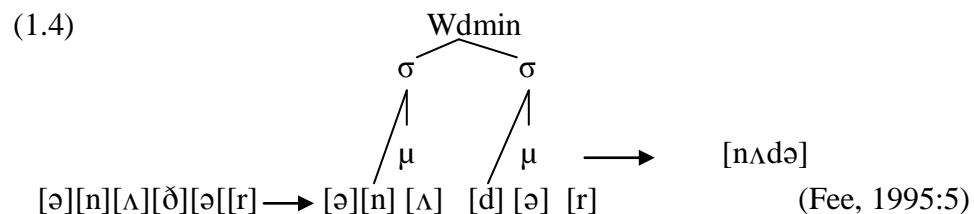
Fee (1995) expects that in the initial period of phonological organization children's representations will be characterized by just those aspects of the phonological system that are supplied by UG, and gradually their phonological systems will change to reflect language-particular aspects of phonology and they will learn that certain modifications are required to fit the language being acquired. She assumes that "UG provides the child with certain unmarked aspects of feature hierarchy (e.g. the structure and feature values), and the child's representation may also contain some learned information, permitting the child to represent the appropriate melodic content of the target." (p. 54).

As mentioned above, this organizational theory predicts and explains mismatches between the target form and the child's representation of the same form when the number of features sets and prosodic slots are not the same. Two examples of two types of these mismatches are given in (1.3) and (1.4). The first type occurs when there is more prosodic information present in the target than the

child can represent as shown in example (1.3) where the child attempts a trisyllabic adult word such as ‘banana’ [bənænæ].



Here the child’s form is realized as bisyllabic rather than trisyllabic after employing a deletion process to delete the unstressed syllable for the child seems to know where the stress falls in the adult form. The leftmost mora of the prosodic structure is constructed over the leftmost stressed syllable, with the result that the initial syllable of the target word is not linked to the prosody. Another type of mismatch occurs when the child’s melodic representation is distinct from or less complex than that of the adult. In other words, the child may not be able to provide melodic information for all prosodic positions, or his/her melodic information is different (i.e. when the child’s segmental material differs from the target). The example given in (1.4) shows a child’s attempt to produce the trisyllabic word ‘another’ as [nʌdə]. The child’s representation of this word is shown below:



The child’s underlying representation contains melodic information distinct from that of the adult’s form. The child’s melodic representation for the intervocalic fricative [ð] appears to be different from the target. Due to the child’s immaturities at the segmental level of structure and his/her limited inventory, the [ð] is substituted by [d]. Other several phonological processes such as unstressed syllable deletion, stopping, and final consonant deletion have yielded the child’s form [nʌdə]. Another mismatch may also occur when the child’s form does not contain all the melodic information of the target. For example, Vihman (1978)

suggested that children produce assimilated form when the sound is not part of the child's inventory (e.g. [bibə] for 'Peter'), or to simplify a target word so that the child can focus on some other aspect of the word (e.g. [bæbæ] for 'Patrick').

Thus, it could be said that Fee's model of the phonological organization and word formation suggests that children's representations may in many cases be different from those of the adults because their phonological systems do not yet contain the language-specific mechanisms that are required for complete representations.

To sum up, we can say that the nature of the child's underlying representations has been a debatable issue since 1970s and it is still a controversial matter that is greatly considered by linguists. Some researchers (e.g. Braine, 1976; Stampe, 1979; Macken, 1979; Fee, 1995) have suggested that children's representations are different from the adults' because their perception of adult forms is incorrect or incomplete; their melodic and prosodic information are less or different from those of the adult forms; or their phonological systems do not yet contain the language-specific mechanisms that are required for complete representations as suggested by Fee (1995). Others (e.g. Smith, 1973; Ingram, 1976; Menn, 1978) have argued that children's underlying representations are identical or very similar to the adults', given that their perceptual abilities are in advance of production skills.

1.3.3 The basic unit in phonological organization: word, syllable, or segment?

The earliest work on prosodic structure stems from the seventies, and is mainly concerned with the question of what the basic unit of acquisition is (Ferguson & Farewell, 1975; Menn, 1978). It has become clear that segments are not acquired in isolation, but need a word to surface. Here, the sound position in the word matters; some contrasts appear in onset position earlier than in coda position, and vice versa.

Researchers argue about the first unit in the phonological organization in child phonology as to whether it is the word, the syllable, or the segment. Some researchers have adopted the notion of word as the first phonological unit of

production in single cases of acquisition studies (e.g. Waterson, 1971; Ferguson & Farewell, 1975; Ferguson, 1978; Macken, 1979; Ferguson, 1986). In other words, children's early phonological units appear to be whole words. Others have treated the syllable (e.g. Moskowitz, 1973; Menn, 1979, 1980) or isolated phonemes (e.g. Jakobson, 1968) as subword units of construction. The following section discusses this issue in detail.

1.3.3.1 From word to syllable to segment

For over thirty years, child phonologists have been claiming that the earliest phonological structure is whole-word based, i.e. children's early phonological units were first treated as whole words. Many detailed studies have provided further support for the basic idea of whole-word phonological development. The central role of the word has been applied to single acquisitional case studies (e.g. Waterson, 1971; Ferguson & Farewell, 1975; Ferguson, 1978; Macken, 1979; Ferguson, 1986). Since the early 1970s, the whole word approach has been adopted into phonological acquisition research and generally accepted for the early stages, but then there is a shift towards the syllable and a phonological system in which the segment plays a critical role alongside the word and the syllable. Therefore, other researchers have treated the syllable (e.g. Moskowitz, 1973) or isolated phonemes (e.g. Jakobson, 1968) as subword units of construction (see discussion in Vihman, 1996).

Menn (1971,1983) and Waterson (1971,1987) provide empirical data that seem to point to the idea that the whole word was at the core of a child's early phonology. Analyzing her son's first words, Menn (1971) reports that Daniel's assimilation embrace the whole monosyllable and involve velar harmony (e.g. [gʌg] *bug*, [gʌk] *truck* (Daniel, 1;10)). Menn (1971:247) suggests that "all simplifying is done within word boundaries, [and].there is no conditioning across word boundaries indicate that the word is an entity, stored and accessed as a block." Waterson (1971: 206) concludes her findings by stating the following:

It seems reasonable to consider that the child perceives some sort of schema in words or utterances through the recognition of a particular selection of prosodic features ... which go into the composition of the forms of the words of groups of words, and this recognition of schema

results in his producing words of the same type of structure for such adult forms.

She does not provide enough evidence for her claim of perception as a source of her son's early word schemas and the idea the children's patterns derive from what is salient in the target words.

Ferguson, Peizer and Weeks (1973:57), studying a case of a single child, assert that 'for the adult we may assume that the predominant [phonological] unit is the phoneme ... [whereas] for many children the earliest domain seems to be the entire lexical unit.' Ferguson and Farewell (1975) using longitudinal first word data from three children and the data elicited from the English-German bilingual child, Hildegard from Leopold's study (1949), assert the whole word approach. They state that their data suggest a new model of phonological development that

would de-emphasize the separation of phonetic and phonemic development, but would maintain in some way the notion of 'contrast'... It would emphasize individual variation...but would incorporate the notion of 'universal phonetic tendencies'... [and] it would emphasize the primacy of lexical items... but provide for a complex array of phonological elements and relations (p. 437).

The idea of whole word phonology has been further extended and more tightly defined by Macken (1979), who investigates the early phonology of a Spanish-speaking child (Si) by noting that "[a number of] unusual substitutions can be accounted for by the over-generalization of...preferred word patterns" (p. 29). Like Waterson, she finds a probable source for the child's patterns in the 'prosodic similarity' of words in the adult language. Her findings of her longitudinal study of the early word learning period show that "all [Si's] words had a consistent word pattern form;... new patterns resulted from the expansion of previously acquired word patterns; some words changed patterns over time as new word patterns were learned." (p. 34).

Vihman provides a number of arguments for supporting the whole word phonology:

(1) Variability of segment production which suggests that children have some knowledge of certain words but has not yet developed abstract categories of sound for production.

(2) Relationship of child word to adult target (i.e. such relationship cannot be accounted for on a segment-by-segment basis, but on whole word basis). In other words, children's patterns have been described as 'whole word processes' such as harmony. Menn (1971:246) has also observed that early phonological patterning "is partly determined by the shapes of the first handful of words attempted."

(3) Relationship between the child's words (i.e. the child's reliance on one or two patterns in attempting to produce specific phonological forms).

(4) Source of child patterns (i.e. children's early productions are responses to challenges posed by adult target words such as the challenge of producing distinct consonants or distinct vowels, or both, in different syllables or different word positions (initial, medial, or final)).

Here we can say that the simplest expression of the idea is that of Francescato (1968:148) who states: "Children never learn sounds: They only learn words, and the sounds are learned through words."

Since the 1970s, there has been a shift toward the study of prosodic development i.e. the tonal and accentual system. In consequence, nonlinear approaches to phonology have led to a new focus on the syllable alongside the segment in many studies. The notion of the syllable and its role in phonological development has been referred to and discussed in early and recent research. Many studies focus on and emphasize the influence of syllable on young children's phonological patterns. Four basic topics of research into this issue have been tackled: syllabic phonological processes, the development of canonical shapes, word or syllable position and segmental development, and interaction between segmental and syllabic acquisition. Most of these studies focus on the notion of syllable and show how it is central to understanding children's phonological development.

The primacy of the CV syllable or the core syllable has been stressed in many studies of child English (Jakobson, 1968; Moskowitz, 1970; Waterson, 1971; Stampe, 1979; Menn, 1971; Vihman, 1978). Moskowitz (1970, 1971) focuses on syllable development and states that the major phonological unit of first words in English is the syllable. The child first acquires the syllable, and only later develops the notion of contrastive segments. By practicing different syllables,

the child begins to grasp the notion of phonetic contrast, and particularly consistent contrast: by practicing different repetitions of the same syllable at different times, the child begins to grasp the notion of phonetic similarity and identity, together with the limits of the absolute free variation which is an inherent part of any phonetic series of like phonetic manifestations. Through the necessary processes which result from the syllable's place as the elementary unit of speech, the child develops notions of rules. (Moskowitz, 1970: 18-19)

Waterson's prosodic theory (1971:206) proposes that children establish perceptual schemas or structures which extract out perceptually salient features of adult words. She considers the important role of the syllable in constructing these schemas, yet most of Waterson's account deals with the extraction of perceptually salient features from segments.

Tracing and analyzing phonological development from short babbling utterances to longer vocabulary which bear adult-like prosodic patterns, researchers investigating child English⁴ have found that the first production unit is the CV syllable, and began to equate it with the word. Reduplicated forms (CVCV) appear and progress in comparing parts of such productions leads the child to discover the segment and the distinctive feature as well.

Thus, the child starts discovering the syllable, which soon acquires semantic value and becomes the syllable-word which increases in number gradually. The child's inventory of syllables at the early stage constitutes both the phonological and lexical units of his/her language. Phonetic differences between the syllables

⁴ It should be noted here that most of the early studies focused on early word acquisition in English.

become increasingly precise (e.g. the difference in syllable onset between *pa* and *ma*). The syllable structure continues to elaborate and CVC, CV and V syllables begin to appear and then CVCV words occur. The child begins contrasting syllables by producing various consonantal and vocalic segments, some identical and some different (e.g. *didi*, *baba* (full reduplication), and *dibi*, *babi* (partial reduplication)). It is at this point that the child discovers the phone or segment as a unit. At the very early stages, reduplication appears and enables the child to produce longer words (CVCV) than a single syllable. With the onset of CVCV structures, the child starts analyzing syllables and develops segmental contrasts at the same time.

At a later stage i.e. the second half of the child's second year, there is a gradual shift from a predominance of processes affecting the structure of whole words (consonant harmony, reduplication, final consonant deletion) to those affecting specific segments or classes of segments (fricative stopping, liquid gliding, etc). This shift from word to segment has been argued by Studdert-kennedy (1987:67) who states that this shift results from vocabulary growth which leads to 'recurrent patterns of sound.' This gradually results in emergence of a full repertoire of phoneme by the middle of the third year. Vihman (1996: 216) also suggests that this shift indicates the gradual emergence of segments as control units for the child. Nittrouer, Studdert-Kennedy, & McGowan (1989) also note that the emergence of segments is a gradual process that begins as early as the second year of the child's life when his/her lexicon has more than 50-100 words. They similarly note that with vocabulary increase, the child's produces words with similar acoustic and articulatory patterns which begin to cluster. From these clusters, coherent units of sounds or phonetic segments eventually emerge.

Through his functional model, Lindblom (1992) considers that segments of a later stage of the child's phonological organization emerge through the 'interaction of subsystems' in the form of a build-up of distinct word forms involving different activity patterns for the various articulators. Nittrouer, Studdert-Kennedy, & McGowan (1989) also note that the emergence of segments is a gradual process that begins as early as the second year of the child's life when

his/her lexicon has more than 50-100 words. They similarly note that with vocabulary increase, the child's produces words with similar acoustic and articulatory patterns which begin to cluster. From these clusters, coherent units of sounds or phonetic segments eventually emerge.

The following quote from MacKain & Stern (1985) below captures what many researchers consider to be the essence of phonological development.

“Essential to language development is the discovery of those sounds that contrast in the target language to convey differences in meaning. In acquiring these oppositions, the language user establishes phonemic categories. The speaker is perceptually sensitive to the acoustic parameters that function to distinguish these categories while remaining relatively insensitive to the parameters that do not distinguish meaning... The infant must eventually come to recognize and construct an internal representation of phonetic oppositions with phonemic significance and also assimilate phonologically irrelevant phonetic variations to represent a single phoneme.” (MacKain & Stern, 1985: 1-3)

To sum up and conclude this last section, we say that concerning the basic unit of phonological acquisition, some linguists argue for a larger unit, i.e. the word (Menn 1971, 1978; Ferguson & Farewell, 1975) and some argue for a smaller unit, the syllable (Waterson, 1971; Moskowitz, 1973; Macken, 1979), and then there is a shift to and more focus on the segment. It has become clear that segments are not acquired in isolation, but need a larger unit to surface. This depends on their position in the word for contrasts appear in onset position earlier than in coda position, and vice versa and on the relationship between position and some prosodic elements such as stress. In general, this line of research led to focus on fixed word templates which constrain word forms that children produce and form the basis of children's phonological representations (Waterson, 1971; Macken, 1979; Demuth, 1995; Vihman, 1991).

Finally, we can say that research interest in the prosodic structure rather than the segmental structure of child phonology has started with the question of what the basic unit of acquisition is. The earliest works on prosodic structure mainly focus on the syllable and its role in phonological acquisition. The

phonological acquisition researchers' interest in the prosodic structure has increased and greatly developed recently. The following chapter will shed light on the current Prosodic Theory on which this study is mainly based and the recent studies dealing with the phonological structure and representation of early words and prosodic word development.

1.4 Outline of thesis

The outline of this thesis is as follows: Chapter 1 is an introduction presenting the aims and motivation of this study. It also provides a linguistic background relating and discussing basic issues in early phonological development through giving a survey of early studies in the area of phonological development. Chapter 2 provides an outline of the prosodic theory, adopted for this research and discuss relevant issues in relation to the particular points/structures analyzed. This will be followed by a review of recent works dealing with the representation of early words and the development of the prosodic structure of early word productions of children having different linguistic backgrounds (English, Dutch, French, Spanish, Catalan, and Japanese). Some of the key issues, arguments, and evidence for the existence of foot and moraic structure in early phonology of children with different linguistic backgrounds will be introduced. The effect of prosodic word constraints and the role of phonological rules on the shapes of first words will be presented. This chapter also sheds light on child-adult differences related to syllable structure and word structure through tracing the stages of syllable internal structure and word internal structure development. Chapter 3 focuses on Arabic phonology and presents an overview of the phonological structure of Arabic in general and the prosodic structure of adult Hijazi Arabic in particular. The discussion is organized around the concepts of the prosodic theory reviewed in chapter 2. Then, a review of the studies done on Arabic phonological acquisition will be given to show the gap that needs to be filled and to be researched in this area of child language. Chapter 4 provides the methodology used for collecting the spontaneous data required: the material used, the elicitation techniques employed, and the cross-sectional and semi-longitudinal, qualitative

approach adopted for this study. It also focuses on the ethical issues to be considered since this study investigates the speech of vulnerable groups (i.e. very young children). The final sections will present the criterion used for selecting and preparing the data for analysis and the methods employed for data analysis. Chapter 5 will be assigned for data analysis where a qualitative approach is adopted. This chapter will end with a summary of the main findings of this study. Chapter 6 is devoted to the discussion of the findings in the light of this study research questions and the theoretical implications related. This will be followed by a general conclusion and further recommendations in chapter 7.

CHAPTER TWO

Prosodic Theory and Prosodic Acquisition Background

2.0 Introduction

Non-linear generative phonology theories provide a promising framework for child language development studies (Fikkert, 1994; Demuth & Fee, 1995; Ota, 2003). For example, the CV-Phonology Model of syllable structure (Clement and Keyser, 1983), the Moraic Theory (Hyman, 1985), and the Prosodic Theory developed in the works of McCarthy and Prince (1986, 1990) can be employed to explain children's behavior in acquiring their first words in connection with the Prosodic Phonology Theory, proposed by McCarthy and Prince (1983, 1986, 1990), which proposes prosodic principles such as the Prosodic Morphology Hypothesis (PMH) and Template Satisfaction Condition (TSC). Research into such areas in child language development may test and support such theories. It can also benefit from such research in that answers to markedness vs. frequency issues, for instance, may be provided.

The advancement in the Prosodic Theory in the 1980s, however, brought to focus the prosodic aspects of acquisition, and interest in this area has increased steadily in the last two decades. Developmental phonologists started viewing prosodic development as a sort of residue that is left after segmental phenomena and the phonological rules specific to child language are dealt with. Important insights can be gained when child language is analysed within the framework of a non-linear phonological theory such as the prosodic theory. This approach will be adopted for this study to show how the basic prosodic units and principles play an important role in early phonology. For example, just as children may focus on the labial properties of words at the initial stages of acquisition for instance, they may similarly focus on the final-stressed foot, neglecting the rest of the word for some time. The child's developmental patterns can also be described using the tools of prosodic theory i.e. in terms of the basic prosodic categories: the mora, syllable,

foot and prosodic word. The child's template is extended in such a way that it contains a larger prosodic constituent at various stages. As reported in some Germanic languages such as English and Dutch, the child's template contains only one syllable at the onset of speech; then it can contain two syllables, as long as these syllables are contained in one foot, and later on forms consisting of more than a single foot.

Adopting a non-linear phonological approach, recent studies have focused mainly on early word production and development, the representational levels of word production, the role of phonological rules and prosodic constraints in shaping child forms, and the relationship between the child's system and the adult model (Boysson-Bradies & Vihman, 1999; Demuth, 1993, 2003; Vihman, 1991, 1996; McCune & Vihman, 2001). Only recently have researchers begun to examine children's early words from the perspective of developing prosodic structure, focusing specifically on the level of syllables and words (e.g. Demuth 1994, 1995; Demuth & Fee, 1995; Ota, 1998, 2003; Prieto, 2006; Lleo, 2003, 2006; Lleo & Prinz, 1996).

This chapter continues providing the phonological acquisition background. It introduces the Prosodic Theory and the Moraic Theory on which this study is based, and reviews some of the recent studies based on the Prosodic Theory. Section 2.1 is concerned with the Prosodic Theory and the Moraic Approach used for this study. It introduces prosodic principles, identifies prosodic units (the mora, the foot, and the prosodic word), and explains certain phenomena such as compensatory lengthening. Section 2.2 reviews previous research dealing with prosodic phonological development to introduce some of the questions raised and the arguments held concerning the prosodic structure of children's first words and the stages of prosodic word development. Subsequent sections will deal with the representation of early words (2.2.1), child-adult differences in syllable and word internal structure (2.2.2), word size restrictions and their role in determining the shape and size of early words (2.2.3), and the developmental stages of prosodic structure of early words and the child's access to the Prosodic Hierarchy (2.2.4). These sections introduce the possible suggestions offered in the literature to explain

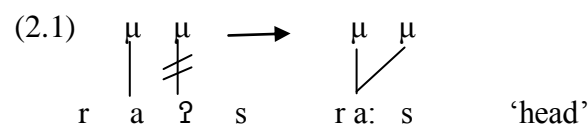
why and how children’s early words are constrained, how the constituents of the prosodic hierarchy become accessible to the child, and how the child’s prosodic words develop since the onset of speech. Section 2.3 summarizes the key findings of previous studies and section 2.4 provides this study research questions that are based on these findings.

2.1 Prosodic theory and moraic approach

This section will dwell more on viewing the Prosodic Theory on which this study is mainly based, but it will briefly refer to some aspects of the Moraic Theory that are relevant or will be used in this research. The Moraic theory will not be reviewed in detail, but it has been adopted for the following reasons:

(1) It develops a prosodic conception of the syllable, and it gives status only to those segments which bear weight and are potentially stressable such as coda segments. Onset segments have no effect on stress assignment (Watson, 2002: 54).

(2) It identifies some prosodic units such as the mora and it provides an economical means of capturing phenomena such as compensatory lengthening (CL) (Hayes, 1989). For example, in historical development of most of the Arabic dialects (e.g. Cairene or Hijazi [ra:s] ‘head’ from Classical Arabic /raʔs/, the pre-consonantal glottal stop is deleted: this frees up the right-hand mora into which the short vowel spreads, as in (2.1):



To simply introduce the Moraic Theory, we say that this theory (Hyman, 1985; McCarthy & Prince, 1986, 1990; Hayes, 1989; Ito, 1989) requires the use of the mora as a unit involved in the determination of syllable weight; light syllables count as monomoraic and heavy syllable as bimoraic. The moraic approach eliminates the skeletal tier⁵, and moras are used instead.⁶ Moreover, the moraic

⁵ In the CV-tier approach proposed by McCarthy (1979) and advanced in Clement and Keyser (1983), the skeleton is represented by C’s and V’s which indicate non-syllabic and syllabic elements and encode syllabicity information.

approach has been used in capturing and explaining a phenomenon such as compensatory lengthening (CL) as we will see in a later section (2.1.2.1.2).

The rest of this section is concerned with presenting the Prosodic Theory and some of its basic concepts and principles that are relevant to this study data analysis in subsequent chapters. Prosodic structures above the word level will not be discussed since these will not be tackled in this study. First, I discuss the prosodic units of the prosodic hierarchy, as proposed by Selkirk (1980, 1984), McCarthy and Prince (1986, 1990), and others.⁷ Second, I present some principles of the Prosodic Theory that relate to the acquisition of prosodic structure at the end of this section.

To investigate the structure of children’s early words and utterances, it is useful to appeal to the Prosodic Hierarchy, where phonological prosodic words (PWs) are composed of feet, syllables, and moras (McCarthy & Prince, 1986, 1990; Nespor & Vogel, 1986; Selkirk, 1980). The prosodic phenomenon involves units larger than segments and these are shown to constitute domains that are organized in a hierarchical structure as shown in the following Figure (2.2) (Selkirk, 1980; McCarthy & Prince, 1986, 1990). Research in prosodic phonology has called on the prosodic constituents both at and below the level of word.

(2.2) Prosodic Hierarchy

PW	(Phonological Word)	banana
Ft	(Foot)	cat/doggie
σ	(Syllable)	Cat
μ	(Mora)	Ma

In this theory, the phonological word (PW) corresponds roughly but not exactly to the grammatical or syntactic word; it is the domain of main stress-

⁶ McCarthy and Prince (1986, 1990) use the moraic approach to morphological templates instead of the CV-approach as follows:

(1) (σ) a vowel less syllable, (2) σμ CV
(3) σμμ CVV, CVC (4) σ core syllable

⁷ Prosodic structure above the word level is discussed in Selkirk (1984) and Nespor & Vogel (1986).

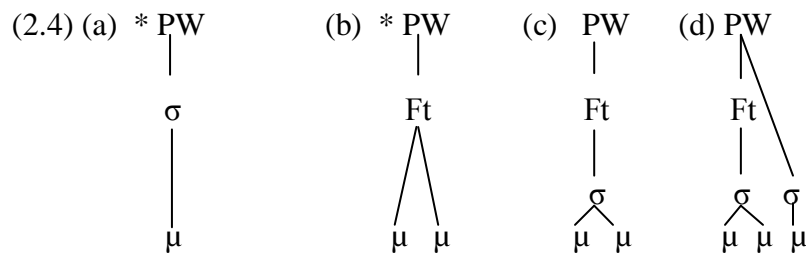
assignment. The foot (Ft) is a constituent composed of at least one stressed syllable (σ) and an unstressed syllable, and the mora (μ) is the unit that reflects syllable weight (McCarthy & Prince, 1990: 3-4). The mora has two functions: it functions as a subsyllabic constituent, and it is a weight unit, i.e., it determines the weight of a syllable, and also functions as a subsyllabic unit. A syllable may contain one or two moras, and this reflects the weight distinction between light and heavy syllables. A light syllable contains one mora, whereas a heavy syllable contains two moras (subsyllabic units such as coda consonants or long vowels). Some researchers adopt the more traditional view of a syllable, in which the onset, the rhyme, the nucleus and the coda are subsyllabic constituents. In such a view syllable weight can be expressed in terms of branching rhymes or nuclei. The syllables of a word are parsed into a feet, which contain strong (stressed) and weak (unstressed) positions. There is a pattern of alternating stressed and unstressed positions, reflecting a basic rhythmical principle of alternation. Then feet are organized into prosodic words.

Each of these prosodic constituents is dominated by a constituent of the immediately superordinate category in the hierarchy as shown in Figure (2.2). The following Proper Headedness condition stated in (2.3) is a universal condition.

(2.3) Proper Headedness (PH) (Selkirk, 1996)

Every (non-terminal) prosodic category of level i must have a head; that is, it must immediately dominate a category of level $i-1$.

This condition rules out structures such as (a) and (b) given below in (2.4) because in (a) the prosodic word is not headed by a foot, and in (b), the foot is missing a head syllable.



In contrast, (c) and (d) are well-formed because Proper Headedness is satisfied. Although the last syllable in structure (d) is unfooted, the foot is

dominated by a syllable that heads it and all the other constituents are headed as well.

Evidence for the status of the syllable as a prosodic unit is documented in the literature (Waterson, 1971; Menn, 1971; Stampe, 1979; Vihman, 1978; Goldsmith, 1990). The syllable is the domain of many phonological processes and the target of morphological operations. Syllable types vary across languages. Open CV syllables are universal. Some languages permit only CV syllable structure, whereas others allow more complex syllable structures with onset and coda clusters (e.g. CVCC, CCVC, CCVCC, CVCCC, CCVCCC). Some languages allow onsetless syllables (V, VC) and/or syllables with codas (CVC, CVCC). According to the implicational laws, languages that admit onsetless syllables will always have syllables with onsets, and languages that admit syllables with codas will always have codaless syllables. Thus, no language has a syllable inventory that contains CVC but not CV, or an inventory that includes VC but not CV, CVC, or V.

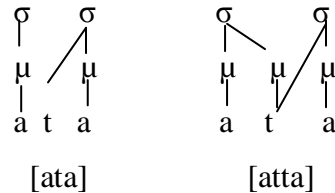
Below the syllable level, most phonological theories postulate a level of prosodic constituency. To clarify this point, the moraic approach to subsyllabic constituency (see Hayes, 1989; Hyman, 1985; McCarthy & Prince, 1986; Ito, 1989; Broselow, 1992) is adopted here. As a prosodic unit, the mora has two functions: First, it functions as a phonological position. In languages with contrastive vowel length (e.g. Arabic, Japanese), a short vowel is associated with a single mora, while a long vowel is associated with two moras. The segment that stands for a long vowel is doubly linked to two moras as shown below in (2.5):



The mora also represents the contrast between singleton consonants and geminates (McCarthy & Prince, 1986; Hayes, 1989). In Hayes (1989, 1995) and others, long/geminate consonants are distinguished from short/single consonants as underlyingly monomoraic versus underlyingly non-moraic. In other words, a geminate is associated with an underlying mora, and is linked to the following syllable as well to form an onset for that syllable as illustrated in the following hypothetical examples given in (2.6). Thus, under moraic theory, long segments –

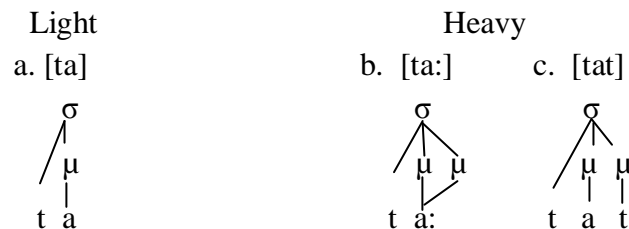
that is, long vowels and geminates – are treated as single segments associated with contrastive moraic values.

(2.6) Single consonant vs. geminate



The second role the mora plays is that it is a unit of weight. Syllables can be divided into two classes that differ in their degree of prominence in prosodic phenomena. In moraic theory, the difference is represented by the number of moras dominated by the syllable: a syllable with one mora is light and a syllable with two moras is heavy. Because long vowels and geminates add a second mora, syllables containing these structures are heavy. In languages that follow the weight-by-position rule (Hayes, 1989), a (V)VC syllable counts as heavy while in languages without it (Weight-by-Position), a (C)VC syllable counts as light (see the figures in (2.7)) where the contrast is captured by the projection of a mora by the coda consonant (c), or the lack of it thereof (b)). Onset consonants never project moras.

(2.7) Moras and syllable weight



Feet are the prosodic units of metrical parsing and various morphological operations. Foot-based morphological phenomena are discussed in McCarthy & Prince, 1986, 1990, 1993). The typological survey of Hayes (1985, 1995) identifies the inventory of possible foot types (iambic, trochaic, and syllabic). Within this theory, possible foot types are identified. Iambs can be either disyllabic or bimoraic. Moraic trochees are always bimoraic. Syllabic trochees are disyllabic regardless of the moraic internal structure of the syllables (and hence ‘quantity

insensitive’). All foot types share a general restriction called Foot Binarity (FB) that can be captured by the following statement.

(2.8) Foot Binarity (McCarthy & Prince, 1986)

Feet are binary under syllabic or moraic analysis.

Unlike PH, FB is not a universal condition for there are cases in which it is not fully obeyed, but it militates against a foot containing only one light syllable (a ‘degenerate’ foot), or a foot with three or more syllables. This means that the unmarked foot is minimally bimoraic and maximally disyllabic.

The prosodic word is the level at which prosodic constituents systematically correspond to morphological constituents (McCarthy & Prince, 1986; Selkirk, 1996). There is a kind of mapping condition that holds between a lexical word and a prosodic word ($LxW \approx PW$) i.e. a lexical word must be a prosodic one. This mapping condition, along with PH and FB, make a lexical item correspond to a PW that should contain at least one foot. PH requires that each syllable has at least one mora and FB requires that a foot be either disyllabic or bimoraic. Both PH and FB are to be satisfied for a well-formed prosodic word. Thus, a lexical word must be bimoraic if FB holds. This leads us to the word minimality condition which states that a word must be minimally bimoraic.

The smallest PW often has a special role in the phonology of languages, and is referred to as ‘the minimal word.’ This term is used to refer to a prosodic word that minimally satisfies the word minimality restriction. Lexical items having CV:, CVC, and CVCV structures are bimoraic minimal words, whereas a CV structure is considered subminimal. This concept of ‘word minimality’ plays an important role in early word production. The bimoraic minimality condition applies to lexical words independent of the foot types i.e. whether it is trochaic or iambic. The minimal word is typically bimoraic, not disyllabic (Hayes, 1995). It represents the minimal size that a content word may have. Since content words must be stressable, the minimal word is equal to the minimal foot (the unmarked foot of the language). In quantity-sensitive systems the minimal stressed foot contains one heavy syllable of two light syllables; in quantity-insensitive systems the minimal stressed foot contains two syllables. Some languages (e.g. Japanese) have minimal word

constraints. Words that are too small are augmented in such a way that they conform to minimal word templates (see Ota's study (1998, 2003)). Further evidence for the operation of the minimal word requirement occurs in truncation processes.

Here I also add and present some prosodic principles that are relevant to this study and they will be used to show the role of these principles in the acquisition of prosodic structure. These principles are given below in ((2.9):

(2.9) Principles of prosodic morphology (McCarthy & Prince, 1990, 1993)

a. *Prosodic Morphology Hypothesis (PMH)*

Templates are defined in terms of the prosodic units: mora (μ), syllable (σ), foot (Ft), prosodic word (PW).

b. *Template Satisfaction Condition (TSC)*

Satisfaction of templatic constraints is obligatory (i.e. All elements in a template are obligatorily satisfied); this is determined by both universal and language-specific principles of prosody.

c. *Prosodic Circumscription*

The domain to which morphological operations apply may be circumscribed by prosodic criteria as well as by the more familiar morphological ones.

These principles relate the Prosodic Theory to acquisition and will help in answering some of the questions raised concerning the representational nature of early words and the role of these principles in word acquisition. The Prosodic Morphology Hypothesis asserts that adults' templates are composed of the units of prosody (the mora, syllable, and foot), and it requires templates that are exactly specified by a single prosodic constituent. For example, nouns in Arabic are minimal words, whose template is identical to a prosodic constituent, the quantitative trochaic foot. It is assumed that the child's templates could also be defined in terms of the authentic prosodic units and are determined by the same principles and constraints of adult phonology. This determines the relation between the input and the child's output. There are arguments about the relation/the

differences between them both and whether they are the same or not and whether early word representations are adult-based or child-based (see section 1.3.2.1).

The adult template differs from that of the child's. The mismatches between the two have been argued to be the result of mapping the former onto the latter via the child's initially simple grammar which mediates between them in a way that his/her template is minimally or maximally satisfied. When the mapping procedure takes place, not all the input material can be accommodated into the child's template because it is more constrained than the adult's which is largely varied from the beginning. That the child's stored form is different from the input form s/he receives, is largely due to the child's restricted grammar. At each stage of the development, his/her template might determine the relation between the input and the output. This may depend on the child's own input, which has a shorter form that may serve as input for the subsequent stages in which this form is expanded gradually until it resembles the longer adult form. The child's phonological system is not stable yet for it is in constant development. In this respect, it is different from the adult grammar which has reached a steady state. Therefore, repair strategies appear to avoid violating the child's grammar by altering the adult template. Through employing a selection strategy and some phonological rules, the child may only select certain parts of the target base that fits into his/her template. Phonological units that are not 'prosodically licensed,' i.e., not belonging to the higher prosodic structure (Ito, 1986), are subject to 'stray erasure' (McCarthy & Prince, 1990) i.e. subject to deletion of segments and/or syllables. For example, codas will be deleted, complex onsets and codas will be reduced, and initial weak syllables will be omitted since the template does not allow them. For instance, if a child's system/template only allows CV(C) syllables, the child has to 'repair' a target word like *train* /tre:n/; in this case, the child's production form [ten] for *train* is not due to an incomplete representation, but due to an incomplete grammatical system. When the child's grammatical system grows and allows for initial clusters, this repair strategy is no longer needed and ceases to occur.

The Templatic Satisfaction Condition requires that all elements in a template are obligatorily satisfied (McCarthy & Prince, 1990: 41). For example, noun templates in Arabic must obey the following constraints: (1) syllable onsets are obligatory; (2) all stems must be consonant-final; (3) association of root with skeleton is from left-to-right; and (4) maximization of melodic association takes precedence over any other considerations. Root consonants, for example, must be conserved. In its essence, this condition does not allow excess materials to be present in the representation. Moreover, template satisfaction may dictate the expansion of a target form. The child's templates are expanded by some processes such as reduplication in the course of development. For example, in the case of onsetless targets in some languages, the child's core syllable template can be supplied with an onset in the child's form since at the early stages onsets are obligatory in the child's template. For example, in child Dutch, auto 'car' /'o:to:/ is produced as a reduplicated form [l'to:to] by the child to satisfy his/her template. On the foot level, if the target is multisyllabic consisting of more than a foot, the child often selects only one foot of the target word for production because his/her template contains a single foot at the early stages (e.g. /hala:wa/ > [la:wa] 'candy' and /ʃukala:ta/ > [ta:ta] ~ [la:ta] 'chocolate'). This resembles the mechanism of prosodic circumscription which is a general approach to the problem of limiting the domain of rules to less than a morphological constituent. In general, the base is divided into two parts: the KERNEL, a prosodic constituent, and the RESIDUE (McCarthy & Prince, 1990). In such a case, the child 'prosodically circumscribes' the foot which contains a stressed syllable at the right edge, copies the segmental material contained in it, and maps this onto tochaic template. The residue of the word is not realized, because it is not prosodically licensed by the template, it is therefore subject to 'stray erasure' or, in other words, deleted (McCarthy & Prince, 1986, 1990). This study will show that in these cases the child circumscribes the rightmost foot of the adult target form, rather than the whole adult form, and maps the segmental material of this foot onto his/her template.

To summarize this section, we can say that the Prosodic Theory states that prosodic words in adult phonology have three levels of internal prosodic

representational units that are organized according to PH and FB which are to be satisfied for a well-formed prosodic word. The proper prosodic hierarchical structure is ill-formed when it lacks one of its units (i.e. a head) such as the foot, for instance, which causes violation of PH. FB is violated when the foot contains only one syllable or one mora. These prosodic elements that exist in child phonology along with the prosodic principles play a role in the acquisition of prosodic structure of first words as will be shown in the following section and in chapter five and six.

The following section reviews some recent studies based on the Prosodic Theory to point out some key debates and related issues that will be raised and discussed again later in this current study through the analysis of the child Arabic data collected.

2.2 Previous studies on prosodic structure acquisition

During the last two decades, studies of prosody have been very extensive, but this is not reflected in the phonological acquisition literature. Developmental phonologists paid attention mostly to the segmental structure in early research and focused on phonological rules specific to child language to shed light on child-adult differences (Ingram, 1986; Ferguson & Farewell, 1975; Vihman, 1978; Ferguson, 1983; Yeni-Komshian, Kavanagh & Ferguson, 1980; Ferguson, Menn, & Stoel-Gammon, 1992). Recently, more attention has been paid to the prosodic aspects of phonological acquisition, particularly with the increase of interest in the child's early word production. Researchers have begun examining children's early words from the perspective of developing prosodic structure, focusing specifically on the level of syllables and words (Demuth 1994, 1995; Fee, 1995; Lleo, 2006) and the role of stress and syllable structure and position in determining the shape of the child's early words (Demuth, 1994; Fikkert, 1994; Ota, 1998, 2003).

The last decade witnessed the accomplishment of researches investigating early prosodic word production across different languages. Early phonological acquisition works provided possible reasons why children's language behavior may differ from that of adults depending on extralinguistic factors including articulatory

inabilities and perceptual and memory capacities (see sections 1.3.1 and 1.3.2). Recent phonological acquisition literature focusing on word representation has shown that child-adult differences could be explained in terms of linguistic factors. Recent studies have shown that early word production is guided and constrained by prosodic conditions and that children's words are produced with certain consistent size and rhythmic patterns (Demuth, 1994, 2003; Demuth & Johnson, 2003; Demuth & Fee, 1995; Fikkert, 1994; Pater, 1997; Lleo & Demuth, 1999). For example, at an initial stages of development, children produce minimal words consisting of a binary foot which tends to conform to a trochaic stress pattern (Demuth & Fee, 1995; Salidis & Johnson, 1997; Lleo, 2006). At later stages, children's words are maximally bisyllabic (Fikkert 1994; Demuth, 1995, 1996; Pater, 1997; Ota, 1998, 2003; Lleo, 2006, Prieto, 2006). Many of these researches have provided evidence that children are also sensitive to the properties of the input or their native language specific prosodic features that are reflected in their early word shapes (Demuth, 2003; Lleó, 2006; Demuth & Johnson, 2003, Ota, 2003). For instance, early PW productions in French are characterized by an extended period of development where half of the words consist of a binary foot and the other half of subminimal CV forms resulting from producing either monosyllabic or bisyllabic targets (Demuth & Johnson, 2003) (see examples given below in (2.10)). The minimality constraint is violated here due to language-specific properties from French that is characterized by few codas and high frequency of subminimal words of CV structure.

(2.10) Examples of early words in French (Demuth & Johnson, 2003:223)

Adult's form	Child's form	Gloss		Child & Age
/pɔm/	[pɔ]	Pomme	'apple'	(Suzanne 1;5) ⁸
/ʃo'sɔ/	[tɔ]	Chausson	'slipper'	(Suzanne 1;5)
/ma'dam/	[da]	Madame	'Mrs'	(Suzanne 1;6)
/para'plɥi/	[pi]	Parapluie	'umbrella'	(Suzanne 1;6)

⁸ Adult target forms are given between slashes and child forms are given in square brackets. Child age is given in 'years;months.days.' For example, 1;6.15 indicates one year, six months and 15 days.

Similar cases, such as the contrast in acquiring initial weak syllables by Spanish and English children which can be predicted by the exposure to frequent prosodic structures in the target language, have been reported. In Spanish, pretonic syllables are acquired earlier (before 1;6) than in English where they are often deleted until the age of 2;6 (Gennari & Demuth, 1997; Lleó & Demuth, 1999; Roark & Demuth, 2000; Lleo, 2001, 2006). Omission of initial weak syllables, a frequent process in children acquiring trochaic languages, fades rapidly at 1;9 – 1;10 in Spanish but continues after age two in English (Lleo, 2001), reflecting the different proportions of child-directed words with weak initial syllables between Spanish (45%) and English (10%) (Roark & Demuth, 2000).

Previous studies have discussed subsyllabic prosodic representation in relation to the overall structure of the word (e.g. Demuth & Fee, 1995; Fee, 1995, 1996; Salidis & Johnson, 1997), and to the early syllable-internal prosodic structure (Fikkert, 1994; Ota, 1998, 2003; Prieto, 2006; Lleo, 2006) in Germanic languages (e.g. English and Dutch), and Romance languages (e.g. Spanish, and Catalan). Some of these studies have investigated whether the child's linguistic system has the same prosodic organization proposed for adult language and received much empirical support and evidence. This domain of investigation has important implications for the question of whether all the prosodic units found in adult phonology are present in early phonology. One of the goals of this study is to show whether early phonology in child Arabic has the same prosodic organizational units of adult phonology. This will be investigated and discussed in detail in chapter five and chapter six.

The interest in the prosodic structure of early words has resulted from researchers' observation that there are child-adult differences and deviations from the adult targets concerning the shape of early words. Recently, studies have focused on how and to what extent early words are constrained by output restrictions defined in terms of prosodic constituents such as feet, for example. One of the debates raised by Demuth (1995) and others is that children's earliest words are binary feet (Demuth & Fee, 1995; Salidis & Johnson, 1997; Pater, 1997;

Kehoe & Stoel-Gammon, 1997, Ota, 2003). This is what is called the Minimal Word Hypothesis (MWH) which states that children's earliest words are the most unmarked prosodic words, or binary feet. This indicates that the child's early words, in spite of the difference in shape between the child's and the adult's forms, are minimally well-formed and satisfy the well-formedness conditions required by the prosodic theory. One of the aims of this work is to provide another evidence for the role of foot and other prosodic units (i.e. syllables and moras) in delimiting the structure of early words.

In order to present the key debates raised and to lay out the previous prosodic research findings that are relevant to the main issues raised in this study, I will review some of the recent studies in the prosodic acquisition literature in the following sections.

2.2.1 Representation of early words

One of the main questions raised in the literature is concerned with the relationship between child phonology and adult phonology. It has been assumed that early prosodic child phonology has the same prosodic units of organizations found in adult phonology, and it is governed by similar sets of universal constraints shared by all adult languages despite the language-specific differences. The differences between the prosodic shapes of child and adult words could be accounted for via the phonetic factors and the constraints that constrain children's word productions.

The literature investigating the prosodic structure in child phonology has provided crosslinguistic evidence that children's phonological system includes similar prosodic units to those found in adult phonology. The following sections review studies providing evidence for the existence of each prosodic unit such as foot and mora in child phonology. Based on the findings of the studies, I assume that early phonology in child Hijazi Arabic has the same prosodic organizational units of adults' prosodic phonology. This will be discussed thoroughly in chapters five and six assigned for data analysis and discussion.

2.2.1.1 Evidence for syllable structure

Of all the constituents in the prosodic hierarchy, the syllable is the only unit that has been investigated extensively in child and adult language research. The early existence of the syllable and its role in phonological acquisition has been documented in the literature. This has received supporting evidence, including infants' perceptual sensitivity to syllable boundaries (Jusczyk, 1997; Eimas & Miller, 1980) and the prevalence of CV forms in early speech, and other phonotactic constraints on early production that are similar to those constraints on syllable structure in adult phonology (Menn, 1971; Smith, 1973; Stampe, 1979; Ingram, 1974, 1978; Vihman, 1992,1996; Bernhardt & Stemberger, 1998). More focus will be given to the other lower subsyllabic prosodic constituents (i.e. feet and moras) in the following sections.

2.2.1.2 Evidence for moraic structure

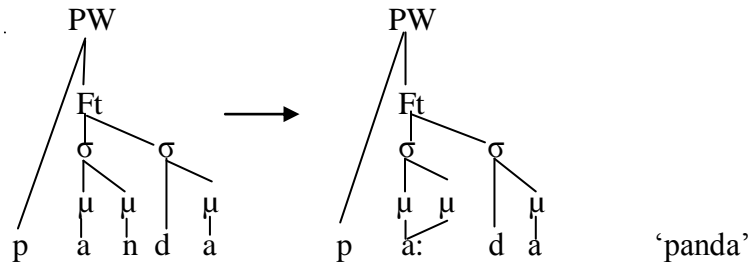
Concerning the moraic structure, some studies have discussed the early CL phenomenon and provided evidence for the mora existence in child phonology (Fikkert, 1994; Ota, 1998). For example, Ota (1998, 2003) provides evidence for moraic structure and reports the occurrence of CL by giving examples from Japanese data collected from four children (Kenta, Hiromi, Aki, and Takeru) aged between 1;0 and 2;0 (see (2.11)).

(2.11) C L resulting from coda deletion (Ota, 2003:61)

/wanwan/	[wo:wɔ:]	'doggie'	(Hiromi 1;2.7)
/panda/	[pa:da]	'panda'	(Hiromi 1;10.23)
/nanda/	[na:da]	'what?'	(Kenta 1;7.16)
/denʃa/	[da:da]	'train'	(Kenta 2;5.10)

When a syllable-final consonant is deleted, the preceding vowel in the target word is lengthened. A phonological explanation of this phenomenon is that after deleting the consonant, the mora with which the postvocalic consonant is associated becomes linked to the preceding vowel. As a result, the vowel is associated with two moras as shown in the following figure (2.12).

(2.12) Compensatory lengthening



Similarly, Fikkert (1994) reports the following data from her study investigating the early word productions of 12 Dutch-speaking children.

(2.13) CL resulting from coda deletion (Fikkert, 1994:130)

/dt/	[ti:]	Dit	(Jarmo 1;2.7)
/kvak/	[kɑ:]	Kwak	(Jarmo 1; 7.15)
/dat/	[ta:]	Dat	(Tom 1;2.27)

It should be noted here that CL takes place only when a segment associated with a mora is deleted. In the case of onset deletion, lengthening does not occur because according to the moraic theory, syllable onset segments are universally non-mora bearing elements. Previous studies failed to demonstrate this point, and hence they have not presented conclusive evidence for moraic structure. Another type of data has been used to argue for moraic phonology, and that is the relationship between nucleus types and codas. Some children tend to delete target codas depending on the nucleus type as to whether it's a lax vowel, tense vowel, or a diphthong. For example, Bernhardt and Stemberger (1998) report that their subject, Gwendolyn, deleted the second half of a diphthong in a closed syllable until the age of 2;6 (e.g. /klaʊn/ > [tʰan] and 'clown,'/hoʊm/ > [hʌm] 'home'). Demuth and Fee (1995) also observed that their subject MH (1;7) deleted a target coda when preceded by a tense vowel in the same syllable (e.g. [ɛg] ~ [ɪʔ] ~ [ʔe] 'egg').

An explanation that could be offered for such patterns is that codas are forced to be moraic in early syllables. Tense vowels and diphthongs are considered bimoraic under moraic analysis; therefore, the bimoraic upper limit of the syllable

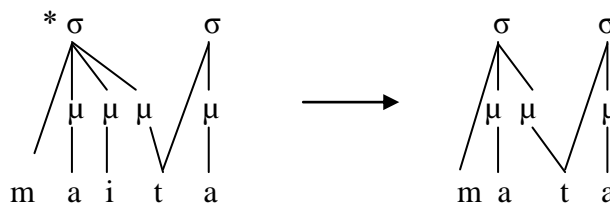
is saturated by parsing these segments within the same syllable. Deleting the second vowel in a diphthong can be used as a strategy to leave a space for the coda consonant and for moraic conservation as well or to avoid trimoraic syllables. Findings of studies carried out by Salidis and Johnson (1997) and Ota (1998, 2003) lend support to this explanation. Salidis and Johnson (1997) show that English-speaking children generally produce codas more frequently in target syllables with lax vowels than in those with tense vowels and diphthongs. Ota's (1998:14) data elicited from four Japanese-speaking children show that these children, by the age of 1;11, tend to delete the second vowel of a target diphthong. He has noticed that they lengthen the first vowel as shown in the following examples in (2.14).

(2.14) Deletion of the second vowel in Japanese target diphthongs (Ota, 2003:63)

a. /nai/	[na:]	'not here'	(Hiromi 1;2.21)
b. /taija/	[da:ta]	'tire'	(Hiromi 1;2.21)
b. /aita/	[a:da]	'opened'	(Kenta 1;5.7)
c. /oide/	[o:de]	'come'	(Takeru 1;11.16)

He also reports that this takes place even in a syllable closed by a geminate (e.g. /maitta/ > [matta] 'give up'). Under moraic analysis, Ota interprets the deletion of the second vowel as a strategy to avoid trimoraic syllable as shown in the figure given below in (2.15):

(2.15) Avoidance of trimoraic syllables and CL



These studies actually indicate that the nucleus dictates the presence or absence of codas, but rarely the other way around. However, an empirical issue that must be addressed with respect to these studies is that analysis of early subsyllabic structure of languages such as English and Dutch is dependent on the status of phonological vowel length contrasts, which is still controversial.

To conclude, these investigations suggest that there is a subsyllabic prosodic structure in early language that is similar to the moraic structure of adult language, but there is a need for further investigations of early word productions and evidence from other languages such as Arabic that belongs to the Semitic family of languages.

2.2.1.3 Evidence for foot structure

Evidence for early foot structure in child phonology has been offered in the phonological acquisition literature. Two arguments have been raised for the existence of foot in early phonology and these are: minimality effects and disyllabic maximality.

The first argument for the existence of feet in child phonology comes from minimality effects. Evidence comes from investigations of child English, child Dutch, child Spanish, child Catalan, and child Japanese (Fikkert, 1994; Salidis & Johnson, 1997; Ota, 2003; Lleo, 2006; Prieto, 2006). When children's first prosodic words fully satisfy PH and FB, these words must be minimally bimoraic. Using truncation data collected from a child (Kyle) aged 0;11 to 1;7, Salidis and Johnson (1997) argue for bimoraic minimality in child English. They have examined their subject's production of target words with two or more syllables, and found many truncated outputs such as the following:

(2.16) Truncated forms (Salidis & Johnson, 1997)

a. bubble	[bo]	(Kyle 0;11)	e. bread	[bɛ]	(Kyle 0;11)
b. tofu	[fu]	(Kyle 1;0)	f. fish	[fi]	(Kyle 1;0)
c. starfish	[dæs]	(Kyle 1;1)	g. belt	[bɛ]	(Kyle 1;1)
d. berries	[bɛz]	(Kyle 1;4)	h. carry	[kɛ]	(Kyle 1;5)

These outputs, which constitute 75% of the production of disyllabic or multisyllabic targets, are all monosyllables with a tense vowel nucleus (a-b) or with a coda consonant (c-d). On the other hand, the data show truncated forms of a monosyllabic type with short lax vowels and without codas as those shown in (e-h), and these constitute less than 15% of the productions. If the forms in (a-c) are bimoraic and those in (e-h) are monomoraic, the sparseness of the latter could be

resulting from a restriction against monomoraic outputs. The issue that is still controversial is whether the forms in (a-c) and (e-h) contrast in prosodic structure (i.e. bimoraic vs. monomoraic). As mentioned earlier, the issue of vowel quality and its relation to the bimoraic size limit is still controversial. Some researchers argue that the vowel quality leads to a difference in prosodic value (Salidis & Johnson, 1997), whereas others still maintain that children lack vowel length contrast at the early stages.⁹ Demuth and Fee (1995) and Fikkert (1994) report that children acquiring English and Dutch seem to make no vowel length distinction at the earliest stage of word production.

Another argument comes from researchers' observations that there is a stage of development when children's word productions are maximally disyllabic. At the same stage, their monosyllabic outputs end up with a coda or contain a long vowel. This stage has been documented extensively in studies dealing with Germanic languages (child English, Dutch, and German) (Allen & Hawkins, 1978; Echols & Newport, 1992; Demuth & Fee, 1995; Pater, 1997; Fikkert, 1994; Lleo, 2006). Some examples from these languages are given in (2.17) and (2.18).

(2.17) Disyllabic forms from child English (Pater, 1997)

a. tomorrow	[¹ moro]	Trevor (1;8-2;1)
b. umbrella	[¹ bɛla]	Trevor (1;7-2;1)
c. balloon	[bun]	Julia (1;9-1;10)
d. guitar	[ga:r]	Trevor (1;7-2;1)

(2.18) Disyllabic forms from child Dutch (Fikkert, 1994: 226-7)

a. olifant	/ ¹ o:li:fant/	[¹ o:fant]	Eva (1;9.8)
b. telefoon	/ ¹ tɛ:lɔfo:n/	[¹ tɛfo:]	Tirza (1;8.6)
c. kangoeroe	/ ¹ kangu:ru:/	[kau] ~ [¹ ka:ku:]	Tom (1;5.28)
d. telefoon	/ ¹ tɛ:lɔfo:n/	[fɔm]	Robin (1;10.7)

⁹ By vowel length, I mean a contrast in vowels that has prosodic consequences (e.g. monomoraic vs. bimoraic).

This stage has also been reported by researchers investigating early word productions in child Japanese (Ota, 1998, 2003) and in Romance languages such as child Spanish and Catalan (Lleo, 2006; Prieto, 2006). Illustrative examples are the following:

(2.19) Bisyllabic words from child Catalan (Prieto, 2006:248)

/pi'lɔtə/	[^h tɔtə]	pilota	'ball'	(Luis 1;7.18)
/ə'kɛstə/	[^h k ^h ɛk ^h a]	aquesta	'this'	(Anna 1;6.9)
/əs'kɔlə/	[^h kɔlə]	escola	'school'	(Ot 1;6.24)

(2.20) Bisyllabic forms from child Japanese (Ota, 2003:156)

/banana/	[bana], [nana]	'banana'	(Hiromi 1;10.23)
/kofewa/	[kowa]	'this is?'	(Hiromi 1;7.3)
/dʒido:ʃa/	[ʒi:da]	'cat'	(Kenta 1;7.16)

The argument for foot structure in the literature is that all these forms given above are a binary foot, i.e. they are minimal forms satisfying the requirements of PH and FB (Fikkert, 1994; Demuth & Fee, 1995; Pater 1997; Ota, 2003). In addition, most of the children's outputs are trochaic forms (i.e. initially stressed or containing a strong syllable followed by a weak one). A trochaic foot template analysis provides an explanation of the truncated forms in child language. For example, in child Dutch, disyllabic targets with a final accent lose their initial unstressed syllables (Fikkert, 1994) as shown below.

(2.21) Truncations of disyllabic targets (Fikkert, 1994: 202)

a. giraf	/ʃi:'rɑf/	[^h la:f]	Tirza (1;9.22)
b. muziek	/my:'si:k/	[^h si:k]	Robin (1;7.27)
c. trompet	/trɔmpɛt/	[^h pɪt]	Robin (1;9.4)
d. banana	/ba:'na:n/	[^h pa:n]	Robin (1;10.7)

Such findings support the claim that foot is a unit in the child's early phonology. Despite this, some researchers (e.g. Echlos & Newport, 1992) propose a perceptual model and resort to the child's perceptual filter as a possible explanation for truncations appealing to the notion of foot in child language. They claim that the child's disyllabic outputs reflect the effect of the child's perceptual

filter which favors stressed and final syllables because of their acoustic saliency. Accordingly, weak/unstressed syllables are deleted because they are not acoustically salient enough to be perceived and lexically represented, and not because they are constrained by any templatic restrictions. This mechanism enables the child to truncate adult target words that are either di-, tri-, or quadrisyllabic to monosyllabic or disyllabic forms. The perceptual model, in fact, cautions against using truncation data to argue for the existence of feet in early phonology. Demuth and Fee (1995) criticize and argue against this model by providing two counter evidence. First, children perceive unstressed syllables even though they are deleted in production. Second, some sound segments from omitted unstressed syllables often appear in children's production. Though the perceptual accounts caution against using truncation data to argue for the existence of feet, this does not stand against having templatic restrictions on children's output structures defined by a binary foot.

To sum up, there are two types of evidence for foot structure in child phonology: word minimality effects and disyllabic maximum. Despite the implications related to this evidence such as the unresolved issue of vowel length contrast in child English, and the perceptual filter proposal that may caution against using truncation data to argue for the existence of feet in early phonology, more examination of the size limit of child word production is needed to support this evidence. This study aims to provide evidence for early foot structure in early child Arabic as we will see in chapter five and six.

2.2.2 Differences between child and adult forms

Child-adult differences are of great interest to many researchers and they have been the domain of early and recent first language acquisition research. Section 2.2.2.1 focuses on these differences in syllable internal structure and section 2.2.2.2 deals with them in word internal structure.

2.2.2.1 Differences in syllable-internal structure

The main properties of child syllables and how they differ from adult syllables have been documented in the literature. Some of these features are the following:

1) Open syllables characterize the child's initial productions. Target codas are often deleted at the onset of speech (Jakobson, 1968; Ingram, 1978; Allen & Hawkins, 1980; Fikkert, 1994; Ota, 2003). As a result, CVC targets become CV and CVCVC targets are produced as CVCV. CVC targets are produced sometimes, but less frequently as CVCV with an epenthetic vowel in final position.

2) Complex onsets and codas in adult targets are often reduced to simple ones (i.e. consonant clusters are reduced to singletons) (Allen & Hawkins, 1980; Ingram, 1986; Fikkert, 1994; Kirk & Demuth, 2003).

3) Diphthongs are also reduced to monophthongs (Bernhardt & Stemberger, 1998; Fikkert, 1994; Ota, 1998, 2003).

The emergence of contrastive vowel length is still a controversial matter in early subsyllabic prosodic structure. Fikkert (1994:134) reports that Dutch children have no control on vowel length at the early stages of word acquisition. She assumes that vowel length distinctions can only be learned when the child has closed syllables. Similarly, Demuth and Fee (1995) report that children acquiring English make no vowel length distinction very early, and this may be due to the variability in duration that signifies a lack of length contrast. Illustrative examples from Dutch and English are given in (2.22) and (2.23).

(2.22) Vowel length in early child Dutch (Fikkert, 1994)

Woef	/vu:f/	[hu:],[hʊ]	(Noortje 1;7.14)
Paard	/pa:rt/	[pɑ],[pa:]	(Tom 1;1.7)
Dat	/dat/	[ta:],[tɑ]	(Tom 1;2.27)

(2.23) Vowel length in English (Demuth & Fee, 1995)

a. girl	[gʊ]; [gu:]	EW (1;4)
b. ball	[bo],[ba], [bo:]	PJ (1;8)
c. baby	[bi:], [bi]	PJ (1;8)

It has been reported that English children control vowel length around the age of 1;6 (Salidis & Johnson, 1997; Kehoe & Stoel-Gammon, 2001), and sometimes earlier depending on analyzing and interpreting tense vowels (e.g. [i], [e]) as phonologically ‘long’ and lax vowels (e.g. [ɪ], [ɛ]) as phonologically ‘short’. There is still a kind of disagreement on the quality of the vowel and the phonological interpretation of the phonetic data. Long and short vowels differ phonetically in duration and tenseness in Dutch, English, and other languages. In fact, there is a difficulty in realizing the phonological vowel contrast in early child language due to the lack of phonetic dimensions (i.e. duration and vowel quality such as tenseness, for example).

2.2.2.1.1 Open and closed syllables: Emergence of coda

The first issue considered in early phonological acquisition is the emergence/development of the rhyming structure or coda acquisition. This issue is related to the occurrence of open and closed syllables in the initial stages of word production. Recent studies (Fikkert, 1994; Demuth, 1995; Grijzenhout & Joppen, 1999; Lleo, 2003, 2006; Lleo & Prinz, 1996, 2001; Rose, 2000) have focused on the early production of codas because they stand at the intersection of universal tendencies and language-particular diversity. Universally, the CV syllable is considered the core syllable or the unmarked syllable in all accounts and codas, by implication, are considered marked. Lack of codas is one of the features marking the child’s early structure in child English, child Dutch, and some other languages. Subsequent research on the acquisition of English supports this claim but demonstrates that consonant-final forms are available at a relatively early age for at least some children (Brannigan, 1976; Ingram, 1976, 1986; Lleo, 2006). This indicates that, as in all aspects of language acquisition, there is a great deal of variation in the syllable shapes used by individual children or according to language differences. Even in languages such as Arabic, Hebrew, and Spanish that allow structures with a rhyming coda early and have a high frequency of the unmarked CVC syllable structure in Semitic languages, children tend to delete codas.

Despite the universality of certain phonological principles, coda acquisition is characterized by individual variation and different appearances in some languages. For example, English and Dutch children tend to omit codas at the initial stage, but the duration of the omission stages varies. From the first attempts, German children produce target codas early and very fast, especially final codas (Grijzenhout & Joppen, 1999; Lleo, 2006). In French, the early stages are characterized by the predominance of monosyllabic CV forms and codas are acquired late, but final codas appear earlier than medial ones (Demuth & Johnson, 2003; 1995; Rose, 2000). It has been proposed that children acquiring French (Demuth & Johnson, 2003; Rose, 2000) and those acquiring English (Demuth, 1995; Goad & Brannen, 2003) produce final consonants before medial codas due to the fact that final consonants are not analyzed as codas, but as onsets of empty syllables, i.e. syllables without nuclei. Freitas (2001) reports that in European Portuguese certain codas, namely fricative obstruents – especially [ʃ], are produced earlier in word final position because of their morphological import (i.e. being used as plural markers in NPs and as verb endings in VPs), whereas liquids appear later because they require branching of the nucleus. For the early stages, Fikkert (1994) states that the emergence of codas requires a certain parameter to be set, i.e. the branching of the rhyme due to their markedness, or according to Optimality Theory, markedness constraints to be demoted, i.e., the coda constraint becomes outranked by faithfulness (Smolensky, 1996). Investigating the acquisition of Dutch, Fikkert (1994) argues that in coda position, obstruents are acquired before sonorants, because sonorants are represented as part of the nucleus. Her claim is based on the relationship found between the presence of a sonorant in the rhyme and the presence of a long vowel or a diphthong, in the sense that sonorants are deleted more often when the target vowel is long than when it is short. In Spanish, codas are acquired relatively late (Macken, 1978; Lleo, 2003, 2006). In Lleo's study (2003) which examines the acquisition of coda by two Spanish monolingual children, Spanish children show considerable variability; some seem to follow a common pattern: they acquire medial codas before final codas, sonorant codas

before obstruent codas, and the codas of functional words at about the same time as those of lexical items.

2.2.2.1.2 Development of syllable structure with complex onset and coda

Another difference between child and adult syllable structure is the simplification or reduction of target complex onsets and codas to simple ones by deleting a member of the consonant cluster (CC) (Ingram, 1978, 1986; Fikkert, 1994; Lleo, 2006). Children acquiring languages with complex onset and coda structures, such as Germanic languages and Romance languages often go through an intermediate stage where singleton codas are preserved, while coda clusters are reduced to singletons. This stage has been documented in Dutch (Fikkert, 1994), English (Gnanadesikan, 1995; Demuth and Fee, 1995; Demuth, 1996; Pater, 1997), Spanish (Macken, 1979; Lleo & Prinz, 1996), and French (Rose, 2000). For instance, Pater (1997) shows that there is an intermediate stage for her subject, Trevor, coming between his initial and final stage of coda acquisition as shown below in (2.24). Rose (2000) also reports similar stages on a longitudinal study of Québécois French as acquired by two children, Clara and Théo. At the initial stage (1;0.28 - 1;9.01), the onset clusters are reduced, whereas at the intermediate stage (1;9.29 - 2;3.05), only stressed clusters are retained. At the final stage (2;3.15) consonant clusters are retained. Both of her subjects pass through a stage at which complex onsets are preserved in stressed syllables, but the same clusters are reduced to singleton in unstressed syllables.

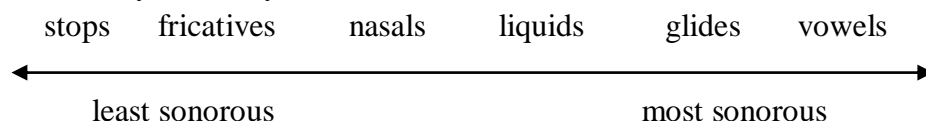
(2.24) Three stages of coda and complex coda acquisition in English (Trevor's data from Pater's (1997))

Singleton Codas			Complex Codas		
a) Initial stage (coda → ∅) (0;10 – 1;4)					
‘duck’	[dæ]	0;10.17	‘plant’	[tæ]	1;3.11 (up to 1;4.2)
‘cup’	[ka]	1;1.0			
‘puppet’	[pʌpə]	1;3.25			
b) Intermediate stage (singleton codas only) (1;5 - 1;7.26)					
‘walk’	[wɔk]	1;6.8	‘box’	[gæk]	1;7.11
‘hat’	[hæt]	1;6.8	‘toast’	[tos]	1;7.20
‘melon’	[memən]	1;7.26	‘milk’	[mɪk]	1;7.26
c) Final stage (all coda retained) (1;9 onwards).					
‘room’	[wu:m]	1;9.2	‘plant’	[pænt]	1;9.2
‘outside’	[saɪd]	1;9.28	‘toast’	[to:st]	1;9.29

2.2.2.1.2.1 Sonority effects in cluster reduction

Two of the proposals offered to explain CC reduction are the ‘sonority pattern,’ and the ‘directionality effect’ proposal. The ‘sonority pattern’ has been reported as a common type of cluster reduction in phonological acquisition. This pattern refers to the tendency for children to reduce both onset or coda clusters to the least sonorous segment of the target cluster. Following the general sonority scale given below in (2.25), an onset cluster such as /tr-/ is typically reduced to [t], rather than [r], while /-nt/ is reduced to [t], rather than [n].

(2.25) Sonority hierarchy (Clement, 1990)



The ‘sonority pattern’ has been well-established in the phonological acquisition literature (Ingram, 1976; Macken, 1979; Pater & Barlow, 2003; Gnanadesikan, 2004). Subsequent researches on the acquisition of other languages such as Dutch (e.g. Fikkert, 1994), German (e.g. Lleo & Prinz, 1996), and Spanish

(Anderson & Smith, 1987; Lleo & Prinz, 1996; Lleo, 2006) have added support to this ‘sonority pattern’ and have shown that it derives from a cross-linguistic preference for syllables that show a maximum rise in sonority from the onset to the nucleus of a syllable.

Considering English, the examples given in (2.24) lend support to the ‘sonority pattern.’ Trevor reduced the target clusters to the least sonorous segment. As to Spanish, there is some evidence to suggest that the sonority pattern is a general pattern in the acquisition of consonant clusters in Spanish as well; at least as far as onset clusters are concerned. For instance, Anderson and Smith (1987), studying of the phonological development of 6 two-year-old children learning Puerto Rican Spanish, report no instances of reduction of onset clusters to the most sonorous segment. They observe that errors on onset clusters are the most common and that the errors generally involve the omission of / l / or / r /.

The directionality effect is another explanation offered for differences in CC reduction, which cannot be explained in terms of the sonority pattern. The direction of CC reduction is predictable in these instances and it can be explained. One explanation for this CC reduction process is directionality, i.e. whether C1 or C2 is more likely to be preserved. This has been observed for Spanish (Lleo & Prinz, 1996). Studying five German-speaking and four Spanish-speaking children’s acquisition of consonant clusters, Lleo & Prinz, (1996) argue that, for the Spanish-speaking children as a group, the most sonorous segment is preserved for a large number of target initial and medial consonant clusters. They suggest that such cluster reduction patterns are based on directionality of syllabification in Spanish, rather than sonority. The directionality effect observed appears relevant for at most two of the four children.

Other asymmetries with respect to heterosyllabic clusters observed and reported are many. In Amahl’s acquisition of English (Smith, 1973), the sonorant is dropped in Amahl’s productions of sonorant + voiceless obstruent clusters (e.g. /-nt-/), while the obstruent is dropped in sonorant + voiced obstruent clusters (e.g. /-nd-/). A similar asymmetry is observed in Macken’s (1979) longitudinal study of one child’s (Si’s) acquisition of a Mexican variety of Spanish, whereby nasal +

voiceless stop clusters were reduced to the stop, while nasal + voiced stop clusters were reduced to the nasal. Pater & Barlow (2003), discussing the cluster productions of a child, Fabiola, notes another CC reduction asymmetry with respect to voicing. She also reduces tautosyllabic clusters following the sonority pattern, but while the sonority pattern is apparent in her productions of some clusters, voicing determines the nature of her productions for other clusters.

To conclude, it appears that the sonority pattern is a cross-linguistic phenomenon. Crosslinguistically, there is a general trend identified in the reduction of syllable-initial and final clusters, whereby the least sonorous segment is retained in the surface form. Despite this general trend observed, certain well-defined exceptions to this pattern have also been noted in few researches. Though there is a range of variation of different patterns reported in some studies of CC acquisition, which might reflect different grammar types, but still the ‘sonority pattern’ types are observed more in many languages.

2.2.2.1.3 Reduction of diphthongs to monophthongs

The reduction of diphthongs to monophthongs is another child-adult difference reported (Bernhardt & Stemberger, 1998; Ota, 1998, 2003). Syllables containing diphthongs are not produced with a target-like structure. They are reduced to monophthongs by deleting the second vowel and lengthening the first vowel. Illustrative examples from Japanese data are the following:

(2.26) Production of target diphthongs in Japanese (Ota, 2003:63)

/nai/	[na:]	‘not here’	(Hiromi 1;2.21)
/daidʒi/	[ta:tʃi]	‘valuable’	(Takeru 1;8.13)
/oide/	[o:de]	‘come’	(Takeru 1;10.2)
/aita/	[a:da]	‘opened’	(Kenta 2;1.4)

To sum up the previous sections, all the above differences mentioned led to observations regarding the development of syllable structure in child phonology. This involves a number of processes, such as coda deletion, syllable structure simplification, and diphthong reduction, employed at various stages of phonological development, which affect the canonical shape of the child’s early

words. These differences also led to arguments about the relationship between the child and adult template and whether they are the same or not and whether early word representations are adult-based or child-based. Given that children's perceptual abilities are in advance of their production skills, and assuming that children generally perceive adult speech accurately, some researchers propose that the child's template is adult-based (Ingram, 1976, 1989; Menn, 1978, Pater, 1997). That is, the child's representation is based on what is identified in perception, not on what is discriminated or analysed. Therefore, others (e.g. Fikkert, 1994; Fee, 1995; Demuth & Fee, 1995 and many others), considering that production tasks, rather than perception tasks, are more effortful and result in better retention, assume that the child has a single representation underlying both perception and production. They do not consider the child's stored representations to be the same as those of the adults, but rather simplified forms in comparison with the adult representation.

These differences between the adult's template and the child's template lead to a mapping procedure between the two. But because the child's grammar at the initial state is simple and more constrained than the adult's, not all the input material can be accommodated into the child's template when the mapping procedure takes place. Therefore, the child's stored form is different from the input received, and his/her own short form may serve as input for the subsequent stages and determine the relation between the adult and child template till the latter is expanded gradually and resembles the former. Consequently, the child employs a selection strategy to select certain elements of the target base that fits into his/her template and repair strategies/phonological rules to avoid violating his own grammar by altering the adult template. The adult phonological units (i.e. segments and/or syllables) that are not 'prosodically licensed,' i.e., not belonging to the higher prosodic structure (Ito, 1986), are subject to deletion. For example, codas will be deleted, onset and coda clusters will be reduced, and initial unstressed syllables will be omitted since the child's grammar does not allow them (see the examples given 2.22 – 2.26).

2.2.2.2 Differences in word-internal structure

The phonological acquisition literature also focuses on child-adult differences related to the word internal structure: the shape of early words and their size restrictions on their production. This section reviews some of the studies dealing with such differences.

Researchers, investigating child English (e.g. Jakobson, 1968; Ingram, 1978; Fikkert, 1994; Demuth & Fee, 1995) have reported the prevalence of CV forms in the initial stages of acquisition and also identified an earlier monosyllabic stage during which children mostly produce monosyllabic forms. Because English is the most widely studied language, much of the literature has made reference to certain characteristics of English acquisition as if they are universal properties, and the dominance of monosyllables in early child English has often been cited as a universal characteristic of the early stages of phonological and lexical development (Ingram, 1978; Ferguson & Farewell, 1975; Vihman, 1991; Vihman et al., 1994; Vihman, 1996; Demuth & Fee, 1995).

Cross-linguistically, this stage has been documented in early stages of word acquisition (Jakobson, 1986; Ingram, 1978; Fikkert, 1994; Demuth & Fee, 1995). Ingram (1978), for instance, presented data from his daughter, Jennika, aged from 1;4 to 2;0. Jennika's most common syllable types during this period are given below:

Table 2.1 Jennika's syllable types (Adapted from Ingram, 1978)

Age	<u>Monosyllables</u>		<u>Disyllables</u>
	CV	CVC	CVCV
1;3	.89%	.11%	.87%
1;6	.14%	.66 %	.47%
2;0	.13 %	.79 %	.36%

At 1;3, Jennika's most common syllable types are CV and CVCV, with CVC forms representing only .11% of all monosyllable forms. At the age of 1;6 - 2;0, CV decreases and CVC increases (.66% & .79%). By the age of 2;0 the proportion of CV monosyllables decreases to only .13%, whereas the proportion of CVCs increases to .79%. CVCV forms decreases to .36% by this same age. The

data demonstrate that very early in phonological development, CV and CV/CV forms represent the majority of early word shapes, but that by the age of 2;0, forms containing final consonants are more common. Similar findings that have been reported by researchers investigating child Dutch (Fikkert, 1994; Levelt, Schilller & Levelt, 2000) and child German (Leopold, 1949; Lleo, 2006; Lleo & Demuth, 1999) advocate the above impression about the monosyllabic stage. Examples from child English and Dutch are given in (2.27) and (2.28).

(2.27) Monosyllabic forms from child Dutch (Fikkert, 1994)

woef	/vu:f/	[hu:],[hʊ]	(Noortje 1;7.14)
paard	/pa:rt/	[pɑ],[pa:]	(Tom 1;1.7)
dat	/dat/	[ta:],[tɑ]	(Tom 1;2.27)

(2.28) Monosyllabic forms from child English (Demuth & Fee, 1995)

a. girl	[gʊ]; [gu:]	EW (1;4)
b. bottle	[ba]	EW (1;4)
c. ball	[bo],[ba], [bo:]	PJ (1;8)
d. baby	[bi:], [bi]	PJ (1;8)

In such cases, one should ask if these children employ an avoidance strategy to avoid disyllabic and multisyllabic targets or this reflects the influence of the target language children are exposed to. It has been suggested that the prevalence of certain syllabic forms may reflect the size and the phonetic structure of the words in the input received. It has also been reported that the prevalence of monosyllables reflect the size of the lexical items in the language to which the child is exposed. In fact, there is cross-linguistic evidence that children do not simply avoid disyllabic and multisyllabic targets, but their monosyllabic productions reflect language-specific phonologies or target word distribution (Vihman 1991; Vihman & McCune, 1994; Ota, 2003; Lleo, 2006; Prieto, 2006). Vihman (1991) compares the early word productions of three languages: English, French, and Japanese. Her findings show that French and Japanese children produce more disyllabic forms than monosyllabic forms, whereas English children produce more monosyllabic forms than disyllabic ones (See Table 2.2). She has also reported that the majority of the words attempted by the children acquiring English are

monosyllabic, whereas for the French and Japanese-speaking children, disyllabic words dominate as targets as shown in Table 2.2. She found that the distribution pattern of children's production is paralleled by the distribution of word size in the actual productions as illustrated in Table 2.2 in comparison with Table 2.3.

Table 2.2 Mean distribution of word length in syllables: Child forms
(Vihman, 1991)

Syllables	English	French	Japanese
Monosyllables	54 %	34 %	24 %
Disyllables	38 %	54 %	61 %
Trisyllables +	9 %	12 %	15 %

Table 2.3 Mean distribution of word length in syllables: Targets (Vihman, 1991)

Syllables	English	French	Japanese
Monosyllables	59 %	25 %	17 %
Disyllables	35 %	68 %	68 %
Trisyllables +	5 %	4 %	14 %

Lleo and Demuth (1999) report similar findings in a study investigating child Spanish and child German. Before 1;8, Spanish children mostly produce disyllabic forms and the majority of adult target words are found to be disyllabic. As to German, they report that 30% to 50% of the German target words are monosyllabic, whereas German children produce a much higher proportion of monosyllabic forms than Spanish children. In another study, Lleo (2006) reports similar results from Spanish and German data of six children: three Spanish monolingual children aged 1;0 to 2;2 and three Spanish-German bilingual of the same age. She has found that disyllables are the most frequent word type attempted by Spanish children (100%) and this coincides with the fact that the majority of Spanish targets are also disyllabic, whereas monosyllables constitute the majority of German children's lexica (60%) and their disyllables come second (50%). As to multisyllabic forms, Spanish children attempt 20% or more, but these amount to

only 10% of the words attempted by German children. Another evidence for the prevalence of disyllabic forms early comes from child Catalan investigated by Prieto (2006). Her data (2006) provide strong support for the idea that early PWs are limited by maximality constraints at different stages. More interesting is that Ota (1998, 2003) has also identified disyllabic productions in child Japanese and provided results supporting the impression of the prevalence of disyllabic forms in the early stages. In his longitudinal study investigating the development of prosodic structure of early words in the production of three Japanese children aged from 1;0 to 2;0, Ota reports that the most frequent production form is the disyllabic one. None of the subjects exhibit a stage dominated by monosyllabic outputs. The size of the targets and child forms produced in the first two months of each of his subjects are given in Table 2.4.

Table 2.4 Percentage of syllables in targets and child forms (Ota, 2003:160)

Child	Age	Adult Targets			Child Forms		
		1	2	3+	1	2	3+
Hiromi	1;0-1;1	2.4	89.6	8.0	2.4	97.6	0.0
Takeru	1;4-1;5	9.1	81.8	9.1	4.5	95.5	0.0
Kenta	1;5-1;6	0.0	100.0	0.0	0.0	100.0	0.0
Aki	1;5-1;6	28.6	71.4	0.0	42.9	57.1	0.0

The findings of previous studies show that children acquiring Germanic languages predominantly produce monosyllabic words more than disyllabic words, whereas children acquiring Romance languages seem to produce very few monosyllabic words and more disyllabic forms. Japanese, belonging to another family of languages, adds more crosslinguistic evidence to the predominance of disyllabic words. This might also indicate the universality of this aspect of child phonology and in particular early word productions, and the influence of the ambient language at the same time. Therefore, language-specific features should be considered for it seems there is a language-specific bias in the input.

To conclude section 2.2.2.2, we say that the existence of a monosyllabic stage or a disyllabic stage at the onset of speech has been controversial and is still open for investigation and discussion. Further investigations are needed in this respect to find out whether early phonological systems restrict the child forms to

monosyllabic/disyllabic forms. The current research aims to contribute and provide more crosslinguistic evidence for the presence or the absence of the monosyllabic stage at the initial stage of word acquisition. The following section will refer to the prosodic word restrictions that constrain the early word shapes and determine their size.

2.2.3 Word size restrictions: Subminimality, minimality, and maximality constraints

Within the Prosodic Theory, there are size restrictions constraining early word productions. It has been proposed that first words should meet the subminimality constraint and obey the minimality and maximality constraints for the production of monosyllabic and bisyllabic forms (Prince, 1980; McCarthy & Prince, 1986, 1990; Demuth & Fee, 1995). McCarthy and Prince (1986, 1990) suggest that since the word dominates the foot in the prosodic hierarchy, the smallest/minimal word will be a single foot. A ‘minimal word’ is a term that refers to a prosodic word which minimally satisfies foot binarity that requires a foot be either bimoraic or disyllabic. Since many languages, including Arabic require trochaic stress feet, the minimal word will be a single foot (moraic trochee) or two moras ($W_{\min} = Ft = [\mu\mu]$). The Minimal Word Hypothesis states:

(2.29) The Minimal Word Hypothesis (MWH) (Demuth & Fee (1995: 2))

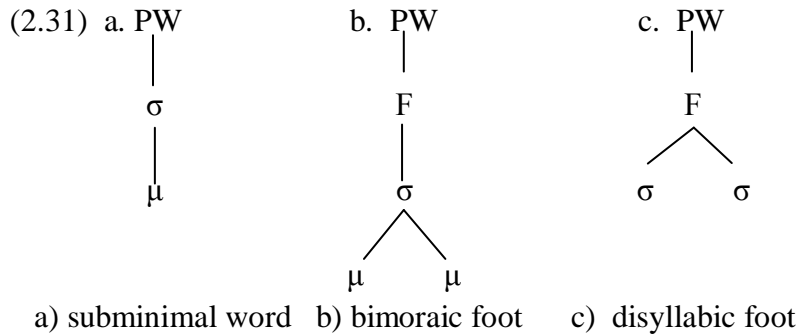
Children’s early words are linguistically well-formed minimal prosodic words or binary feet.

Whereas word minimality requires that a lexical word must be at least bimoraic, word maximality requires that early words be maximally disyllabic as shown below in (2.30).

(2.30) The Maximality Constraint

Children’s early words are maximally disyllabic.

Accordingly, a lexical word must be at least subminimally monomoraic, minimally bimoraic, and maximally disyllabic in early word productions. The following figures exemplify sub-minimal, minimal and maximal structures with foot binarity:



The child's first words are subject to the above prosodic constraints (Demuth, 1995; Demuth & Fee, 1995; Fee, 1995; Lleó & Demuth, 1999; Ota, 1998; Pater, 1997; Lleo, 2006). Accordingly, early word productions should coincide with feet, that is, a PW should not be smaller or greater than a foot. The minimality constraint requires foot binarity in the sense that a PW should not be smaller than a foot. If the maximality constraint is at work, then the PW should not be greater than one single foot. This constraint equates PWs and feet. Because feet can be either disyllabic or monosyllabic, a minimality constraint requiring that the foot (and/or PW) be binary can be satisfied by a disyllable as well as by a monosyllable. In the latter case, monosyllables should have a branching rhyme (i.e. they should have a coda consonant) in order to comply with foot binarity (Fikkert, 1994; Demuth & Fee, 1995). The application of these constraints determines the shape of early words.

The effect of the above constraints on early word production has been documented. For instance, the MWH has received empirical support from the disyllabic word size maximum reported in a number of studies investigating unrelated languages: English (Echols & Newport, 1992; Demuth & Fee, 1995), Dutch (Fikkert, 1994), German (Lleo, 2006); Japanese (Ota, 1998, 2003), Spanish (Demuth, 2001a; Lleo, 2006), and Catalan (Prieto, 2006). However, languages such as French, with few codas and a great number of monosyllabic CV forms constitute exceptions to the minimality requirement stated in the MWH. Demuth & Johnson (2003) and Demuth (2003) report that early PW productions in Parisian French are characterized by few codas and a high frequency of sub-minimal CV truncations. Thus, the violation of the minimality constraint is attributed by a language particular in this respect. Examples illustrating French CV forms resulting

from truncations of CVC words, bisyllabic, and trisyllabic words are given in (2.10).

Lleo (2006) also examines the constraints on Prosodic Word production in Spanish by studying the productions of three monolingual and three Spanish-German bilingual children from the age of 1;0 until 2;2. In order to ascertain the importance of foot binarity in early child speech, she considers syllable structure of monosyllabic words (i.e. the presence or absence of codas). She has reported that though the trochee is the preferred prosodic word shape, few monosyllables, consisting of CVC (or CV) appeared in Spanish-speaking children's productions. At the early stages, the minimality constraint is at times violated by the production of CV forms. Maximality constraints are observed for a very short time, as unfooted syllables appear early in Spanish-speaking children outputs as shown in the data of her monolingual subjects. However, it takes Spanish children several more months to be able to produce prosodic words containing two feet.

Section 2.2.1.3 reviews the evidence offered for foot structure in early phonology. One of these is the disyllabic maximum restriction. At the initial stages, the child's early words are constrained by the binary foot structure. In other words, early words are all single feet; and therefore, in size they are not larger than two syllables. There are a number of possible suggestions provided in the literature for explaining why children's early words are constrained by the structure of a binary foot. Demuth and Fee (1995) propose that units of the prosodic hierarchy are available at the onset of speech, but they are not all accessible at this time. At the initial stage the child has access only up to a certain level, that of feet, but not that of prosodic words. Another proposal contradicting this view is known as the Optimality Theoretic Approach which claims that the prosodic hierarchy is provided innately by UG. It assumes that children have full access to the prosodic hierarchical structure which emerges gradually throughout the acquisition process (Demuth, 1995; Ota, 2003). They assume that the child-specific restriction on

word size derives from markedness constraints that regulate the shape of outputs.¹⁰ Within this approach, there is still an appeal to the same constraint that derives the minimal word effects in adult languages, and that is manifested in the following relevant constraints for the disyllabic maximality effects:

- (2.32) a. ALIGN-Ft-L: The left edge of every foot must be aligned with the left edge of a prosodic word (McCarthy & Prince, 1986, 1990).
b. PARSE- σ : Every syllable must belong to a foot (Prince & Smolensky, 1993).
c. FtBin: Feet must be binary at either the moraic or syllable level (Prince, 1980; McCarthy & Prince, 1986, 1990) (See Prince & Smolensky, 1993 for more information about Optimality Theory).

The following sections will focus on the developmental stages of the prosodic structure of children's early words and children's access to prosodic hierarchy.

2.2.4 Access to prosodic hierarchy and stages of prosodic development

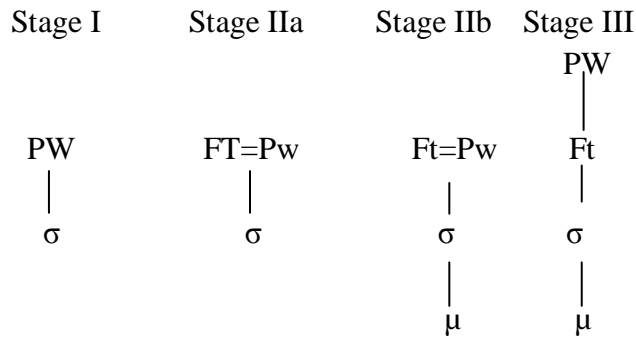
2.2.4.1 Child's access to the prosodic hierarchy

Crosslinguistically, it has been reported that children's early words are constrained by minimality and maximality constraints (see previous section 2.2.3). A number of possible suggestions have been offered to explain why they are constrained by the structure of a binary foot and how the constituents of the prosodic hierarchy become accessible to the child. Demuth (1995) and Demuth and Fee (1995) propose that the units of the prosodic hierarchy are available at the onset of speech, but they are not all accessible at this time. There is a gradual access to the prosodic hierarchy and consequently, the shape of early words changes or develops. At the initial stage, the child has access only up to a certain level, that of the prosodic word and syllables, and gradually he/she would add on

¹⁰ For the role of these markedness constraint in adult prosodic phonology and morphology, see McCarthy & Prince (1994, 1995).

the level of feet and then moras, as shown in the developmental stages given in (2.33).

(2.33) Child's access to the prosodic hierarchy: Developmental stages (Demuth & Fee, 1995: 27)



This model shows how the child gradually has access to the units of the prosodic hierarchical structure. At stage (I) the prosodic word comprises one syllable with no subsyllabic structure; hence, the child's words are all monosyllabic. In Stage IIa, s/he would add on the level of foot. In Stage IIb, the single foot can be either two syllable or two moras (i.e. bimoraic). Thus, all words become disyllabic and monosyllables with a consonant coda or a long vowel. In Stage III all the units of the prosodic hierarchical structure become available and accessible to the child. The prosodic word becomes independent of the foot, allowing words to have more than one foot. It is at this stage that the child starts producing words with two feet. As pointed out by Demuth (1995), the problem with this model is that it advocates a discontinuous account of the child's grammar, but it does not explain why not all the units, which are provided by UG, are accessible in the early stages.

Another proposal contradicting the above model is the Optimality Theoretic Approach which claims that the prosodic hierarchy is provided innately by UG. It assumes that children have full access to the prosodic hierarchical structure which emerges gradually throughout the acquisition process (Demuth, 1995; Ota, 2003). Researchers assume that the child-specific restriction on word size derives from markedness constraints that regulate the shape of outputs. These still show an appeal to the same constraint that derives the minimal word effects in

adult languages, and that is manifested in the relevant constraints for the disyllabic maximality effects given in (2.32).

Based on the theory of parameter setting (Chomsky, 1986; Hyams, 1986) which allows constructing a model of development that assumes identity between the child and the adult systems in the fundamental architecture of the grammar, Fikkert (1994) proposes another model called the parameter-setting model that could be applied to prosodic development. For example, Fikkert (1994), investigating child Dutch, proposes an account for the development of syllable internal structure using the following parameters:

(2.34) Three syllable parameters (Fikkert, 1994:180)

a. Branching rhyme parameter

Rhymes can branch into a nucleus and a coda. [No/Yes]

b. Branching nucleus parameter

Nucleus can be branching [No/Yes]

c. Extrarhymal parameter

A (final) bipositional rhyme can be followed by an extra
consonant. [No/Yes]

The default settings for these parameters are 'No.' She sees development as the setting of the above parameters to the target language values if they differ from the default setting. Dutch sets all three parameters to the marked 'yes' value. Fikkert (1994) finds out that in acquiring this language, the stages of syllable development represent intermediate settings of these parameters.

(2.35) Stages of parameters setting (Fikkert 1994:183)

Stage I: No syllable parameters are set. All have the default value.

Stage II: The branching rhyme parameter (rhymes can branch into a nucleus and a coda) is set to the marked value: [Yes].

Stage III: The branching nucleus parameter (nuclei can branch) is set to the marked value.

Stage IV: The extrarhymal parameter (word-finally syllables can contain an extra position) is set to the marked value.

In Stage I, no complex nuclei or codas are allowed for all parameters have the default value, and the child accordingly only produces CV syllables. In Stage II, closed syllables are allowed because the branching rhyme parameter is set to 'Yes'. In Stage III, nuclei can branch and in stage IV extrarhymal position is allowed. The settings of the branching nucleus parameter and the extrarhymal parameter in the last two stages do not allow a fixed word order. Some children set the branching nucleus parameter first, and then the extrarhymal parameter, whereas others set the two parameters in reverse order. As a result, the Dutch child produces syllables ending in VVC and VCC.

There is great similarity between these models provided by Demuth and Fee (1995) and Fikkert (1994). Both show continuity in acquiring the prosodic structure of early words and that there is gradual access to the prosodic hierarchy, but they do not explain how and when the transition from one stage to another stage takes place. Moreover, there is no indication of any amount of overlap occurring between the stages. In addition, there is a kind of contradiction between the claims of FB and bimoraic minimum principles and the occurrence of CV syllable patterns at the same time, even though this might be explained as exceptions to the minimality constraints due to language specific properties.

Ota (1998, 2003) provides a constraint-based model, Optimality Theory, which is a model of grammatical development that respects continuity. The child is fully equipped with the architecture of the adult-state grammar when s/he starts the task of language acquisition, but with a particular initial-state ranking of constraints. Development is seen as a process of reranking the constraints (markedness and faithfulness constraints) using a mechanism of error-driven constraint demotion (see Ota, 2003 for more information).

The main difference between the parameter setting approach and the constraint-based approach is that parameters are categorically set to one of the values defined by UG. Therefore, a parameter-setting model assumes markedness to show homogenous effects throughout a grammatical system. Recent research in phonological theory, however, shows that markedness is a non-uniform property of human grammar (McCarthy & Prince, 1993), and many of child grammar

properties do not simply disappear in the adult-state but continue to emerge in specific contexts (Gnanadesikan, 1995). For example, the appearance of coda at a certain time in the development can be explained in a parameter-setting model as the setting of the branching rhyme parameter to the marked value.

2.2.4.2 The developmental stages of prosodic word structure

Despite universality of early word properties and the principles governing early word production, there is a wide range of individual differences in this early period which resist coherent formulation in terms of universal phonetic or phonological principles, even across children acquiring a single language. Therefore, it has been suggested that providing general stages of acquisition is a useful way to explain the acquisition process (Ingram, 1976; Ferguson, 1978; Schwartz, 1988; Stoel-Gammon & Dunn, 1985).

The child goes through a number of stages from ‘the initial state’ till the ‘end state’ when they reach the level of adult-like forms. In the phonological acquisition literature, it has been assumed that children’s initial grammars are unmarked, and during the acquisition process, children acquire the marked aspects of their native language over time (Jakobson, 1941/1968; Stampe, 1969; Smith, 1973; Fikkert, 1994). Between the initial state and the final state, there is continuity and children go through various intermediate grammars or stages that capture some but not all of the target grammars’ markedness. The gradual development of syllable and word internal structure has been reported to take place through a number of stages (Fikkert, 1994; Demuth, 1995; Ota, 2003)

Examining the forms of children’s early words from the perspective of developing prosodic structure, researchers focus specifically at the level of syllables, feet and moras (Demuth, 1994, 1995; Fikkert, 1994; Fee 1995; Demuth & Salidis, 2004; Lleo, 2006; Ota, 2003; Prieto, 2006). Demuth (1995:14) captures early word development in terms of the Prosodic Hierarchy and she identifies four stages in the development of prosodic structure for English and Dutch, and suggests that similar stages of development may be found in the acquisition of all languages. These stages are given in Table 2.5.

Table 2.5 Stages of the development of prosodic structure (Demuth, 1995:14)

Stage I	Core syllables - CV (No vowel length distinctions)
Stage II	Minimal Words/Binary Feet a. Core syllables - CVCV b. Closed syllables - CVC c. Vowel length distinctions – CVV
Stage III	Prosodic words - larger than a binary foot
Stage IV	Prosodic words –target form

Similar stages for the development of prosodic structure of Dutch have been identified by Fikkert (1994) who realizes the important role of prosodic categories at the onset of speech. She reports similar stages of early word development and states that

since the child's phonology is word-based, the minimal expansion of the notion word is foot. A foot minimally contains one syllable, which consists of the core syllable at the early stages of acquisition. [The] higher prosodic categories indeed play an important role, in that the child's template is expanded from a core syllable (CV) to a quantity-insensitive binary foot (${}^{\text{f}}\sigma\sigma$) Ft. At the final stage the child's word template can contain more than one foot (Fikkert, 1994: p. 185).

Demuth (1995) has suggested that similar stages of development may be found in the acquisition of all languages. In this current research, I intend to trace and explore the stages of prosodic development of HijAr early words within a representational view/approach, where children might be seen to gradually gain access to different levels of prosodic structure over time. This is to be done through examining and analyzing the early word productions of three age groups during the single word period from 1;0 till 1;9. It is expected that this study subjects would go through similar developmental stages.

2.3 Summary of previous research findings

Regarding the phonological structure and representational nature of early words, the organizational units in the child's phonological system, the child-adult

differences in syllable and word prosodic structures, and the developmental stages of first words, this section provides a summary of previous research findings and these are:

1) There is crosslinguistic evidence for the existence of the prosodic organizational units (i.e. syllable, foot, and mora) in the child's phonological system. Early and recent studies provide evidence for syllable structure, foot structure, and moraic structure in child phonology showing that these prosodic elements are accessible to the child before the age 2;0.

2) Prosodic restrictions on the size and shape of early words have been used as evidence for foot structure.

3) Child-adult differences in syllable and word structure are well-documented in the literature. The main characteristics of child syllable structure have also been identified and considerable accounts have been proposed, but few have tackled the properties of early subsyllabic prosodic structure.

4) Stages of early word structure development have been identified. A monosyllabic stage has been identified in early word productions in some languages such as Germanic languages (e.g. English, Dutch, and German). However, the cross-linguistic generalization of this stage is yet to be confirmed for there is another widely attested stage of maximally disyllabic productions in some other languages such as Romance languages (e.g. Spanish, Catalan) and Japanese. But it is not clear whether this attested monosyllabic stage or disyllabic stage reflects a universal property or a language specific phonology and whether it reflects a grammatical stage in development.

2.4 Research questions

Based on the previous findings, this section provides the fundamental research questions set for this research and these are:

1) Can the characteristics of early words in child Hij Ar be accounted for within the framework of adults' prosodic phonology and can their syllable and word structure be determined by the same representational units and principles found in adult language?

2) Do Hijazi Arabic-speaking children go through the same developmental stages of acquiring syllable structure and word structure reported in the acquisition literature and/or are their early word productions sensitive to their language-specific phonology?

To answer the above questions and to show many aspects of early word acquisition in Hij Ar, i.e. its phonological structure and representations, this study addresses more specific questions and these are:

- A. Does segmental acquisition affect Hijazi Arabic-speaking children's word syllabic structure?
- B. Do Hijazi Arabic-speaking children's early outputs contain the same prosodic organizational units of adults' prosodic phonology?
- C. Are Hijazi Arabic-speaking children's early words subject to the same prosodic constraints, imposed on children's early phonological representations (i.e. the minimality and maximality constraints), that determine their word structure?
- D. Do Hijazi Arabic-speaking children follow universal order in acquiring the syllable structure (i.e. the universal hierarchical structure CV > CVC > CVCC > CCVCC) and word internal structure or are they sensitive to their language-specific phonologies?
- E. Do Hijazi Arabic-speaking children follow universal tendencies and/or employ language specific repair strategies and phonological processes in relating the underlying representations to the surface representations, as those reported in other studies?
- F. Do these children's utterances differ or deviate from those of the adults' and how could these differences in syllable structure, moraic and foot structure be accounted for within prosodic phonology?

These questions are partially based on previous cross-linguistic researches, and this study is an attempt to fill some gaps left by earlier studies, especially in the area of Arabic phonological acquisition. The findings of this study would definitely provide further evidence for all the issues discussed previously, and it would

contribute by adding more data to the field of first language acquisition in general and phonological acquisition in particular.

CHAPTER THREE

Arabic Phonology and its Acquisition

3.0 Introduction

Hijazi Arabic is the language of this investigation and the adult model on which this study is based. The motivation for selecting Arabic as an object of study is that its prosodic structure has been described and documented and its relevance to Prosodic Theory has also been discussed in the literature (Broselow, 1980; Hayes, 1989; McCarthy & Prince, 1986, 1990; Selkirk, 1981; Abu-Mansour, 1990; Jarrah, 1994; Watson, 2002). This provides a firm foundation for acquisition studies. Another motivation is that Arabic (a Semitic language), with its non-concatenative morphological system and distinct stress system, differs from other Indo-European languages that have been studied in previous research in many aspects including prosody. This not only sheds more light on the relation between the Prosodic Theory and early phonology, but it will add more informative data to first language acquisition literature (see also section 1.2).

This chapter describes Arabic phonology and gives an account of its main characteristics in general: its phonemic system and prosodic aspects (syllable structure, moraic structure, and foot structure), and it reviews studies concerned with Arabic phonological acquisition. Examples from some Arabic dialects such as Cairene, San'ani, and HijAr, the variety chosen to be investigated in this research, will be provided within this survey. The prosodic aspects will be discussed in relation to the Prosodic Theory and its main concepts and principles. Section 3.1 focuses on the phonetic system of Arabic. Section 3.2 deals with the prosodic structure of Arabic, focusing on syllable structure, moraic structure, and foot structure. Section 3.3 reviews the studies on Arabic phonological acquisition.

3.1 The phonemic system of Arabic

Arabic is marked by a rich consonantal system and a very limited vocalic system which has three basic vowels /a, i, u/ that are attested in both their short and long forms.

3.1.1 The consonantal system

Hij Ar consonantal system, like that of Semitic languages, “constitutes triads of voiceless, voiced, and emphatic consonants in certain sub-sets of the coronal set” Watson (2002: 2). Table 3.1 provides the consonant inventory for HijAr dialect¹¹. It includes not only plosives, fricatives, nasals, liquids, and glides but also a class of emphatic sounds and guttural consonants, which include the laryngeals /ʔ, h/, the pharyngeals /ʕ, ħ/, and the uvular fricatives /x, ʁ/. The emphatic class of sounds includes /t̤/, /d̤/, /s̤/, /z̤/ which differ physiologically from their non-emphatic counterparts /t, d, s, z/ in the lip being protruded, the tongue being lowered, retracted and its front part being concave.

Table 3.1 The consonant phoneme inventory for Hijazi Arabic

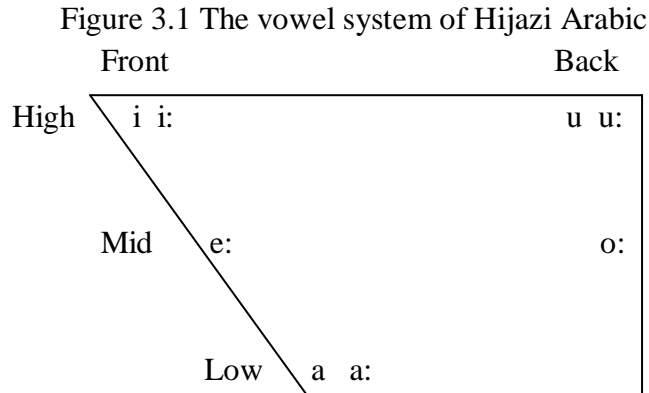
	Labial	Labio-dental	Dental-alveolar	Palatal-(o-alveolar)	Velar	Uvular	Pharyngeal	Laryngeal
Plosive	b		t d		k g	q		ʔ
emphatic			t̤ d̤					
Affricate								
Fricative		f	s z	ʃ ʒ	x ʁ		ʕ ħ	h
emphatic			s̤ z̤					
Nasal	m		n					
Lateral			l					
Trill			r					
Glide	w			j				

It also has the sound /q/ which has a low frequency of occurrence in this dialect. This sound occurs in few words such as *al-qura'an* ‘the holy book’ and *al-qahira* ‘Cairo.’ All the consonants – except /w/ and /j/ can occur with all the vowels in all positions regardless of the degree of frequency of occurrences of each consonant.

¹¹ Modern Arabic dialects have maintained all of Classical Arabic places of articulation except the uvular place, and the palatal place which became marginally present.

3.1.2 The vowel system

The vowel space in Hijazi Arabic and some other dialects like Cairene, for example, consists of three short vowels /a, i, u/, which contrast phonemically with their long counterparts, /a:, i:, u:/¹² and two long mid vowels /e:, o:/ given in Figure 3.1 (Jarrah, 1993, Mousa, 1994; Bakalla, 1981).



The half open central unrounded vowel /ʌ/ occurs as a variant of [a] as in /bʌtt/ ‘duck’. There is no lexical schwa in the vowel space of HijAr. However, there are two types of schwas; the first is epenthetic, introduced by phonological rules to save the sonority hierarchy (e.g. [gabr] > [gabər] ‘tomb’, and [tamar] > [tamər] ‘dates’). Inserting a schwa involves resyllabification of the word. The second type is a phonetic schwa. The last vowel in these words [bagarə] ‘cow’, [ʃadagə] ‘charity’ is perceived and articulated as a schwa. It is phonologically a full vowel serving a morphological function for being a suffix standing for the feminine gender (Mousa, 1994: 79).

Vowels do not occur in initial position, but almost all the vowels are initiated with a ‘hamza’, a glottal stop /ʔ/. Such an initial glottal articulation seems reasonable since all words in Arabic begin with a consonant. It is also observed that the relative durations of the vowels are almost twice as long when in isolation as when they are in speech sequences. The long vowels seem to be twice the length

¹² The short vowels are indicated by harakāt ‘diacritics’ placed above and below the root consonants in the Arabic script.

of the short vowels in either setting. This is probably because these vowels are normally stressed and carefully spoken (Al-Ani, 1970 : 22).

Concerning complex vowels or diphthongs, there are two diphthongs in Arabic: /ai/ and /au/ in Classical Arabic (CA) and Modern Standard Arabic (MSA). These are maintained in some dialects like San'ani in Yemen, whereas in other dialects such as Cairene and HijAr, they were coalesced historically to be realized as /e:/ and /o:/ as illustrated in the examples given in (3.1).

- (3.1) /bait/ → /be:t/ 'house'
 /laun/ → /lo:n/ 'color'

According to the moraic theory, diphthongs, in Arabic, are represented as adjacent melodic units (/a + i/ or /a + u/) linked to adjacent moras and not as diphthongal units (/ai/ or /au/) linked to two moras. This is due to the fact that glides commute with sound consonants in Arabic. Thus, *kayf* 'how' has the trilateral root /k-j-f/ just as *karf* 'type of cactus' which has the trilateral root /k-r-f/. In moraic theory, they are treated as identical to vowel-consonant sequences and there is no structural difference between the sequences –ayf and –arf. Therefore, /y/ of the diphthong needs to be marked as subject to deletion in specific environments, and diphthong shortening is by no means represented as a natural or predictable outcome (Watson, 2002: 55). The moraic representations of the words *ka:f*, *kayf*, and *ħarf* are given below:

- (3.2) $\begin{array}{c} \mu \quad \mu \\ \diagdown \quad \diagup \\ k \quad a: \quad f \end{array}$ $\begin{array}{c} \mu \quad \mu \\ | \quad | \\ k \quad a \quad j \quad f \end{array}$ $\begin{array}{c} \mu \quad \mu \\ | \quad | \\ k \quad a \quad r \quad f \end{array}$
 'the letter 'k'' 'how' 'type of cactus'

3.1.3 Length in Arabic: Vowel and consonant length

Arabic is a language characterized by vowel and consonant length contrast. The distinction between short and long vowel, geminate and non-geminate consonants depends on syllable weight dimensions. These dimensions will be discussed in section 3.2.1.2.

3.1.4 Consonant clustering (CC)

According to Arabic phonotactic constraints, the maximum cluster of consonants allowed is two elements only in a final position, and some sequences of consonants are allowed to occur, whereas others do not occur (e.g. /bf/, /fb/, /fm/). In colloquial dialects such as HijAr, for example, initial CC is allowed, but speakers tend to split them by vowel epenthesis sometimes (e.g. [nla:gi] ~ [nila:gi] ‘we find’). The shape CCV:C is often created by vowel deletion (e.g. /hiba:l/ > [hba:l] ‘ropes’ (Amayreh & Dyson, 1998: 80). In medial position, any two consecutive consonants are considered as abutting consonants. Word internally/medially clusters are syllabified as a coda-onset sequence (e.g. the word *makwa* ‘an iron,’ for instance, is syllabified as [mak/wa], not as *[ma/kwa]). Final clusters in CVCC shape are often simplified by epenthesis to yield CVCVC (e.g. /bint/ > [binit] in Palestinian Arabic and /furn/ > [furun] ‘stove’, /ħabl/ > [ħabil] ‘rope’ in HijAr). A sequence of three consonants is not allowed in Arabic, but across word boundary, such three element cluster may be formed. However, any sequence of such type is always broken by inserting one of the three short vowels. An illustrative example from HijAr is the following:

(3.6) /gult + lak/	[gultalak]	‘I told you (m.)’
/katabt +lik/	[katabtalik]	‘I wrote to you (m.)’

3.2 The prosodic structure of Arabic

This section presents the main features of the prosodic structure of Arabic, focusing on syllable types and structure and other elements in the prosodic word structure such as the notions of mora and foot. It discusses them in light of the concepts of the prosodic theory reviewed in chapter two.

3.2.1 Syllable type and structure

The Arabic syllable structure is relatively simple. The syllable types attested in CA and most of its dialects including HijAr are the following:

(3.7) Syllable types in Arabic

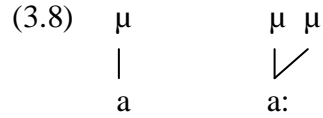
- | | | | |
|---------|------------------|----------|--------------------|
| 1. CV | /g al am/ | ‘pen’ | |
| 2. CVC | /sin/ | ‘tooth’ | |
| 3. CV: | /la:/ | ‘No’, | /ta:lib/ ‘student’ |
| 4. CV:C | /ba:b/ | ‘door,’ | /fusta:n/ ‘dress’ |
| 5. CVCC | /nahr/ | ‘river,’ | /darabt/ ‘I hit’ |

Most of these types occur as monosyllabic words as shown in the above examples. They also occur in multisyllabic words, but no word includes more than one heavy syllable. Some syllables are closed and some are open. The syllable is always initiated with a single consonant which indicates that onsets in Arabic are obligatory, but it is terminated with one of the three elements: zero consonant (CV/CV:), single consonant (CVC), or two consonants (CVCC). Three consonants are not allowed in Arabic in any position. Patterns with CVCCC are very rare and very restricted in occurrence (Watson, 2002; Abu Salim, 1982; Abu-Salim & Abdel-Jawad, 1988).

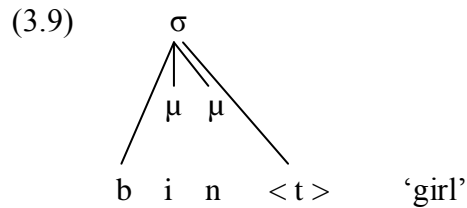
The following language-specific rules about syllabification in HijAr are worth considering. First, no syllable begins with a vowel. In other words, syllable onsets are obligatory. Second, the vowel in CV syllables must be full and the maximum of consonants allowed in the onsets is one, whereas the coda takes two consonants as maximum with the condition that the second consonant is less sonorous than the first.

Syllables can also be classified as light (CV), heavy (CV:, CVC), and ‘superheavy’ syllables (CVCC, CV:C). Heavy syllables generally attract stress to them. Superheavy syllables may also have the patterns CV:CC and CVCCC, but these are very restricted in occurrence (Watson, 2002; Abu Salim, 1982; Abu-Salim & Abdel-Jawad, 1988; Selkirk, 1981; Abu-Mansour, 1990; Jarrah, 1993). For example, these are restricted to the final position in some dialects like San’ani (e.g. /ma: + libist + š/ma: libistš ‘I/you (m.s.) didn’t wear,’ and /ma: + gult + š/ ma: gultš ‘I/you (m.s.) didn’t say’ (Watson, 2002: 58). Final consonants in superheavy syllables are prosodically licensed as extra-syllabic, not as extrametrical. (Watson, 2002: 58).

According to the moraic theory, the above syllable types can also be classified as a monomoraic syllable (CV) with one mora or a bimoraic syllable (V:, and CVC) with two moras. Short vowels are associated with a single mora, while long vowels are associated with two moras as follows:



In some structures such as CVCC (see 3.9), peripheral elements (i.e. the elements at the left or right edge of a stem, or word) may be extrametrical, not participating in the overall prosody of a word¹⁴ or extrasyllabic. Extrasyllabicity implies that one consonant at one edge of the word is licensed as extrasyllabic, as in Arabic word-final consonants of the form CVCC as illustrated by placing the peripheral consonant in angled bracketing as shown in the following example:



Syllables in Arabic dialects are maximally bimoraic (McCarthy & Prince, 1986, 1990; Watson, 2002). There is a strong preference of Arabic dialects for bimoraic syllables and this underlies a number of the phonological processes in Arabic (Watson, 2002: 50). This preference is expressed in terms of the following Bimoraicity Constraint:

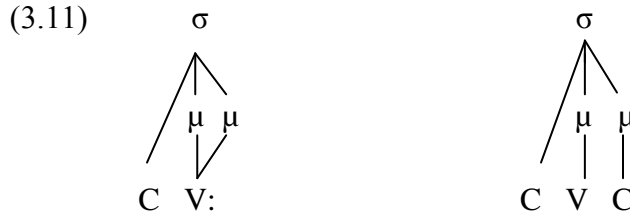
(3.10) Bimoraicity Constraint: (Broselow, 1992: 10)

Syllables are maximally and optimally bimoraic.

In fact, there is no weight distinction between CV: and CVC since both are prosodically heavy in Arabic, but only vowels and geminate consonants are assigned moras lexically. Where syllables are closed with a non-geminate

¹⁴ Extrametricality was first invoked in metrical stress theory to deal with the fact that syllables must contain more segments to act as heavy in final position than in word-internal position.

consonant, the final consonant is assigned a mora through Weight-by-Position, as given below:



3.2.1.1 Syllable type frequency and distribution

Syllable types in Arabic differ in their frequency and distribution. This is partly determined by syllable weight and partly by the application of phonological rules: the lighter the syllable, the most frequent it is and the fewer the constraints on its distribution. Syllable types vary in their frequency. In all Arabic dialects, including HijAr, the most frequent syllable types are CV and CVC syllables for being the most natural and the least marked and there are no constraints of any kind in their distribution in any word position (Abu-Salim, 1982; McCarthy, 1979). The CV-type is more frequent than CVC; therefore, it is the least marked. The less frequent syllable types are CV:C and CVCC structures and their distribution is very restricted to final position in CA (Al-Ani, 1970; Jarrah, 1993)) and most of the dialects such as Cairene (Broselow, 1978; McCarthy, 1979), Palestinian Arabic and Jordanian Arabic (Abu Salim, 1982) and HijAr (Jarrah, 1993; Mousa, 1994). For example, they are restricted to final position in underlying representation in HijAr used in Makka (e.g. na:mat ‘She slept,’ ka.tabt ‘I wrote,’ and mus.ma:r ‘a nail’ (Bakalla, 1979; Abu-Mansour, 1987, 1990). There are some constraints on the distribution of CV: type which is less frequent in final position and more frequent in the others. Abu-Salim and Abdel-Jawad’s study (1988: 3) of syllable patterns in Levantine Arabic spoken in Syria shows that the most frequent syllable is CV syllable (701 occurrences). The second frequent syllable is CVC syllable (652), followed by CV:C syllable (243), CV: syllable (184), and then CVCC syllable (130). The explanation offered for the high frequency of CV syllables and the low frequency of CVCC is that the former is cross-linguistically the most natural or least marked. The application of phonological rules usually determines such low or

high frequency of a syllable pattern. For example, a vowel shortening rule in Levantine Arabic lowers the frequency of the CV: syllables, and a syncope rule increases the frequency of CVC syllables for it deletes short high vowels in unstressed open syllables (Abu-Salim & Abdel-Jawad, 1988: 4) as shown in the following example:

- (3.12) a. ʃirib ‘He drank.’
 b. ʃirb-at ‘She drank.’

Epenthesis is another rule that lowers the frequency of CVCC, and consequently, increases the relative frequency of CV:C syllables in Levantine Arabic. The complex coda of a CVCC syllable is split up by an epenthetic vowel as shown in the following example:

- (3.13) a. jisir ‘bridge’
 b. jisir-na ‘our bridges’
 c. jisr-'een ‘two bridges’

The application of this rule increases the frequency of both CV and CVC syllables and decreases the frequency of CVCC syllable (Abu-Salim & Abdel-Jawad, 1988: 5-6).

In HijAr, epenthesis also plays a role in lowering the frequency of CV:C and CVCC. Abu-Mansour (1991) dealt with the epenthesis rule in relation to syllable structure in HijAr. She shows that the medial or general epenthesis rule operates in cases in which CVCC and CVVC syllables occur in non-final position before consonant-initial suffixes (Abu-Mansour, 1991:138). The following examples illustrate this:

- (3.14) a. ka.tab.t[**a**].ha ‘I wrote it (f)’
 b. ki.taa.b[**a**].ha ‘her book’
 c. ka.tab.t[**a**].kum ‘I wrote to you (pl)’

The epenthetic vowels here create a new syllable with which the stranded consonant syllabifies as an onset as shown below:

- (3.15) katab-t-l-kum → ka.tab.t'.l'.kum Syllabification
 ka.tab.ta.l.kum Epenthesis
 ‘I wrote to you (pl).’

Thus, epenthesis not only lowers the relative frequency of CVCC syllable, but also raises that of the other lighter syllables such as CV and CVC (Abu-Mansour, 1991: 140).

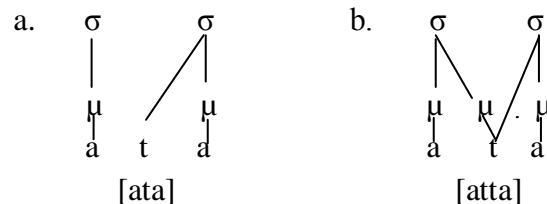
3.2.1.2 Syllable weight

Gemination and vowel length contrast are two main features characterizing Arabic. The distinction between short and long vowel, geminate and non-geminate consonants depends on syllable weight dimensions. Sources of syllable weight are the following:

- a) Short vowels contribute one mora and long vowels two moras (universal).
- b) Geminate consonants contribute one mora (universal).
- c) Weight-by-Position: a ‘coda’ consonant is assigned a mora in the course of syllabification (Watson, 2002: 54).

Long consonants are distinguished from short consonants as underlyingly monomoraic versus underlying non-moraic. The following hypothetical forms where (a) is derived from (b) illustrate the preceding statement.

(3.16) Single consonant vs. geminate



Since single consonants are underlyingly weightless, they must be assigned a mora when they occupy the coda of a heavy syllable. This could be achieved by the Weight-by-Position condition which assigns a mora to a coda consonant in languages for which CVC syllables are prosodically heavy. This condition is restricted to a single application, ensuring that syllables in general will respect a bimoraic limit (Watson, 2002: 54).

3.2.1.3 Stress and its role in Arabic prosodic structure

Another aspect of Arabic prosody is stress. Arabic is a language with word stress. This means that one of the syllables in a content word is perceived as

prominent and receives main stress. On the lexical level, word stress is predictable and not phonemic (Al-Ani, 1970; Watson, 2002). In Semitic languages such as Arabic, stress is sensitive to syllable weight. That is to say that stress is assigned to particular syllables depending on whether they are light or heavy. Onsets are irrelevant to syllable weight for they attach directly to the syllable node and have no bearing on moraic structure (Davenport & Hannahs (1998:148-9)).

Traditionally, it has been widely acknowledged that the item prominence in Arabic is determined by its syllable pattern and syllable weight, regardless of whether affixes are included or excluded. The rules for prominence placement are as follows:

- 1) The final syllable is stressed if it is CV:C or CVCC (e.g. /ki'ta:b/ 'book,' /ka'tab/ 'you wrote').
- 2) Otherwise the penultimate syllable is stressed if it is CV: or CVC (or if the word is disyllabic) (e.g. /maktaba/ 'library,' /kallamak/ 'He spoke to you.').
- 3) Otherwise stress the antepenultimate (the left most light syllable) (e.g. /'bagarati/ 'my cow,' and /'katabu/ 'they wrote').

A basic observation is that the penultimate syllable is stressed if it is bimoraic, otherwise stress falls on the antepenultimate syllable. The above rules apply in a more general way if we take into account the underlying representation (McCarthy & Prince, 1990; Bakalla, 1979; Jarrah, 1993).

3.2.2 Other aspects of Arabic prosody

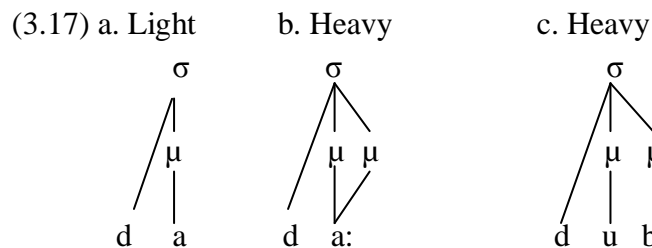
McCarthy and Prince (1986, 1990) developed an approach to the shape-invariant morphology of Arabic. This approach is founded in the phonology of prosody and it is called Prosodic Morphology. The Prosodic Morphology Hypothesis asserts that "templates are defined in terms of the authentic units of prosody: the mora, the syllable, the foot, and the phonological word" (McCarthy & Prince, 1990: 3). Thus, Prosodic templates are connected with other aspects of prosody particularly moraic structure, foot structure, and minimality as well. The following sections provide evidence for the importance of the notion of mora in

Arabic and discuss the notion of foot and the minimality aspect of prosodic words in Arabic.

3.2.2.1 Notion of mora

In Semitic languages such as Arabic, the mora plays a role in representing the contrast between short and long vowels and between singleton consonants and geminates and in determining syllable weight (McCarthy & Prince, 1986; Hayes, 1989) (see section 3.2.1.2 and 3.2.1.3). Evidence for the importance of this notion and its existence in Arabic can be found in prosodic morphology, syllable size restrictions, and stress.

The first evidence comes from the Arabic stress system given in section 3.2.1.3. A basic observation in this system is that the penultimate syllable is stressed if it is bimoraic, otherwise stress falls on the antepenultimate. The second evidence comes from syllable size restrictions. As mentioned earlier in section 3.1.2.1, syllable types, according to the moraic theory, can be classified into a light monomoraic syllable (CV) with one mora or heavy bimoraic syllable (CV:, CVC) with two moras. The representations of these types are as follows:



Short vowels are associated with a single mora, while long vowels are associated with two moras. In Arabic, a language with (Weight-by-Position), the contrast between syllables is captured by the projection of a mora by the coda consonant (c), the long vowel (b), or the lack of it thereof (a) for onset consonants never project moras.

Syllables in Arabic dialects are maximally bimoraic and there is a strong preference for bimoraic syllables (McCarthy & Prince, 1986, 1990; Watson, 2002). This is expressed in terms of the Bimoraicity Constraint (see (3.10)) proposed by Broselow (1992) who argues that this strong preference for bimoraic syllables

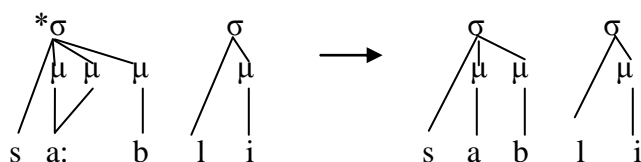
underlies a number of phonological processes in Arabic, including closed vowel shortening and epenthesis.

Arabic has syllable size restrictions that provide evidence for moraic structure. There is an upper limit of two moras per syllable in Arabic; that is to say that syllables in Arabic are bimoraic (McCarthy & Prince (1990). Arabic shows contrasts in vowel and consonant length (see section 3.1.3), but it does not show three way length contrasts: *la:a, *hamm/ma. Furthermore, a syllable with a long vowel cannot be closed by a geminate in native words (e.g. *bi:ssa ‘cat’). Arabic also does not allow a cluster of three consonants.

The markedness of trimoraic or superheavy syllables is one of the properties of moraic theory. In adult phonology, there is a tendency to resort to some phonological processes such as closed syllable vowel shortening or epenthesis to avoid trimoraic syllables. The underlying long vowel shortens in a closed syllable to create a space for a moraic coda. Examples from HijAr illustrate this process and the alternation in vowel length found in hollow verbs in Arabic in (3.18).

(3.18) Hijazi Arabic (Madina Arabic) (Jarrah, 1993:145)

sa:b + u	→	sa:bu	‘He left it/him.’
sa:b + li	→	sabli	‘He left for me.’

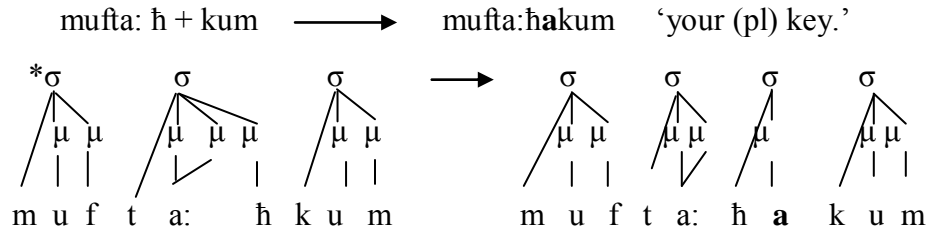


This vowel shortening rule applied in closed syllables has an interpretation in moraic terms. There is a clear distinction between light monomoraic syllables and heavy bimoraic syllables.

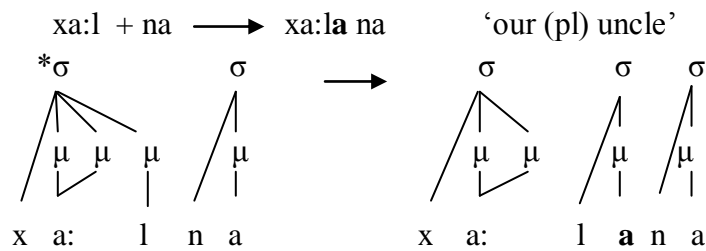
HijAr may take another option sometimes which is epenthesis of a vowel instead of shortening the vowel before an unsyllabifiable consonant as shown in the following examples (see Abu-Mansour, 1987 and Jarrah, 1993 for more examples):

(3.19) Examples of vowel epenthesis in Hijazi Arabic

a. Hijazi Arabic (Makkan dialect) (Abu-Mansour, 1987: 163-4)



b. Hijazi Arabic (Madina dialect) (Jarrah, 1993:119)



These examples from prosodic morphology given in (3.18) and (3.19) can be unified under the hypothesis that there is an upper limit of two moras per syllable. When the morphology concatenates a CV:C syllable to a consonant-initial morpheme within the phonological phrase, the long vowel is shortened to avoid trimoraic syllable as shown in the above example and to satisfy the bimoraicity constraint (see McCarthy & Prince, 1986, 1990 for more evidence on moraic structure from Arabic prosodic morphology¹⁵).

Another phonological process that provides evidence for the mora in Arabic is CL phenomenon, in which the deletion of a syllable-final consonant is compensated for by lengthening of the preceding vowel. This process is quite

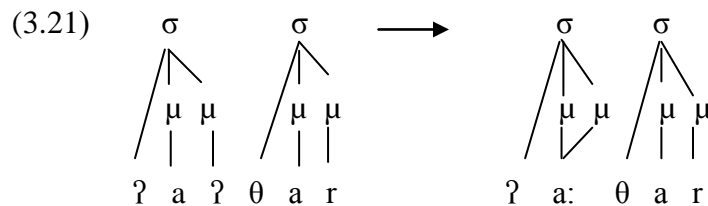
¹⁵ McCarthy and Prince (1990:7) provide evidence from the classical Arabic system of versification in which there is a fundamental distinction between two kinds of sequences: (1) the cord (*sabab*) which consists of any syllable, light or heavy, and (2) the peg (*watad*) (i.e. the iambic foot) that is composed of a sequence of a light syllable followed by a heavy one. It is a syllable with one mora followed by a syllable with two moras (with the moraic equivalence of the heavy CVC and CV: syllables). This stands as an instance of mora counting.

common in Arabic and it shows up obviously in the derivation of (ʔafʔala) from roots whose first consonant is /ʔ/ as shown in the example given below.

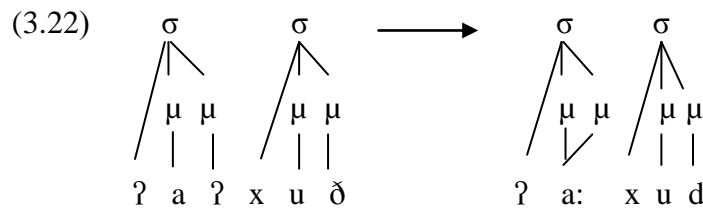
(3.20) An Example of CL in Arabic (McCarthy & Prince (1990:10))

- a. Underlying ʔaʔθar (he root /ʔθr/ ‘prefer’)
 Derived ʔaaθar

In moraic terms, CL is a process in which moraic conservation takes place, i.e. the moras remain the same but the segments associated with them change as shown in the following figure in (3.21).



A similar example of CL from HijAr is the word [ʔa:xud] derived from /ʔaʔxuð/, of which the root is /xuð/ ‘take.’

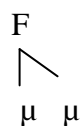


Deletion of the glottal stop /ʔ/ leaves a mora stranded in both examples; then this mora is compensated by spreading of the vowel.

3.2.2.2 Notion of foot

The typology of metrical stress feet introduced by Hayes (1985) and McCarthy and Prince (1986) identifies a stress pattern that is derived by a foot called the moraic or quantitative trochee which contains two moras and is stressed on the left as follows:

(3.23) Quantitative trochee



The fundamental foot-types are distinguished on the basis of the quantitative relation between the two members of a syllable. In quantity-insensitive systems, feet are trochaic in labelling, whereas in quantity sensitive systems, heavy syllables are always foot-final and, and the asymmetrical foot must therefore be quantitatively iambic (Hayes, 1989). Accordingly, the possible foot types identified by Hayes (1987, 1995) are three: iambic, trochaic, and syllabic as shown below where (L) stands for light and (H) for heavy.

(3.24) Foot Types

Iambic (WS)	Trochaic (SW)	Syllabic
LH	H, LL	σσ
LL, H		

Iambs can be either disyllabic or bimoraic. Moraic trochees are always bimoraic. Syllabic trochees are disyllabic regardless of the moraic internal structure of the syllables, and hence ‘quantity insensitive.’ All foot types share a general restriction called Foot Binarity by which every foot must be bimoraic or disyllabic. In languages such as Arabic distinguishing light and heavy syllables, the feet predicted are: [σμ μ] and [σμ σμ]. Examples illustrating foot types of nouns in Arabic are given in (3.25).

(3.25) Foot types in Arabic nouns

Iamb	Syllabic trochee	Moraic trochee
CVCV:(C)	CVCV(C)	CVC(C)
wali:d	samar	ward
ħabi:b	ʕumar	kalb
madʒi:d	ħasan	ʃams

Evidence for bimoraicity of feet can be found in various types of prosodic morphology. The process of nick-naming/hypocoristic formation serves as an example in this respect (Davis & Zawaydeh, 1999, 2001; Farwaneh, 2007). Hypocoristics are shorter versions that can be used of personal names, for instance, to express affection. This broadly attested process in the world’s languages is the result of mapping a name onto a minimal word template, bimoraic or disyllabic, depending in the usual way on the prosody of the language. This process in Arabic has been analyzed by Farwaneh (2007) as an output-to-output process which takes

as its input prosodically circumscribed base, a full word, or a part thereof, and not a consonantal root, underlying or surface (see examples given below in (3.26) and (3.27d). The base to hypocoristic forms is specified as a minimal word, a disyllabic or bimoraic foot (an iamb, a syllabic or moraic trochee). Most nouns and adjectives in this process conform to a member of the foot inventory given in (3.25).

Given the crosslinguistic generalization that templates in prosodic morphological operations are defined in terms of units in the prosodic hierarchy and the base of hypocoristic formation is defined as a trochaic (syllabic or moraic) or iamb foot, the output forms should be seen as forming a bimoraic/disyllabic foot. In Arabic, the most common template of the hypocoristic form is faʃʃu:l (CvCCv:C) (see examples in (3.26)).

(3.26) Arabic hypocoristic forms

Form	Hypocoristic forms	Gloss
kha:lid	khallu:d	‘eternal’
ħabi:b	ħabbu:b	‘beloved’
ħana:n	ħannu:n	‘tenderness’

The first condition from this template concerns the size of stems and syllables. This template sets an upper and lower bound of two syllables per stem and two moras per syllable. The literature on Arabic morphology and phonology has already shown that this binarity is observable in Arabic stems and syllables in general and not limited to hypocoristics (McCarthy & Prince, 1986, 1990; Ito, 1989, Broselow, 1992). It has been observed that foot structure in the verbal and nominal systems is congruent: verbal stems are always trochaic while nouns show tendency toward iambicity.

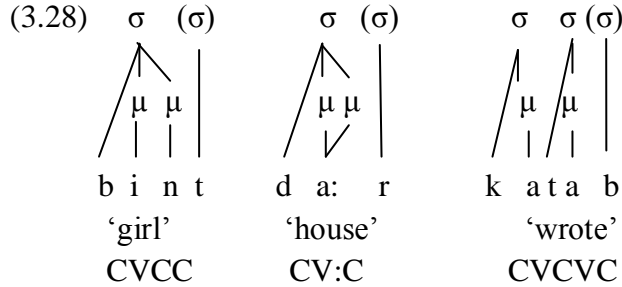
This is also supported by other morphological operations such as Arabic broken plural formation, reduplication, hypocoristics resulting from reduplicated forms, and compound clipping/truncated forms. The stems and their derived output forms contain a disyllabic or bimoraic foot. Illustrative examples are the following:

- (3.27) a. Broken plurals
 dʒabal → dʒi'ba:l ‘mountains’
 galam → ʔag'la:m ‘pens’
- b. Derived Nouns
 katab → ki'ta:b ‘book’
 xaradʒ → xu'ru:dʒ ‘exist’
- c. Hypocoristics: truncated proper names
 Abdulmadʒi:d → madʒi:d
 Abdulʔazi:z → ʔazi:z
 Suza:n → za:n/za:na
- d. Reduplicated forms (total and partial reduplication)
 za:h → 'zaḥzaḥ ‘moved’
 gaṣ → 'gaṣgaṣ ‘cut’
 ʃaraḥ → 'ʃarʃaḥ ‘criticized’
- e. Hypocoristics resulting from reduplicated forms (Farwaneh, 2007: 36)
 faraḥ → 'farfaḥ → farru:h
 lahab → 'lahlab → lahu:b

According to the foot typology given, these examples show a system of bimoraic feet that is either a trochaic or left-headed or an iamb or right-headed. In (3.27e) the template for the hypocoristic forms can be characterized fully prosodically as bimoraic/disyllabic foot or a minimal word. The segments making up a name are mapped onto some expansion of this template, usually from left to right, to obtain the hypocoristic form.

3.2.2.3 Prosodic words: The minimality concept

In the prosodic hierarchy, the word dominates the foot; accordingly, the smallest word will be a single foot. The Prosodic Hierarchy and FB, taken together, derive the notion “Minimal Word” (Broselow, 1982, McCarthy & Prince, 1986,1990). Since every foot must be bimoraic or disyllabic, it is predicted that the minimal prosodic word must contain at least a foot with two moras or syllables. Thus, the word that meets this criterion is called a minimal word. Arabic requires quantitative trochaic stress feet; therefore, the minimal stem or word will be a single foot of this type, or two moras in a single heavy syllable or distributed between two light syllables. Examples of minimal stems are the following:



The final consonants at the edge of these words in (3.28) are licensed as extrasyllabic. Counterexamples to the minimal stem requirement are found in Arabic, but they constitute a very small class of monomoraic words such as those given in (3.29):

(3.29) Monomoraic Words (McCarthy & Prince (1990: 18))

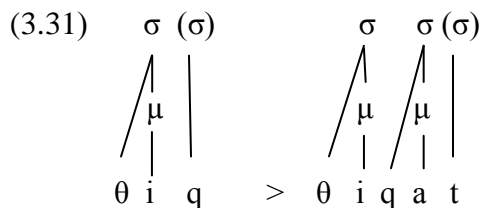
Non-words	Bilaterals	Imperatives
wa ‘and’	?ab ‘father’	li (imperative ‘near’)
qad ‘past’	bin ‘son’	daʕ (imperative ‘leave’)
bi ‘in/with’		ktub (imperative ‘write’)

McCarthy and Prince (1990) provide a number of arguments supporting the bimoraic minimal stem in Arabic. First, some roots with the initial consonant *w* lose this *w* in the case of *masdar* “nominalization” via a partly phonological rule as shown in (3.30).

(3.30)

Perfective	Masdar	Gloss (McCarthy & Prince, 1990:20)
waθiq	θiq+at	‘rely’
wazan	zin+at	‘weigh’
wasiʕ	saʕ+at	‘be wide’

These *masdar* forms/nominalised forms in Arabic require the feminine suffix {-at} and this can be explained by the bimoraic minimum. With the loss of the root-initial *w*, a form like *θiq* becomes too small, since it contains only a single mora. Addition of the feminine suffix augments it to make it bimoraic as illustrated below.



Here the feminine suffix compensates for the loss of the first radical by the bimoraic minimal stem requirement.

Second, the treatment of borrowed words can be another evidence supporting the bimoraic minimal word. A few examples are given in (3.32):

(3.32) Source	Arabicized form (McCarthy & Prince, 1990:21)
bar	baar
gaz	gaaz
shawl	ʃaal

Borrowed words that are monomoraic are made bimoraic in MSA by lengthening the vowel. Here word minimality is satisfied by applying this phonological rule. Broselow (1982) also observes that borrowed words from English into Palestinian Arabic would be bimoraic (e.g. bus > baas). Third, truncated hypocoristics or vocatives demonstrate a two-mora minimality requirement and can be used as evidence, too. Cross-linguistically, truncated hypocoristics (nicknames) are often based on the minimal word or the foot (McCarthy & Prince 1986, 1990). Examples of such forms appear in (3.33):

(3.33) a. CVVCVC nouns (McCarthy & Prince, 1990:22)	
maazin	maazi
maalik	maali
b. CVCVVC nouns	
suʃaad	suʃaa
majiid	majii

Ito (1990) has pointed out that the application of any morphological operation to a lexical word makes the output subject to a bimoraic minimality condition. Thus, no operations can truncate a word to a form smaller than two moras.

Table 3.2 ends up this section providing the most common prosodic word types in HijAr. These include mono-, bi-, and multisyllabic words consisting of more than one syllable.

Table 3.2 Prosodic word types in Hijazi Arabic

Prosodic word type	Examples
Monosyllables S (CV)	wa/wi ‘and,’ da ‘this’
Monosyllables S (CVC)	dub ‘teddy bear,’ xud ‘take,’
Bisyllabic SW (trochees)	'walad ‘boy,’ 'kursi ‘chair’
Bisyllabic WS (iambs)	fus'ta:n ‘dress,’ hu'sa:n ‘horse’
Trisyllabic WSW (iambs)	bal'lo:na ‘balloon,’ saj'ja:ra ‘car’
Trisyllabic WWS	tili'fo:n ‘telephone,’ banta'lo:n ‘trousers’
Trisyllabic SWW	'bagara ‘cow,’ 'samaka ‘fish’
Multisyllabic (other)	maka'ro:na ‘macaroni,’ fuka'la:ta ‘chocolate’

After reviewing the aspects of Arabic adult phonology, I will end up this chapter by some predictions for early word acquisition in Arabic:

(1) Given the various syllable structures in Arabic, the high frequency of some structures (e.g. CVC) for being the least marked, and the less frequent superheavy syllables (CV:C, CVCC) with their restricted occurrence, I predict that the latter are of late acquisition and that there is a prevalence of monosyllabic forms of CVC structure in the children’s outputs at the initial stage.

(2) Given the evidence for the mora and foot notions in adult phonology, it is expected that child phonology has the same organizational prosodic units.

(3) It is also predicted that early words in Arabic will demonstrate FB and will abide by the Bimoraicity Constraint since Arabic dialects are bimoraic varieties.

(4) Since Arabic dialects exhibit trochaic word-stress systems, I predict that children’s early outputs will exhibit bimoraic structures or disyllabic trochaic forms.

(5) It is also predicted that Arabic-speaking children may demonstrate early sensitivity to word-minimality effects and maximality effects too. This is to say,

children's productions might consist of minimal forms at the early stages and words of maximal structure at later stages.

(6) Given the fact that stress in Arabic is sensitive to syllable weight i.e. heavy syllables generally attract stress, I predict that stress may play a great role in guiding children in acquiring their early words and in selecting salient syllables.

(7) Children are expected to employ similar phonological processes (e.g. V-epenthesis, compensatory lengthening, CC-reduction) that may help in shaping their early productions.

3.3 Previous research on Arabic phonological acquisition

Scarcity of research in the area of phonological acquisition in Arabic is remarkable during the 1970s and the 1980s. The difficulty in collecting data from children, the difficulty and the accuracy needed in transcribing it, and the difficulty in interpreting the children's early stages of sound production are some reasons for such scarcity. This area received more attention in the last decade. Few studies have tackled phonological acquisition in Arabic and in particular its relation to phonological theory. Some of these studies are concerned with normal phonological development (Omar, 1973; Bakalla, 1975; Ammar, 1992; Shahin, 1995; Amayreh, 1994; Amayreh & Dyson, 1998, 2000; Salim, 2003) whereas some deal with disordered phonological development (Ammar, 1992; Morsi, 2001). Some deal with phonological acquisition in a monolingual context (Omar, 1973; Ammar, 1992; Amayreh, 1994; Amayreh & Dyson, 1998, 2000) and very few deal with it in a bilingual one (Khattab, 2001).

The study of normal phonological acquisition of Arabic, and specifically Egyptian Arabic, started early in the 1970s, but it has expanded in recent years to include other dialects such as Palestinian, Jordanian, Lebanese, and Hijazi Arabic, etc. Research has mainly focused on issues related to the segmental structure. More concern has been largely devoted to the "phonetics of acquisition." Most of the early studies are concerned with the phonemic inventories, the phonological errors, and the stages of phonological development (Omar, 1973; Bakalla, 1975; Amayreh & Dyson, 1998, 2000; Ammar, 1992; Morsi, 2001) (see Table 3.3 for the

results of the order of acquisition of phonemes in Omar's study (1973)). Bakalla (1975), in an attempt to describe the phonological system internalized by his niece, a two-year old Saudi child speaking Hijazi Arabic, gives an account of her segmental phonology by providing her phonemic inventories at the age of 1;6 and 1;10. This study yields similar results to those of Omar's (1973). Some consonants are acquired earlier by his subject (e.g. the bilabials /b, m, w/, the alveolars /t, d, n, l, r, s/, the labiodental /f/, the pharyngeals /ħ, ʕ/, the palatal /j/, the velars /k, g, x/, the glottals /h, ʔ/), but some sounds like the emphatic sounds /t̤, d̤, s̤, z̤/, for instance, do not appear in the child's phonemic inventory. Similarly, Omar (1973) reports that these sounds are acquired very late, at the age of 3;6.

Table 3.3 Order of acquisition of Egyptian Arabic phonemes (Omar, 1973)

Stage	Age	Acquired Phonemes	
		<u>Consonants</u>	<u>Vowels</u>
Stage I	1;5	/b, m, w, j, ʔ, h/	/a, i, u/
	2;0	/t, d, s, z, n, k/	/æ/
	2;3	/f, l, x, g/	/e, o/
Stage II	2;6	/ʁ/	
	3;0	/ħ/	
	3;6	/s̤, z̤/	
	3;6 – 4;0	/t̤, d̤, l̤/	
	4;0	/dʒ/	
	4;6	/ʃ/	
Stage III	5;0	/r/	
	6;6	/q/	
		<u>Combinations</u>	
1;5-5;0		Consonant clusters	
3;0		Diphthongs	

Both Ammar (1992) and Morsi (2001) investigate normal phonological acquisition as well as phonological disorders for the sake of comparison. Ammar (1992), studying sixteen Egyptian children with typical phonological development

between the age of 4;1 and 4;10 and Morsi (2001) investigating the speech of thirty Egyptian children who were equally divided into three stages: 2;6-3;0 years, 3;0-4;0 years and 4;0-5;0 years, report their phonemic inventory. Ammar (1992) provides a phonetic list that included /p, b, m, w, f, t, d, t̤, d̤, n, s, z, s̤, z̤, l, r, j, k, g, ʃ, q, x, ʕ, h, ʔ, h/. The phonemic inventory of these typically developing children shows that 14 phonemes (of the 27 Colloquial Egyptian Arabic (CEA) consonants) are mastered and the other 13 were in the range of ‘customary production.’ Voicing is one factor that affects the error percentages of some phonemes. Morsi’s (2001) results show that in Stage I (2;6-3;0), all consonants are acquired except /r, d̤, s̤, z̤, z, ʃ, ʔ/. In Stage II (3;0-4;0), /d̤, z̤, z, ʔ/ remain un-acquired. In Stage III (4;0-5;0), only /z̤, z/ remain un-acquired. It is noticeable the emphatic sounds are of later development for all subjects have acquired these sounds after the age of 4;0. This coincides with Omar’s (1973) findings given in Table 3.3.

Amayreh and Dyson (1998) also focus on the segmental aspect of acquisition. Investigating the speech samples of 180 normally developing Jordanian children aged 2;0- 6;4, (ten boys and ten girls), they have conducted a research to study the acquisition of consonants in Jordanian Arabic and to determine their development through the ages of ‘customary, production, and mastery’ for each phoneme, and their accuracy within sound classes and how they vary by position. Concerning the sound inventory acquired, their research yields similar results to those of Omar’s study. The findings also show that medial consonants are significantly more accurate than initial and final consonants. The ages of ‘customary production, acquisition, and mastery’ of most Arabic consonants have been found to be similar to those of English, but with a few exceptions: the consonants /f, t, l/ are acquired earlier in Arabic than in English, while /dʒ, ð/ are acquired later in Arabic than in English.

In another research, Amayreh and Dyson (2000) collected data from 13 children speaking Jordanian Arabic between the ages of 14 – 24 months to describe the characteristics of the phonetic inventory of Arabic and to show the influence of the ambient language on the sounds produced by young children and to provide a support for language universals. They have analyzed the data to determine the

consonant inventory of these children in four different positions: SIWI (syllable initial word initial), SIWW (syllable initial within word), SFWW (syllable final within word), and SFWF (syllable final word final), the frequencies of occurrence and rank order of consonants and vowels in the samples. Their findings show that the most frequently occurring consonants include four stops, produced at three places of articulation – bilabial, dental-alveolar and glottal, one fricative [h], both nasals [m, n], the lateral [l], and both glides [w, j]. Emphatic sounds are not observed in any position in their data. Concerning the percentage of occurrence of consonants in each manner of articulation, the results show that 50% of them are stops, (16.9 %) fricatives, (12.5%) glides, (11.6%) nasals, (7.6 %) liquids, and (18%) affricates. In spite of the individual differences, only three consonants occur in every child's composite inventory: [b, d, j]. An additional four consonants occur in at least ten out of 13 inventories: [t, ʔ, m, w]. Six further consonants: [ʃ, h, n, l, ʕ, ʕ] are used by at least five children. Also in the SIWI position, the nine consonants include four stops in three places of articulation, [b, d, t, ʔ]; one fricative, [h]; one nasal [m]; the two glides [w, j] and the lateral [l]. The eight SIWW consonants include stops at two places of articulation, [b, d, t]; no fricatives except the transitional [h]; both nasals, both glides and the lateral. In SFWF, two stops in two places of articulation, [t] and [ʔ], are seen; one fricative [h]; the two nasals, and the palatal glide [j]. In SFWW, the smallest set of consonants occur: stops at two places of articulation, [b] and [t]; one nasal [m]; and the lateral [l].

Researchers have also investigated child-adult differences by pointing the error patterns and the phonological strategies employed such as substitution, deletion, and assimilation (Ammar, 1992; Morsi, 2001; Amayreh & Dyson, 1998; Dyson & Amayreh, 2000). A number of phonological processes have been identified and categorized as universal or unique to Arabic. These processes are sibilant fronting, devoicing, velar fronting, di- and polysyllabic word simplification, cluster simplification, /r/ deviation and de-emphasization (Ammar, 1992, Morsi, 2001). The latter two processes are found to be unique to Arabic. Ammar introduces the process of de-emphasization in Arabic and relabels some processes as 'r/ deviation' because /r/ shows several distinct patterns of deviation

(Ammar, 1992; Morsi, 2001). Dyson and Amayreh (2000) describe the phonological errors in the utterances of 50 normally developing Jordanian Arabic-speaking children aged between 2;0 and 4;4. Their aim is to see the effect of these sound changes on classes of consonants and the phonological processes that would describe them. They conclude that, at 2;0-2;4, 40% of the consonants do not match the adult target and that these changes have been reduced by about one-half by 4;0-4;4. Almost for all the younger subjects, the most difficult consonants include the emphatic sounds /t̤, d̤, ð̤, s̤/, the uvular plosive /q/, the dental non-emphatic fricatives /ð̤, θ̤/ and the trill liquid /r/. For the oldest children, only /q/ fits the most difficult criterion, but almost half of the 28 consonants match their target with little difficulty. There are fewer voicing changes at all ages, nasals and non-emphatic stops are the most accurate manners, whereas emphatics are the least, with fricatives and glides in middle-difficulty positions. As to the phonological processes, similar findings to those of Ammar (1992) have been reported. They reported the occurrence of syllable reduction, final consonant deletion, consonant sequence reduction, fronting, final devoicing, initial voicing, stopping, de-emphasization, and /r/ deviation (Dyson & Amayreh, 2000: 99-100).

Lack of research dealing with the ‘transition to speech’ or word acquisition and related aspects of prosody is remarkable. To my knowledge, contributions to this area of phonological acquisition are very rare. Some researchers have simply made reference to the onset of speech and that Arabic children start acquiring their vocabulary at the age of 1;0 or 1;5 (Omar, 1973). Bakalla (1975) merely notes that his subject could use from one to four word sentences, each consisting of one - three syllables, and that the development of her speech units seems gradual. Some deal with the acquisition of syllable structure (Salim, 2000; Ammar, 1999, 2000). Salim (2000), basing her research on data collected from 20 Egyptian children (10 boys and 10 girls) aged from 3;0 to 4;0 at their two-word stage, investigates their acquisition of syllable structure from a syntactic perspective. She investigates these syllable structures: CV – CVC – CVV – CVVC – CVCC in monosyllabic, disyllabic, trisyllabic, and quadri-syllabic words and their sequences in the nominal sentences or the phrases that consist of two words. This study shows that the

percentage of the occurrence of nouns in all word types is higher than the verbs and the particles. It also reports the occurrence of some of the phonological processes (e.g. deletion of consonants or vowels, insertion of vowels/consonants, metathesis, sound substitution) that affect the structure of syllables in connected speech compared with adults' speech.

Ammar (2000) investigates the acquisition of syllable structure in the speech of ten normal Egyptian Arabic-speaking children aged from 2;0 to 3;0. This research goal is to ascertain the types of syllables they acquire and the combinations of these types in their words. Her findings show that 90% of the children acquired all syllable types. Difficulties in producing syllables are manifested in CVCC structures ending with CC. She also reports that children prefer short words containing a maximum of three syllables. Quadri-syllabic words tend to be limited to one type of structure. In addition, syllabic structure is influenced by the tendency to avoid abutting consonants, thus, reducing the number of syllables or changing the types of syllables from closed to open. Closed syllables usually contain a long vowel. Prolongation of vowels seems to be a preferred technique to facilitate articulation. The results also show that syllable structure processes always preserve the prosodic structure of the target form.

To investigate the acquisition of consonant clusters in utterances collected from 51 typically developing Egyptian Arabic-speaking children aged between 2;0 and 4;0 and divided into four groups in six-month intervals, Ammar (1999) studies a list containing 100 monosyllabic words of CVCC structure using quantitative and qualitative analyses. Her results show that word final consonant clusters are acquired early compared to that of English-speaking children. Word-final consonant cluster acquisition is apparent at two years and is mastered by the age of four. The findings also show that there is a significant relationship between age and the acquisition of consonant clusters. A qualitative analysis has been applied to describe the different error patterns observed, and this demonstrates the phonological processes used such as deletion of the whole cluster (e.g. [daʔn] > [dæ] 'chin'), deletion of one member of the cluster (e.g. [ʔird] > [ʔid] 'monkey'), deletion of one member with compensatory lengthening of the vowel (e.g. [kalb] >

[kæb] ‘dog’), deletion of one member and applying diminutization (e.g. [rukn] > [luki] ‘corner’), and insertion of a vowel between two consonants (epenthesis) (e.g. [baħr] > [baħar] ‘sea’) or after the final consonant to break the cluster (e.g. /ʃæms/ > [ʃæmsi] ‘sun’). Her results also reveal that the trend of deleting one consonant of the cluster and the stability of the other is due to the degree of obstruction in the vocal tract and the age of acquiring the consonant. Plosives are the strongest consonants; fricatives come in the second stage, while trill and lateral are mostly liable to deletion. Nasals are considered to be strong but they are deleted if they occur with certain plosives.

Very few studies have tackled the issue of phonological acquisition in its relation to phonological theory. To my knowledge, the only research concerned with this issue is Shahin’s (1995), a study of first language acquisition of Palestinian Arabic (PA) phonology. This research is based on data gathered from a single subject aged between 1;6 and 2;9. Its aim is to see whether the order of acquisition of PA reflects “the maturational theory” whereby the difficulty of articulation controls the initial order of phonological acquisition or reflects “the NeoJakobsonian theory” which claims that first words show the organization and also ambient language effects (Shahin 1995:105). Shahin investigates whether the order of segments and feature acquisition for PA reflects articulatory difficulty or the phonemic inventory of the language. Her aim is to see if the child’s order of segment and feature acquisition reflect articulatory difficulty, or the inventory of PA. The findings show that her son’s order of featural acquisition until 2;6 is {[LAB], [PHAR]}+{[SON], [CONT]} + {[VOICE]} and that the child has acquired a phonology that reflects her target language, not articulatory difficulty. Thus, PA provides further counter evidence to maturationalist claims on first language acquisition, and lends support to the NeoJakobsonian view (Shahin, 1995:107).

As to research dealing with disordered phonological development, scarcity also marks this area of research in Arabic. Few attempts and contributions have taken place recently to investigate phonological disorders for clinical purposes and

to develop developmental articulation tests that help in assessing phonologically disordered children and planning therapy for them (Ammar, 1992; Morsi, 2001).

Ammar (1992) investigates the phonemic inventory of sixteen phonologically disordered children and their error patterns to see how they differ considerably in terms of the percentage of phonemes in error from that of the normally developing children. Comparing her results with those of the typically developed group, she finds out that the speech of the phonologically disordered children is more delayed than deviant, i.e. their speech patterns are predictable from what happens in normal development. She reports that it is also characterized by restrictions on the number of speech sounds and the persistence of a considerable number of phonological processes compared to the normally developing children. Her results also show similar order of acquisition and similar error patterns, some of which are observed more in the speech of the disordered group as indicated by their high score of occurrence. The phonological processes employed are di- and polysyllabic word simplification, devoicing, sibilant fronting, /r/ deviation, assimilation, velar fronting, cluster simplification, de-emphasization, glottal replacement, and final consonant deletion. Implications for the assessment and treatment of children with phonological disorders are then suggested and a tentative design for an Arabic articulation test is proposed.

Morsi (2001) carries out a research to establish both the norms of Colloquial Egyptian Arabic (CEA) phonological development and a developmental articulation test for phonologically disordered Egyptian Arabic-speaking children. For this purpose, she collects her data from thirty normally developed Egyptian children. These have been equally divided into three stages: 2;6-3;0 years, 3;0-4;0 years and 4;0-5;0 years. Using substitution and phonological process analyses, she tests eight phonological processes (weak syllable deletion, final consonant deletion, cluster simplification, velar fronting, sibilant deviation, /r/ deviation, de-emphasization, and devoicing). Based on the results of the typically developing children, a chart of phonological development for CEA is introduced and a developmental articulation test for phonologically disordered Egyptian children

was designed. This study provides the developmental norms required for the diagnosis of atypical phonological development.

Khattab (2002) contributes to the field of phonological acquisition by conducting a study of Arabic phonological acquisition in a bilingual environment. Her study differs from the previous studies in many ways. Her study focuses on bilingual phonological acquisition. Her Lebanese subjects are Arabic-English bilingual children aged 5;0, 7;0, and 10;0. They are older than the subjects (aged 1;6, 2;0, 4;0) in other studies. This study provides a detailed phonetic description of certain aspects of phonological acquisition that are important for understanding phonemic contrast and that also play a role in their native-like acquisition of each language and their sociolinguistic competence. Investigating the sociolinguistic competence of bilinguals shows how their speech undergoes parental, societal, and language mode influence, and how they may deploy acquired features to suit certain communicative contexts.

Khattab's study is based on data collected from three English-Arabic bilingual subjects and three monolingual children from each language, along with both parents of all children. The inclusion of their parents has offered a substantial contribution to the analysis of the bilinguals' production in the two languages. Her research deals with the production patterns of two variables (/l/ and /r/) and raises questions about whether English-Arabic speaking bilinguals acquire separate sociolinguistically appropriate production patterns for these variables, and whether these patterns of production in each language are similar to those of the monolingual controls. It also questions the signs of influence from one language to the other in the bilinguals' production and looks for the factors that lead to such influence and how they are related to the bilinguals' language mode. In general, this study sheds light on the bilingual's processing of the two languages (i.e. how they learn, store, and use their two languages). For these purposes, Khattab analyzes the single-language utterances and the code-switched utterances. The consonants or consonantal features that are analyzed in both languages include: (1) Voice Onset Time (VOT) patterns in voiced and voiceless stops (mainly /p, t, k/ and /b, d, g/), (2) /r/ production and phonotactic rules governing its realization in

each language, and (3) /l/ production and the social and phonetic factors governing its realizations in different syllable positions.

Concerning VOT patterns, the results obtained from this study do offer support to the view that bilingual subjects acquire separate production strategies for their stops in each language. As to the /l/ and /r/ production, the findings show that the bilinguals do acquire separate /l/ production patterns for each of their languages. This shows mainly in coda position, whereby the subjects produce mainly dark and vocalized /l/'s in English, and clear /l/'s in Arabic. In onset position, the bilinguals produce both clear and dark /l/'s in English, but only clear /l/'s in Arabic. As to the patterns produced in each language, the bilinguals' are on the whole similar to those of the monolinguals, but there are minor differences depending on the input received from monolingual or bilingual interlocutors. As to the /r/ production, the bilinguals acquire separate /r/ production patterns for each of their languages. They mainly produce approximant types of /r/ in English, whereas they mainly produce taps and trills in Arabic. Moreover, their accent in English is mainly non-rhotic, whereas in Arabic /r/ is produced in all pre- and post-vocalic positions. The patterns produced by the bilinguals are on the whole similar to those of the monolinguals. In English, both groups of children mainly produce the alveolar approximant [r]. One minor difference between the two groups is noted in the small number of taps and post-vocalic productions that the bilinguals produced, which may be due to influence from Arabic. These do not decrease with age, and are present both in isolated word productions and running speech.

Khatab also reports that developmental features such as omissions, assimilations, and substitutions appear in the productions of both groups, but there are two differences between them: First, the developmental features in the monolingual group's productions decrease with age whereas the bilingual group has the lowest number of omissions and other realizations. Second, other realizations by the monolingual include variants normally reported in the literature for children acquiring Arabic. The bilinguals, on the other hand, produce the same and other realizations not normally reported for monolingual Arabic children, including retroflex taps, retroflex approximants, and rhoticized vowels.

To conclude, this section provides a survey of research on Arabic phonological development. It is obvious that there is limited research in this field. Most of these studies have mainly focused on the segmental level of early phonological acquisition. They have examined the similarities and differences in the developmental patterns of Arabic-speaking children from various language backgrounds by investigating the phonetic inventories, the order and rate of acquisition of phonemes, the developmental error patterns, and the acquisition of syllable structure. Because of lack of research in Arabic phonological acquisition, it is not possible to determine whether the findings of a certain study are consistent with those reported by others. Therefore, further research is needed to give a more comprehensive account of normal and disordered phonology in Arabic, to test some of the theories (e.g. the continuity model and the maturation model, the prosodic model, etc), to analyze the phonological structure and prosodic features of babbling and first words, and to investigate linguistic phenomena such as the vocabulary spurt phenomenon, for instance.

Because most of these researches are based on individual case studies or very small samples i.e. only one child (Bakalla, 1975; Shahin, 1995) two or three subjects only (Omar, 1973; Khattab, 2002), and most of the samples in other studies are not large enough (Ammar, 1992; Amayreh & Dyson, 1998; Morsi, 2001), few generalizations can be made from these studies. Therefore, cross-sectional studies with large samples or sufficient number of subjects are needed to yield better results and to establish a typical developmental pattern that minimizes individual differences in the rate and patterns of development. Ideally the larger the size is, the more representative the findings will be in statistical terms.

In order to fill in one of the gaps in Arabic phonological acquisition literature pointed out in the preceding survey, this current study focuses on the phonological development in early word productions. The following chapter deals with the methodology employed in collecting and analyzing this research data, and the subsequent chapters are assigned for data analysis, discussion of the findings, and theoretical implications.

CHAPTER FOUR

Methodology

4.0 Introduction

This study is a cross-sectional and partly semi-longitudinal study of twenty-two typically developing children speaking HijAr, a dialect spoken in the western province of Saudi Arabia. It is cross-sectional in that the speech of three age groups is investigated and taped recorded while they are engaged in different activities and free play sessions with their mothers in near natural settings. The study is observational in nature and it mainly uses a qualitative data analysis to show children's phonological development in the single-word period and to explain their behavior in acquiring their first words.

The domain and goals of the study affect the design of this research. They determine the type of data collected, the techniques used in data collection, and the number of subjects, etc. Basic issues have to be considered: the observation method, subject selection, the actual data collection, the transcription method, the data selection criteria and the method of data analysis. All these will be discussed in this chapter which is concerned with the methodology used for this study.

To decide which appropriate methodology to use and to test the appropriateness of the material used and the suitability of the place for recording, a pilot study was conducted. For this purpose, twelve subjects of different age groups ranging from 1;0 to 1;9 were tape recorded in near natural settings while naming objects and items. The analysis of these subjects' productions has shown many aspects of child Arabic phonology during the single word period. It has revealed the phonological representations of early words, various word patterns, changes in syllable and word structure of their outputs and how they are determined by certain phonological strategies and prosodic word constraints at different stages of development. This pilot study enabled me to decide on (i) the age and number of subjects needed for the study (Section 4.1), (ii) the corpus and the criteria for selecting the list of target words used (Section 4.2), (iii) the kind of qualitative data

required and the collection procedure suitable for eliciting the data needed for this investigation (Section 4.3), and (iv) the data that should be assigned for data analysis and the appropriate methods used for data analysis (Section 4.4).

4.1 Subject selection

The subjects participating are 22 Hijazi Arabic-speaking children whose ages range from 1;0 to 1;9. This period of acquisition (i.e. the child's second year) was chosen because onset of speech begins at 1;0 and it is considered the most productive and creative period of the child's life when his/her representational ability and symbolic capacity emerge and develop (Piaget, 1952; Anisfeld, 1984). The second half of this year is also marked by bursting curiosity and children's exploration become more directed and object specific and their word production increases and becomes clearer by the end of the second year (Anisfeld, 1984).

The number of subjects appears small, but this could be justified by providing the following reasons:

(i) The purpose of this research is to focus on the phonological structures and representation of early words and the actual development of these structures in child Arabic and to provide qualitative data for this purpose. Therefore, there is no need for a large amount of data to be gathered.

(ii) The study is not designed in such a way that it is amenable to statistical analysis because of its goals and the small number of its subjects.

(iii) The difficulty of collecting data from very young children, especially in a conservative society like that of Saudi Arabia where there is lack of nurseries, could be another restriction.

In child language research, studies with small numbers of subjects tend to be explanatory analyses that provide descriptive groundwork and suggest possible hypotheses that can be systematically examined in subsequent research with larger sample of subjects. In many studies, language acquisition has been studied using longitudinal acquisition data from one child (Leopold, 1949; Smith, 1973; Macken, 1979) or a bit more (i.e. 2, 3, 4, or 12 children or more) (Ferguson & Farewell, 1975; Fikkert, 1994; Ota, 2003). Small numbers of subjects seem to be a necessity

in some cases because of the difficulty encountered in collecting data from such very young children, and the time required for collecting, transcribing, and analyzing data.

The twenty-two children selected live in Jeddah at the western region of the Kingdom of Saudi Arabia. They are monolinguals speaking Hij Ar, a variety used mainly in three cities: Jeddah, Makkah, and Madinah. Few of them were exposed to English, but their exposure had been very minimal. These subjects were recruited from a number of private and public nurseries and some homes where possible. Nursery records and maternal reports were used to get information about these subjects and to ensure that all of the children are monolinguals acquiring HijAr as a first language, and that they have no intellectual/cognitive problems, medical problems such as ear infection, for instance, or any speech or hearing impairment that might interfere with their language development (See section 4.1.2 and Appendix A). The questionnaire filled in by the mothers has shown that the subjects belong to either middle-class or upper-middle class families and their parents are well-educated. In fact, the significance of the socio-economic status and education variable has never been shown for phonological acquisition, but homogeneity of the group has been taken into consideration.

Because this study is mainly cross-sectional, the subjects are divided into three groups in three months intervals as follows: 1;0-1;3 (12-15 months), 1;4-1;6 (15-18 months), and 1;7-1;9 (18-21 months). Each group has ten children. The reason for this division is to follow or trace the developmental patterns of the subjects' early words at sequential stages of acquisition. In other words, the overall word shapes produced by the subjects at three periods starting from 1;0 till 1;9 will help in differentiating various stages of early word acquisition in child Hij Ar. This division is based on Vihman, Ferguson, & Elbert's selection of points that allows comparing children in a developmentally meaningful way rather than merely on a purely chronological basis (1986:7). Accordingly, this division starts from the very initial stages (1;0 -1;3), i.e. from the 4- to 15-word point to (1;4 -1;6) the 25- to 50-word point, till (1;6 – 1;9) when the child starts producing from 50 to 100 words or more during the 'vocabulary spurt' period.

Full information about their age, gender, and the number of recording sessions is given in Table 4.1. A balanced distribution has been attempted between boys and girls within each age group, but this could not be achieved. Children who were found to be unwilling or unable to vocalize during the sessions were excluded.

Table 4.1 gives some variables such as sex and sibling position, but the subjects have not been selected according to them since these are assumed to be insignificant in demonstrating any differences in the developmental stages of acquisition and irrelevant to the concerns of this study. There are suggestions that girls acquire language faster than boys who are less productive and that sibling position and rate of development are dependant, but the evidence, however, is often contradictory.

Table 4.1 Information about the subjects, sessions, and total number of words.

Age Groups	Name	Sex	Age	Sibling Position	No. of Sessions	Total No. of Voc.	No. of Words
(AG 1: 12 – 15 months)							
	*Abdul	M	1;1	3 rd	1	28	14
	Mohd	M	1;2.25	2 nd	1	40	12
	*Nor	F	1;2.18	1 st	1	41	21
	*Mar	F	1;2	3 rd	1	45	18
	Ibr	M	1;3	3 rd	1	33	12
	Dem	F	1;0.15	1 st	1	20	13
	Lor	F	1;1	1 st	1	25	12
	*Tal	F	1;3	5 th	1	41	18
	Shom	F	1;3	5 th	1	44	17
	Maria	F	1;1.25	1 st	1	39	16
(AG 2: 16 – 18 months)							
	*Naw	F	1;4	1 st	1	57	40
	Mays	F	1;5	2 nd	2	99	62
	*Mar	F	1;5	3 rd	1	129	109
	*Nor	F	1;6	1 st	1	140	134
	Marm	F	1;5.10	1 st	1	55	51
	Rem	F	1;5.15	1 st	2	68	62
	Lin	F	1;6.12	2 nd	1	88	45
	Adeb	M	1;4	2 nd	1	55	50
	Al	M	1;4.10	1 st	1	56	54
	*Abdul	M	1;6	3 rd	1	60	52
(AG 3; 19 – 21 months)							
	Fais	M	1;7	2 nd	1	62	55
	Shah	F	1;8	1 st	1	69	67
	Maw	F	1;8	4 th	2	82	74
	*Nor	F	1;9	1 st	1	241	231
	*Mar	F	1;9	3 rd	1	250	221
	*Tal	F	1;9.11	5 th	2	182	177
	*Mohd	M	1;8	1 st	1	111	95
	Trq	M	1;9	2 nd	2	109	100
	*Naw	F	1;9	1 st	1	167	150
	Yas	F	1;9	3 rd	1	206	201

Where * = Subjects recorded longitudinally (i.e. at three or two intervals);
AG= age group; M = Male; F = Female).

4.1.1 The ethical issues considered

Because this research investigates the speech of vulnerable subjects (i.e. very young children), I have considered certain ethical issues which have been worked out as follows:

1) The confidentiality of information to be obtained from the nursery records and the maternal reports and the anonymity of the subjects have been respected. Mothers' permission has been obtained before getting any information about their children.

2) Because the subjects are very young and dependent, an 'informed consent' has been obtained from the mothers on their behalf. An 'informed dissent' that allows them to refuse to participate in research has been offered as well.

3) Because the subjects are very young, their mothers' presence is essential to comfort the child and provide a relaxing and familiar atmosphere. Therefore, if the mother could not attend the recording session, the researcher would seek the help of one of the child's very close relatives (e.g. a sister or an aunt) or his/her caretaker, and such cases were very rare.

4) To minimize any risks of physical harm, appropriate materials have been used for data collection. The toys and objects were bought from the Early Learning Centre and Fischer-Price Company that usually consider safety in manufacturing children's toys. The picture books selected are small colorful books with no sharp pointed edges. Also a suitable and safe place where the child feels comfortable has been chosen for data collection.

5) To avoid health problems, the mother's permission was always considered if any kind of food (e.g. milk, juice, biscuit, or chocolate) would be given to the child because some children could be allergic to certain types of food (e.g. nuts).

6) Before starting any recording session, the researcher used to make sure that the child is relaxed, not hungry nor exhausted.

7) Because this study has been carried out in a very strict, conventional, and segregated society where privacy and confidentiality are greatly considered for

social, cultural, and religious factors, mothers' permission to be audio-taped and/or videotaped has been obtained.

To gain easy access to the nurseries in Jeddah, the researcher obtained an official letter from the Vice Dean of the Faculty of Arts and Humanities at King Abdulaziz University. Official permission was also obtained from the General Manager of Jeddah Institute for Speech and Hearing (JISH) where some of the maternal interviews and the recording sessions took place.

4.1.2 Maternal interviews and mothers' role in data elicitation

The maternal interview, which is a technique developed by Bates et al., (1979), has been adopted and used in eliciting data. Participating mothers filled in a short questionnaire (See appendix A) that requests information about their children's date of birth; any intellectual/cognitive problems or any speech and hearing impairment affecting their language development, any medical problems (e.g. ear infection); any complications during delivery; exposure to languages other than Arabic and the degree of exposure; attending nurseries where a foreign language is used; and parental education and employment. To collect more data about the words that are missing in the recorded sessions, the mothers filled in reports based on McArthur Infant Communicative Development Inventories (CDI) and prepared by Dashaash and Safi (2008) for the Arabic CDI Project that is being carried out at JISH Centre¹⁶.

The mothers played a role in eliciting data for many reasons:

(1) At the very early age of phonological development, the child's new linguistic forms begin to emerge. These are rather few and mainly consist of reduplicated babbling forms. Because mothers see their children across many

¹⁶ This is a project, based on McArthur CDI and sponsored by JISH Centre and King Abdulaziz University, to document the lexicon of Hijazi Arabic-speaking infants between ages 8m – 16m and between 16m – 36m and to see if the development of early lexicon follows a universal sequence and is sensitive to the saliency in the input language.

different contexts, and because there is a strong relationship between maternal speech and children's early words (Barrett, 1986), they can provide more information to offset scanty and perhaps unrepresentative samples taken in short term observations and to point to the researcher the meaning of the child's "prototype" words, varied or unclear pronunciations, and word references as well.

(2) Because the subjects are very young, their mothers' presence is essential to comfort them and provide a relaxing and familiar atmosphere in order not to intimidate them. Mothers are able to handle their children better than the researcher. In addition, some children might refrain from speaking in the presence of strangers. The mother's presence also enables the researcher to elicit more natural, spontaneous utterances.

(3) The affectionate, personal relationship between the mother and her child helps in initiating a dialogue and encourages the child to participate more easily. Dore (1983:168) emphasizes the role of the mother and insists that "the origin of words occurs in the immediate context of affective conflict arising solutions to maintain and negotiate relationship through dialogue."

The participating mothers are educated, middle-class mothers. It has been reported that middle-class mothers can be very reliable observers if the interview is constrained to very specific questions about the child present ability and if the mother is asked to provide concrete examples of the child's linguistic behavior (Bretherton, et al., 1983: 296).

The maternal interviews were conducted once before the recording of any session to collect information about the child, to make sure that the child is not a late talker, to give the mother an idea about this research topic and explain her role in eliciting data, and finally to arrange for the recording session. The mother was also asked to bring available toys favored by her child or other stimuli (e.g. photos of their close relatives) that would give rise to word use during the sessions. Before any session, the mother and her child were allowed time to become familiar with the place where the sessions were recorded and to fill in the questionnaire. After that the researcher explained to her the task of eliciting data and her role in this task which is merely asking her child questions to name the objects or the

pictures and not producing the names at all till she was asked to do so if there was a need for the elicited imitation task. In the case of the mother's inability to attend the session, the researcher sought the help of any very close relative (e.g. a sister or an aunt) or his/her nursery caretaker, and this happened twice only.

4.2 Corpus

Around 75 words were selected for the following targets:

- 1) To sample all the 27 phonemes of the HijAr acquired at the single word period, with the exception of /θ/, /ð/, and /q/ because of their low frequency of occurrence in this dialect.
- 2) To elicit single-word responses representing initial, medial, final consonants in monosyllabic, disyllabic, and polysyllabic words.
- 3) To determine the Arabic syllable types acquired at this stage of development, the syllabic structure of words or the combination of syllables in the word.
- 4) To identify the phonological processes: consonant and vowel harmony, initial or final syllable deletion, weak syllable deletion, final consonant deletion, consonant cluster simplification, substitution, and de-emphasization, etc.

4.2.1 Criteria for selecting the word list

The criteria used for selecting the words are the following:

- (1) The choice of the target words was primarily motivated by their familiarity to young children and imageability for producing the objects and pictures (i.e. they can be easily represented by pictures). First, the researcher prepared a word list that included more than 200 nouns and very few verbs that are likely to be known by the children at an early age (i.e. 1-2 years) (e.g. /batt̪a/ 'duck,' /tuffaːħa/ 'apple,' /baːb/ 'door,' /kalb/ 'dog,' /sajjaːra/ 'car,' /ħaliːb/ 'milk,' /sariːr/ 'bed,' etc). Mostly nouns were used more than any other category for they could be easily represented by objects and pictures better than other types of words (e.g. verbs and adjectives). Very few verbs (e.g. /ʔaktub/ 'write,' /ħutti/ 'put,' /ħaːti/

‘bring’), adjectives (e.g. /kati:r/ ‘many,’ /hilo/ ‘nice’) and other forms (e.g. /ʔana/ ‘I’, /hina:/ ‘here’, /ta:ni/ ‘again’, /haggi/ ‘It’s mine’) were expected to be used. Some of these words were chosen from the CDI forms prepared by Dashaash and Safi (2008), a word list, presented in a pilot study by Nawwab (2007), of the most frequent 250 Arabic nouns in the speech of monolingual Saudi children aged from 1;10 to 6;0, and another word list of the most frequently occurring words in the speech of children speaking Egyptian Arabic from the age of one to six years, presented by Karam Al-Diin (1990). Some of the Egyptian Arabic lexical items have been replaced by those used in Hijazi taking into consideration the lexical differences between HijAr and Colloquial Egyptian Arabic. The researcher’s experience as a mother having two children as well as nephews and nieces helped in selecting the words and narrowing down the list to include mainly the words that are familiar to the age of the subjects. The final word list prepared is a list representing the initial, medial, and final consonants of HijAr in monosyllabic, disyllabic, and multisyllabic words. The list included the most frequent words related to food items, animals, household objects, and body parts that are familiar to the subjects (See Appendix B for the word list). The use of frequently occurring words is recommended as they will minimize the need to use the imitative method in eliciting the speech sample (Ingram, 1976; Vihman, 1978; Ammar, 1992; Amayreh, 1998).

(2) Words that fit more than one target, whether a phoneme or a phonological process, are preferable for they will be less time-consuming in data collection. For example, [kalb] is used to test the occurrence of the phoneme /k/ and the consonant cluster reduction.

(3) Words that have different pronunciations, i.e. different phonetic representations, were avoided (e.g. /ʃubbæk/ and /ta:ga/ “window”).

4.3 Data collection

4.3.1 Near Naturalistic observational method

The near naturalistic observational approach used in several studies (e.g. Ferguson & Farewell, 1975; Ingram, 1976; Smith, 1973, 1975; Macken, 1978;

Vihman, Ferguson, & Elbert, 1986; Vihman, et al., 1985) was followed in eliciting the subjects' spontaneous word productions through naming objects or pictures. The researcher's aim is to collect spontaneous samples to yield more accurate results; therefore, the setting of the data collection is primarily near natural, in that the child does not recognize that s/he is being observed or involved in a certain task. The data was collected in simulated near natural settings and child-mother interaction environment (i.e. free play sessions) where the child and his/her mother were audio-recorded and/or videotaped (Stoel-Gammon & Dunn, 1985; Ingram, 1989).

Collecting speech data is typically accomplished through recordings of spontaneous utterances rather than by controlled elicitation techniques. This is due to the limited size of active vocabulary and the short attention span of children under the age of two years. The naturalistic observational method has its own advantages and drawbacks. One of its drawbacks is that it is time consuming and the production of certain data, and of certain types of errors, is left to chance and circumstances. Another drawback of spontaneous speech data is that they largely rely on children's intention to produce words. This means that the full range of phonological competence may not be captured. If the child does not attempt to produce a particular word, there will be no information about how and whether that word would have been produced. As a result, the data may not contain a suitable variety of words or utterances to allow a complete analysis and the samples of subjects may be too different to compare with each other. On the other hand, this method is the most suitable for eliciting spontaneous utterances from children at this age, and spontaneous speech data is considered a valid subset of the child's natural linguistic performance. Experimental studies are not very suitable for very young children because very young children can quickly lose interest in the tasks, have a tendency to get bored and tire easily, and they can be easily distracted.

4.3.2 Elicitation techniques used

To elicit natural, spontaneous data sampling, two elicitation techniques were used: the elicited-naming technique and the elicited-imitation technique.

Therefore, the tape-recording sessions were designed around two tasks: the object and picture-naming, and the elicited-imitation task.

For this purpose, I collected a number of toys, objects (e.g. doll, car, cat, dog, food items, etc.) and pictures that are familiar to children at this early age from the toy/object bank at JISH centre. Some were bought from the Early Learning Centre and Fischer-Price Company that usually consider safety in manufacturing the objects and the toys they sell. The pre-selected items were presented to the child in a free play session with his/her mother or caretaker. To create a real play situation, the mother and the child sat on a colorful carpet or small colorful chairs available in the rooms where the recording sessions took place. The elicited naming technique was used first, but sometime, when it failed as a result of the child's refusal to respond spontaneously, especially with children of younger age, or if the object/picture was not familiar to the child, the child needed to be encouraged to produce words, and therefore, the elicited imitation technique was implemented instead.

4.3.2.1 The elicited-naming technique

The recording sessions were designed around the following two tasks:

(A) The object-naming task:

The researcher started with task (A) because toys or objects are more familiar to very young children and more preferred than pictures. The child will be asked to name a toy or any other objects, and some of his body parts (e.g. his eye, mouth, hand, etc). One object was presented at a time. The child was given time to look at the object, touch it, handle it, and play with it, and then s/he was asked to name it. Before starting this task, the mother was instructed not to name any object because spontaneous utterances are required. Sometimes the mother might receive quick responses and sometimes she might not because the child might not recognize the object, or he might be unwilling to talk. Therefore, in the case of the child's attempt at producing the target word, the mother would offer some contextual prompts or another item is presented to motivate the child to produce more words and utterances. Then the mother was asked to introduce the previous

object again during the session. She was also asked to keep encouraging her child to produce words by rewarding him/her by candy or offering contextual prompts.

(B) The picture-naming task:

The same procedure followed in the object-naming task was used here. Children were asked to name the pictures presented to them in a picture-naming book and/or separate pictures of food items, animals, household objects, and body parts prepared for this task. Each picture contained one single item. Pictures were simple, clear, colorful, and have a medium size. Actually, task (B) was used less than (A) because some children were not used it. Very few children were trained by their mother to look at pictures and name them.

4.3.2.2 The elicited imitation technique

Great efforts were made to use the selected common words for eliciting spontaneous natural sampling in the object- and picture-naming task, and attempts were done to consider the occurrence of all the phonemes in all word positions (i.e. initial, medial, final), but there were occasions when the child did not attempt to produce the target word spontaneously due to the following reasons:

(1) Some of the sounds could not be exemplified in words familiar to the child due to his/her limited inventory at this early stage (e.g. the glottal /ʔ/ in medial position), and the target word used would be beyond the child's conceptual and lexical ability for it cannot be represented in a picture/object familiar to the child.

(2) The child's refusal/unwillingness to talk or his/her use of an avoidance strategy if some sounds were difficult to produce (Macken & Ferguson, 1983; Stoel- Gammon & Dunn, 1985).

In case of such failure, the researcher would resort to the elicited imitation technique. The mother would ask the child to repeat some of the target words. When the child produced a wrong word, the examiner would ask for repetition or other attempts. Imitated responses were noted on the transcripts.

4.3.3 Elicitation procedure

Attempts were made to elicit as many of each child's words as possible by the researcher or the mother or both of them together if the child felt comfortable in the presence of the researcher. Some of the sessions were tape-recorded and videotaped and some were tape-recorded only. Live transcription and notes were taken during each session, especially those that were audio-taped only.

Before starting any recording session, it was important to make sure that the children were relaxed and in good health. Most of the time, the recording sessions took place during the middle of the day when children were at their most active state, neither sleepy nor hungry nor exhausted. Before the meeting took place, the researcher checked the toys, objects, and pictures prepared for the elicitation task. After filling in the mother's questionnaire and CDI maternal report and getting familiar to the place, the mother and her child were led to the room assigned for recording the sessions by those who were in charge of JISH centre. The room is small and very quiet. It is well-furnished and well-decorated with a small, colorful carpet, small chairs and a table suitable for kids, and a small closet for keeping the toys and other objects. It is equipped with a tape-recorder and a video camera. The room is not spacious and this has an advantage for it controls and limits the child's movement in the room and allows him to be close to his mother and the tape recorder. In the case of any child feeling unhappy and uncomfortable in the presence of a stranger (e.g. the researcher), the researcher listened to and watched the child and his mother on a TV screen if the session was videotaped.

The mother was instructed to present one toy or an object at a time or to point to some of his body parts and ask the child /ʔe:ʃ də/ "What is this?" /ʔeʃ ʔismu ha:da/ "What is the name of this?", /mi:n də/ "who is this?" etc. Sometimes the children responded quickly as soon as the object was introduced and sometimes they kept mouthing it, or handling it, and playing with it instead. In this case, another toy or object was introduced to attract his/her attention to something else and to motivate him/her to produce more utterances in order to continue with the elicitation task. At the end of the session, the child was rewarded by a gift and some candy and the mother was thanked and informed that there might be another

session if needed. Very young children (i.e. 12-14 months old), for instance, take less time than older ones (i.e. 21-24 months old) for the latter recognize more objects and have more word productions.

Utterances were recorded at the child's home or nursery during near natural, spontaneous, interactive session with the child's mother and/or the researcher. The sessions were audio-recorded using a Sony digital IC recorder with a built-in microphone for high-quality voice recording. Some sessions were videotaped via video cameras available in the room assigned for the recording sessions in JISH centre. Duration of sessions was one hour or less or more depending on the child's age and productivity or the occurrence of any technical problems.

All the recording sessions took place with the attendance of children's mothers in all cases except for one child whose caretaker played the role of the mother because the latter could not attend. A considerable amount of data was collected from around 22 children (7 boys and 15 girls). Five children were excluded because they were older than 1;9 i.e. they passed the single-word period and started producing two-word utterances, and four other children who seemed to be late talkers.

4.4 Data analysis

4.4.1. Data preparation

Though the data mainly consists of cross-sectional speech samples, but semi-longitudinal samples were also collected from six children (Mar, Nor, Tal, Naw, Abdul, and Moh'd) recorded regularly at two or three intervals (see Table 4.1). There was not a possibility to follow up with all children due to occasional large gaps because of illness or family vacations.

The data elicited included different word categories: nouns, verbs, adjectives, and other categories such as function words, social and relational words, and onomatopoeic words. Table 4.2 shows the percentage of the occurrence of these categories in children's speech of each age group. The dominant category is

that of nouns, followed by social utterances, verbs, and modifiers, the least acquired¹⁷.

Table 4.2 Percentage of word categories in all age groups (1, 2, & 3)

W-category	Age group (1)	Age group (2)	Age group (2)
Nouns	61.7 %	69.2 %	65.7 %
Verbs	6.5 %	14.4 %	17.1%
Adjectives	.6 %	2.2 %	3.3 %
Others	31.2 %	14.2 %	14 %

The data was transcribed in broad phonetics using the IPA phonetic system assigned for Arabic, and, where necessary, a phonetic transcription was also made (Handbook of the International Phonetic Association: A guide to the use of the International Phonetic Alphabet, 1999: 51-2). To ease the process of analysis, the data was prepared and arranged in a way that equivalent adult forms, the number of syllables, their canonical shapes, and stress marks were provided as well. The videotapes were viewed and re-viewed to detect and confirm contextual cues used to establish word, quasi-word, or “nonword” status for each of the child’s vocalizations. In the cases where no videotaping took place, live notes to detect and confirm these cues and comments were taken during the sessions.

4.4.2 Criteria for data selected for analysis

The data collected included not only the items given in the word list prepared by the researcher, but all the utterances produced by the child during the session. Most of the words collected were recorded during the sessions but some were reported by the mothers in the filled-in CDI forms. There was a good degree of overlap between words identified on my transcripts and words reported by the mothers.

A critical problem encountered was to decide the status of some vocalizations and whether they are adult-based or not because babbles are produced at the very early stage of word production (i.e. 12- 15 months). Oller (1980:93)

¹⁷ This finding supports the Noun Bias Hypothesis which states the predominance of nouns in children’s early words, and it confirms the findings reported in the literature from different languages (English, Dutch, French, Hebrew, and Italian).

notes that ‘it is hard to tell, at times, whether infants are producing words or merely babbling.’ Cruttenden (1980) also finds it difficult ‘to pin down the occurrence of the first word.’ Actually the distinction between babbling and first word is not at the heart of this analysis, but it is well known that babbling lasts till the first half of the child’s second year (Vihman, et al. 1985; Vihman, Ferguson, & Elbert, 1986, Vihman, 1996).

The data inclusion criteria followed are the basic criteria used in some earlier studies (Shibamoto & Olmsted, 1978; Ferguson, 1978; Menn, 1978; Vihman, et al., 1985; Vihman & Miller, 1986; Vihman, Ferguson, & Elbert, 1986). They apply for this study as follows:

Before we credited a child with a spontaneous use of a word, we required that he or she produces a phonetic form that was a recognizable attempt at adult words, given frequent child-reduction rules.... In addition, the child had to use the word appropriately, with an apparently intentional meaning that was plausible in terms of the adult meaning or use of the word and commonly occurring child semantic rules (Vihman et al. 1985: 401).

Thus, the criteria are:

- (1) the mother and the researcher’s recognition of the child’s form,
- (2) sufficient phonetic consistency to allow recognition of the form as a meaningful utterance, and
- (3) some consistency in reference or accompanying action.

As to criterion (1), the researcher managed to recognize most of the words produced by her subjects, but in some cases the identification was aided by the mothers’ recognition. Criteria (1) and (2) indicate that the production of a meaningful utterance is determined by consistency and that the child’s form should not necessarily be exactly that expected from the meaning of the adult form. Some children’s forms are consistently used, but they do not have specific adult equivalents. Such uninterpretable words occurred, but they were included in the data, as well as forms which seemed to correspond to whole word phrases rather than words, (e.g. /maʔassala:ma/ ‘goodbye,’ and /ʔeʃda/ ‘what is this?’), imitations, onomatopoeic words (e.g. /ʔumwa/ ‘kiss,’ /ʔan ʔan/ ‘car,’ and /ba:ʔ/ ‘cow, horse,’) and forms idiosyncratic to a given family (e.g. /lu:lu/ and /bibbe/

‘wee-wee’) were counted as words as long as the adult model was used with a consistent conventional meaning. Vocalizations which are called as “proto-words” (Menn, 1978), “quasi-words” (Stoel-Gammon & Cooper, 1984) or “invented words” (Locke, 1983) were also included, especially those that have ‘consistent communicative function’ and ‘phonetically consistent form’ used by the child but lacking an adult model. Some of these vocalizations were problematic as whether to be counted as babbles or as adult-based words. For instance, [dada] was used by some children (e.g. Abdul and Moh’d) as babbles or as an early word meaning ‘grandmother’ in solitary play while holding a toy or the phone to talk to their grandmother. Resort to the context and considering the referential nature of the utterance were the only solutions for such problematic nature of word usage during this early period. Vocalizations, such as [ʔapita], [ʔamamtitada], and [dəgdəgdəg] that are not adult-based words or called ‘non-words,’ were not considered and accordingly excluded (Menn, 1978; Berman, 1977) though some of them included true consonants and were syllabic. These utterances are usually produced in solitary play or in child-mother interaction. Marginal forms such as ‘mmm,’ ‘uh,’ ‘wa,’ and ‘hush’ were excluded unless they had a conventional referential meaning. All other productions such as crying, screaming, and few babbles that do not convey any sound-meaning relationship were excluded too. The rapid succession of word-based vocalizations (e.g. /ʔam ʔam/) was treated as one unit for repetition is clear in such cases. Similarly, the two- word strings (e.g. /ʔeda/ ‘what is this?’) that occurred for some children, and in particular at the onset of first word production, were treated as single vocalizations as well.

As to imitations, it is common to exclude them in any phonological analysis for priority is usually given to spontaneous utterances. Ferguson & Farewell (1975:422) have stated that

researchers have sometimes found that such imitations may be more accurate phonetically than the same forms said spontaneously; and they have excluded imitations in order to maximize the number of utterances processed by the child’s phonological system, rather than by a separate imitative ability.

Priority, in this work, is given to spontaneous utterances, but imitations, have been included because imitation is a characteristic of this early period of language acquisition and a “very high percentage of what a one-year-old says is imitated,” and “even children this young can repeat or imitate things said by adults at some distance of time, five minutes or more, despite considerable intervening speech, so that no simple definition of imitation is feasible” (Ferguson & Farewell, 1975: 422). During the recording sessions, the imitation task was used by the researcher and the mother sometimes to encourage very young children to talk and to elicit more data. For data analysis, the word-based vocalizations were coded as spontaneous or attempted.

Then all the data selected were organized in three files for the three age groups. Each file contains general information about the subjects such as name, age, and number and duration of sessions. Each child is assigned a file that includes his/her phonetic inventory and utterances and information related to these utterances such as syllable types and phonological rules. Then to make the data analysis easier and to easily compare child’s utterances to the adult targets on several levels and to capture the relationship between them, all the data were organized in tables with columns assigned for adult targets, child forms, the orthography, glossary, transcription, number of syllables, syllable types, etc (see Appendix C).

4.4.3 Methods of data analysis

Two methods were used to analyze the collected data: a ‘substitutional analysis’ and a ‘phonological process analysis’ in order to show the segmental development and the prosodic structure development of the subjects’ early words at different stages of acquisition and to help explain child-adult differences easily. This has been accomplished by comparing the child’s forms to the adult model and noting the correspondences and differences between the two.

The first method employed is that of substitutional analysis. This type of analysis is a relative one, in the sense that children’s realizations are compared with corresponding adult targets. The purpose of this analysis is to determine child-adult differences and deviations from the norm in segmental and syllabic/ prosodic

structure of words (e.g. the omission of any target phoneme as a whole and in different words positions and the substitutions of each target phoneme). The second method used (i.e. the phonological process analysis) analyzes children's pronunciation in terms of phonological processes to explain the error patterns and deviations/mismatches between child and adult forms. These processes are assumed to reflect the natural (production) restrictions of human speech capacity (Grunwell, 1985:53). Stoel-Gammon & Dunn (1985) noted that it is an uncomplicated and economical way to differentiate between the structural and segmental realizations of the adult and the child forms. This approach provides information about the processes that are present in child's speech and it reflects the role of phonological processes in determining the shape and structure of early words. These types of analysis have been used by several researchers for normal and disordered children (Ingram, 1976, 1986; Grunwell, 1986; Stoel-Gammon & Dunn, 1985). This analysis is used to describe and relate substitutions and other processes in a way that pinpoints the segmental and structural errors easily. It also determines which processes occur frequently in the speech sample of all groups at various stages of acquisition, which processes are common, and which are language-specific to Arabic such as de-emphasization, for instance.

In sum, this chapter provides a detailed description of the methodology designed for this study to collect spontaneous, cross-sectional, and semi-longitudinal data and to accomplish a qualitative data analysis of the early word productions of twenty-two HijAr-speaking subjects. Chapter five provides a detailed analysis of the subjects' early word productions: their phonetic inventories, word syllabic and prosodic structure, prosodic word development, and their representational nature.

CHAPTER FIVE

Data analysis

5.0 Introduction

The data will be analyzed qualitatively to describe the following aspects of children's first words in the speech of Hijazi Arabic-speaking children, most of which has been reported in the phonological acquisition literature and these are:

(1) Segmental acquisition and development and the effect of this along with the phonological processes on the syllabic structure of the subjects' first words, and how these aspects explain child-adult differences.

(2) The canonical shapes/syllable structures of their early words, their word internal prosodic structure, and the word size restrictions determining their shapes at various stages of development.

The data analyzed was elicited from twenty-two subjects divided into three age groups: age group (1) (12-15 months), age group (2) (16-18 months), and age group (3) (19 - 21 months) (See Table 4.1). The inventory of each child in each group is provided first to show the consonant and vowel phonemes acquired by the children at a particular stage of word production to see the segmental development. This will be followed by an analysis of the prosodic structure of each age group's words to shed light on the prosodic development of the internal structure of syllables and words. This will be accomplished by employing two methods: a 'substitutional analysis' and a 'phonological process analysis' to analyze the segmental development and the prosodic structure of the subjects' early words at different periods of acquisition and to shed light on child-adult differences. This is done by comparing the child forms to the adult model and noting the correspondences and differences between the two. Section 5.1 is assigned for age group (1) data analysis, section 5.2 is concerned with analyzing age group (2) data, and section 5.3 with age group (3) data.

5.1 Early stage: First quarter of the second year (Age group (1))

5.1.1 The subjects' phonemic inventories

The consonantal system of each subject is given as shown in Table 5.1 which shows the consonants acquired by one of the subjects (Abdul 1;1).

Table 5.1 The consonant system of a subject (Abdul 1;1) in age group (1)

	Labial	Labio- dental	Inter - dental	Dental- alveolar	Palatal	Velar	Uvular	Pharyn- geal	Laryn- geal
Stop	(p)* b			t, d					ʔ
emphatic									
Fricative								(h)	h
emphatic									
Nasal	m			n					
Lateral									
emphatic									
Trill									
Glide	w				j				

() = first/inconsistent appearance.

* = phonetically , but not phonemically distinct.

The consonantal system of all the subjects is given below in (5.1).

(5.1) Consonantal system of age group (1) subjects

Abdul: [b, m, t, d, n, ʔ, h, w, j]

Moh'd: [b, m, t, d, n, ʔ, h, w, j]

Nor: [b, m, t, d, n, s, l, ʔ, h, w, j]

Mar: [b, m, t, d, n, s, l, ʔ, h, w, j]

Ibr: [b, m, t, d, n, ʔ, h, w, j]

Dem: [b, m, t, d, n, ʔ, h, w, j]

Lor: [b, m, t, d, n, ʔ, h, w, j]

Tal: [b, m, t, d, (k), n, ʔ, h, w, j]

Shom: [b, m, t, d, (k), n, ʔ, h, w, j]

Maria: [b, m, t, d, n, ʔ, h, w, j]

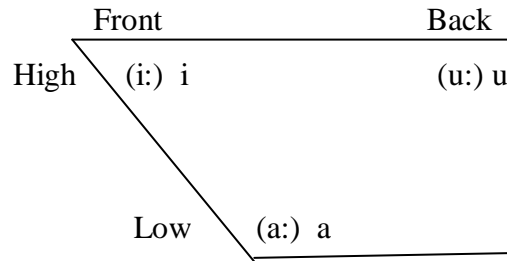
Their consonantal inventory is very limited. It includes these phoneme classes: stops (mainly bilabials, dentals, and glottals) [b, t, d, ʔ], nasals (bilabials

and dentals) [m, n], glides [w, j] and the glottal fricative [h]. Some sounds, such as velar stops [k] and [g], fricatives [x], [s], pharyngeal fricatives [ħ] and [ʕ], which are not usually acquired at this early age, appeared inconsistently¹⁸. Some sounds appeared only in long string vocalizations (non-word utterances or ‘jargon’ as termed by Menn (1976)) with no reference, some of which are adult-based and some are not. Instances of such vocalizations, which did not occur in later stages, are the following: [ʕij ʕij ʕij ʕij], [dəgdəgdəg], [ʔapita], [daʕutta]. The occurrences of such sounds are merely accidental, which suggests that they are not yet controlled or mastered by the children. The sound [b] was realized as [p] sometimes as a result of a devoicing process in a certain phonetic environment as in the word [p^hatta] ‘duck’ where de-emphasization of the emphatic sound [ɓ] takes place. The alveolar lateral sound [l] infrequently appeared only in the speech of two subjects: Nor and Mar. The sound [v] is not an Arabic phoneme, but it has been produced in pretend play by some children, especially boys as an onomatopoeic word denoting car sound [vu:vu:]. No voiced-voiceless contrasts have been found in the data.

As to their vowel system, the short vowels [a, i, u] have been acquired early and their long ones [a:, i:, u:] appeared in some words (see Figure 5.1). As reported cross-linguistically in the literature, vowels, and in particular the universal vowels /a, i, u/ are acquired very early. Mid back vowels [o:] and [e:] have not been acquired yet at this early stage. The mid back vowel [o:] appeared in two words only: [mo:ja] ‘water’ and [no:na] ‘balloon’ in the speech of two children (Mar & Nor).

¹⁸ The consistency criterion followed is the occurrence of the sound consistently in more than one position i.e. initially, medially, and/or finally

Figure 5.1: Vowel system of age group (1)



Thus, we can say that at this early stage these children have a very limited segmental system that includes a small set of consonantal phonemes (stops, nasals, and glides) and the short vowels /a, i, u/ with their long counterparts. This is typical of the phonology of very young children at the beginning of their second year of life.

5.1.2 Gemination and consonant clusters

The data show that gemination or C-lengthening appears very early, and in particular in a medial position as shown in the following examples:

(5.2) Examples of medial geminates from age group (1) data:

Adult's form	Child's form	Gloss	Child & Age
[ʔanna]	[ʔanna]	'grandma'	(Mar 1;2)
[dʒadda]	[dadda]	'grandma'	(Nor 1;2.18)
[ʃamma]	[ʔamma]	'aunt'	(Tal 1;3)
[dub]	[dubba]	'teddy bear'	(Moh'd 1;2.25)

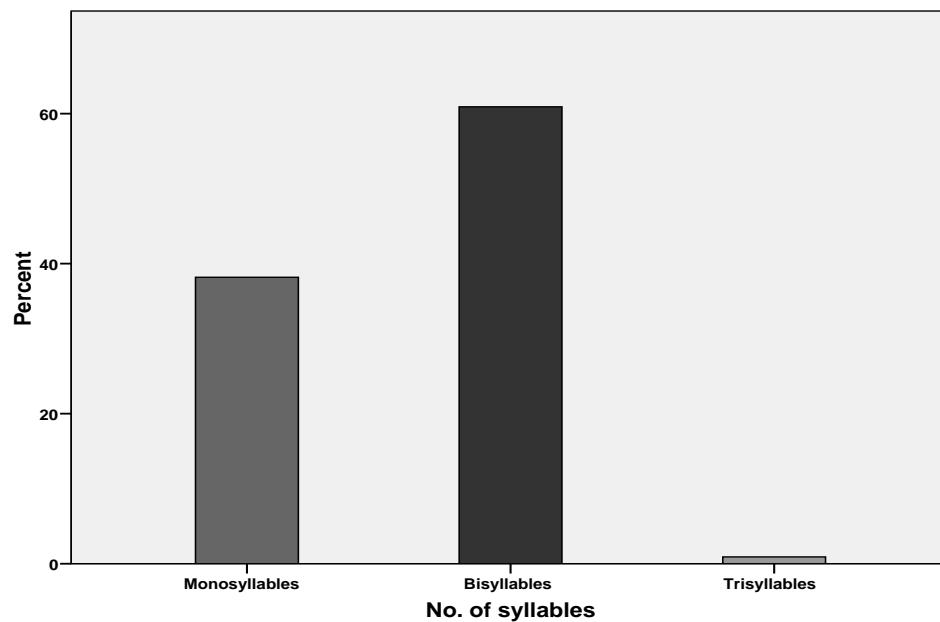
Medial geminates often appear in baby talk words such as [nanna] 'food' [dadda] 'grandma,' and [tuttu] 'sit down.' All the children attempted and produced spontaneously many words with medial geminates in their spontaneous and attempted words.

Apart from one word only which is /mbu/ 'water' where two initial consecutive consonants /mb-/ appear, there is no evidence for any consonant clustering in initial or final position in the data. This word /mbu/, which was found in Nor's repertoire, is a common lexical item in the input received by these children for it is often used by adults in baby talk register.

5.1.3 Word syllabic structure

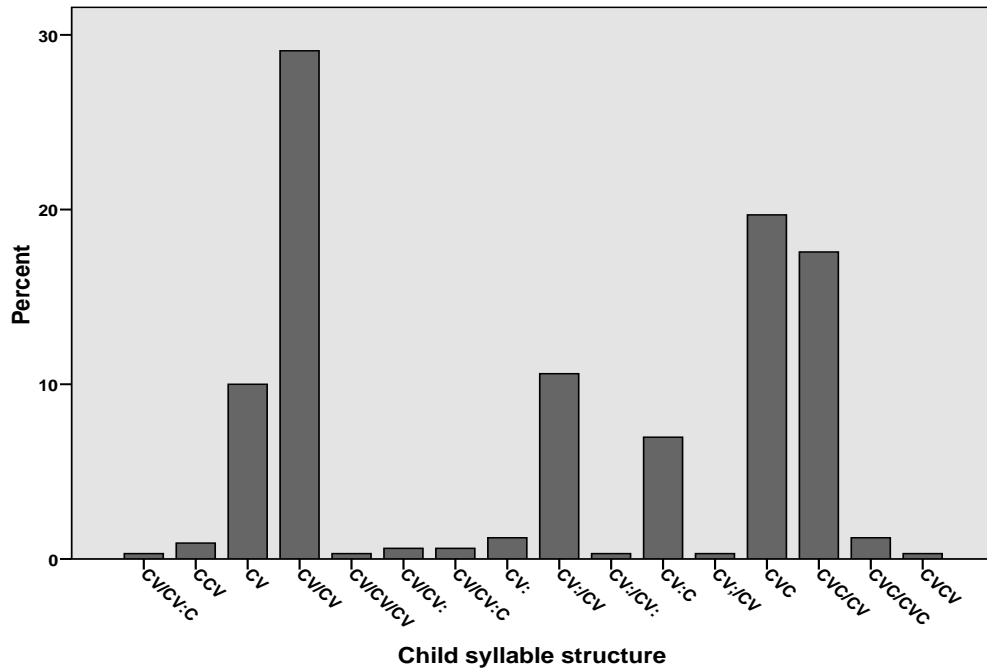
At the initial stages of speech development, children may restrict their lexical productions to words having certain patterns: CV, CVC, and CVCV according to their individual preferences. Most of the words produced by the subjects of age group (1) are disyllabic (60.9%) and monosyllabic (38.2%) as shown in the following Figure 5.2.

Figure 5.2 Percentage of word syllabic types in age group (1) data



Tri-syllabic words are actually very rare at this early stage of word acquisition. The tri-syllabic words portion is very small (.9%). The only three tri-syllabic words found in the data were those produced by one subject (Mar) the most productive child among this age group, and these were: [ʔijja:la] ‘plane,’ [matati] ‘shoes,’ and [ʔami:na] ‘Amina’ (her caretaker’s name).

Figure 5.3 Percentage of syllabic/canonical shapes in age group (1) data



The above Figure 5.3 and Table 5.2 given below show the various canonical shapes of these children's utterances provided with some examples from the data. The proportion of CV (10%) is less than CVC (19.7%), CV/CV (29.1%), CVC/CV (17.6%) structures. The latter three types are more frequent and somehow equally produced by these children. Other syllabic structures, produced with vowel length, such as CV: (1.2%), CV:C (7.1%) and CV:/CV (10.6%) are less frequent too.

Table 5.2 The subjects' most common syllable types and canonical shapes.

Monosyllables				Bi-syllables		
CV	CV:	CVC	CV:C	CV/CV	CV:/CV	CVC/CV
[ba]	[do:]	[ʔam]	[ba:b]	[dudu]	[ma:mi]	[nanna]
[da]	[mi:]	[dub]	[ta:h]	[nunu]	[li:bu]	[dadda]
[ti]	[wa:]	[ʔan]	[nu:n]	[ʔaba]	[ʔa:da]	[patta]

These children follow certain word patterns across the development of their phonologies. Table 5.3 shows the early preferred word patterns that mark the initial stage of word acquisition:

Table 5.3 Age group (1) subjects' most common word patterns

C1__ C1__	C1 __ C2 __	C1__ C1/C2
b__b__	b/p__ t__	b__ b
m__m__	b__ d__	m__ m
t__t__	b__ j__	n__ n
d__d__	b__ w__	d__ b
n__n__	m__ n__	t__ b
w__w__	m__ j__	ʔ__ b/p
j__j__	t__ b__	ʔ/h__ d/t
	t__ d__	ʔ/h__ m
	ʔ/h__ t__	ʔ__ n
		ʔ/h__ w
		l/n__ ʔ

The most preferred initial consonants are [+ front, + anterior] (i.e. labials and dental-alveolars). Such patterns demonstrate the subjects' preference for a 'fronting' strategy. At this stage, glottals and glides are freely used to replace other sounds. The most frequent word-patterns are those given in the first column where both consonants agree in place and manner. They are identical as a result of a reduplication process (e.g. [dudu] 'an insect'). Some are not fully identical because

children also produce variegated utterances where either the consonants or the vowels vary (e.g. /nanna/~nanni/ ‘food,’/mana/ ‘Abdulrahman’, and /tidu/~didu/ ‘grandpa’). The data analysis has also shown that reduplication operates actively at this early period resulting in such common word patterns. Another common process used is substitution, though not as frequent as reduplication. This process operates yielding some of the patterns given in the second column. Some of these patterns contain consonantal place contrasts. It is also noticeable that all the disyllabic words, produced by these children, end with open syllables.

The monosyllabic words with C1__C1/C2 pattern/structure, given in the third column, either contain identical consonants in place and manner (e.g. [nu:n] ‘Noor (a name),’ [bi:b] ‘car sound’) or different onset and coda consonants (e.g. [dub] ‘teddy bear,’ [ham] ‘food’]. Few consonants appear as codas in CVC words, but some appear as syllable final codas in the first syllable of geminated CVC/CV structures.

5.1.4 Onset and coda acquisition

In accordance with the subjects’ limited consonantal inventory, their onset and coda inventory given in (5.3) is very limited and this indicates a gradual segmental development that influences the shape of their early words.

(5.3) Onset inventory: [b, m, t, d, n, ʔ, h]

Coda inventory: [b, m, w, t, n, ʔ]

All the words produced by the subjects have onset consonants which are mainly stops and nasals. Coda consonants develop gradually when they begin to appear in the child’s initial word productions. The subjects begin to produce few target codas in CVC syllables, many of them with first attempt. Some early attempts to produce CVC target forms (e.g. ‘ [ba:b] ‘door,’ [dub] ‘teddy bear,’ [ham] ‘food,’ [mi:n] ~ [mi:m] ‘who,’ and [ʔan] ‘car’) suggest that coda acquisition in Arabic begins early, particularly if these coda consonants are within the limited inventory of the child’s system (i.e. stops, nasals, and glides) (see also the examples in Table 5.2). This could be attributed to the fact these children are exposed to a Semitic language, similar to Hebrew, where CVC is considered an unmarked

syllabic structure/shape (See Berman, 1977, Bolotzky, 1973). Certain consonants occur before others in coda position. The early appearance of stops [b, t, d, ʔ] and nasals [m, n] as codas is noticeable in the data. This somehow coincides with the Sonority Hierarchy given in (5.4).

(5.4) Sonority Hierarchy

Glides > liquids > nasals > fricatives > stops

These subjects' performance is better on stops, the least sonorant sounds. Nasals and glides appeared as coda in few words, but their occurrence is not frequent; they have been subject to deletion, sometimes. Liquids and fricatives never occur as coda consonants at this stage. This suggests an effect of segmental development and a gradual development coda consonants at this stage. Instances of attempts where children tend to delete codas resulting in CV subminimal/minimal truncations (CVC > CV or CV:) by coda deletion and/or CL are illustrated in (5.5). Such cases occur sometimes due to segmental difficulties i.e. when the coda consonant has not yet been acquired or mastered by the child. It should be noted here that these children sometimes simply deleted the coda consonant without applying a CL process.

(5.5) Examples of coda deletion from age group (1) data

/ta:h/	[ta:]	'fell down'	(Abdul 1;1.15)
/nu:r/	[nu:]	'Noor (a name)	(Nor 1;2.15)
/mi:n/	[mi:]	'Who?'	(Moh'd 1;2.25)
/laʔ/	[la:]	'No'	(All subjects)

As to some classes of sounds such as fricatives, for instance, their production tends to be easier finally than initially, i.e. in post-vocalic position rather than pre-vocalic one. This particular class of sounds has not yet been acquired by these subjects. Therefore, apart from the only example found ending with [ʃ] which is [biʃ] 'shower' produced by Nor and [wi:ʃ] 'shower' produced by Moh'd, no instances of fricatives in coda position were found in group (1) data. This is an indication of individual variation among children during the acquisition process.

5.1.5 The prosodic structure of early child productions

Using the prosodic hierarchy, this section analyzes the prosodic structure of age group (1) early words showing their representational nature and their internal structure as well.

Syllables vary in adult Arabic phonology. In a language with contrastive vowel length such as Arabic, syllables have different syllable weight (See section 3.2.1.2 and Fig 5.4).

Figure 5.4 Examples of light, heavy, and superheavy syllables in Arabic

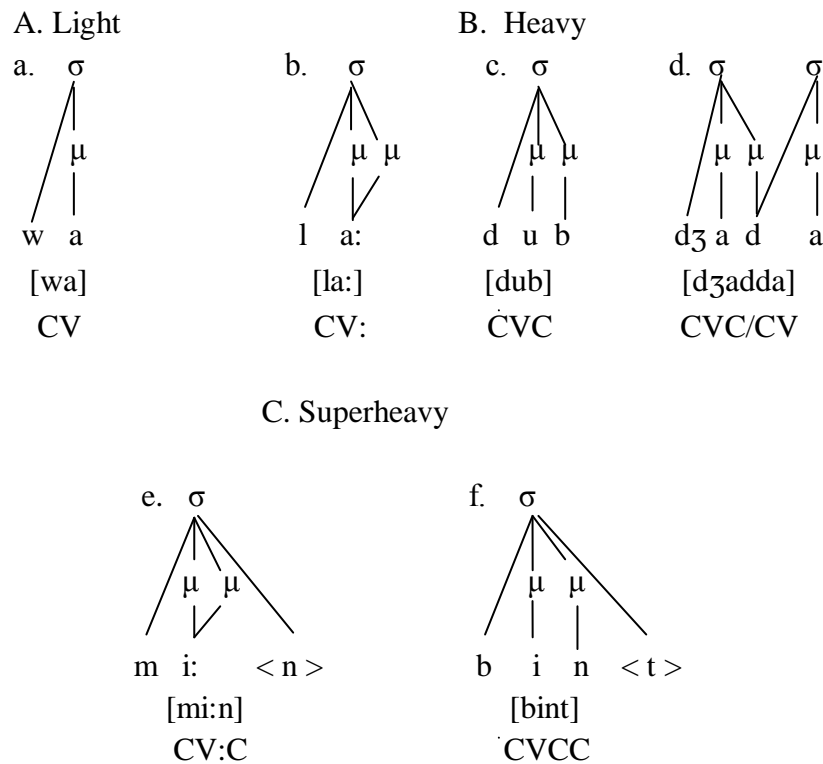
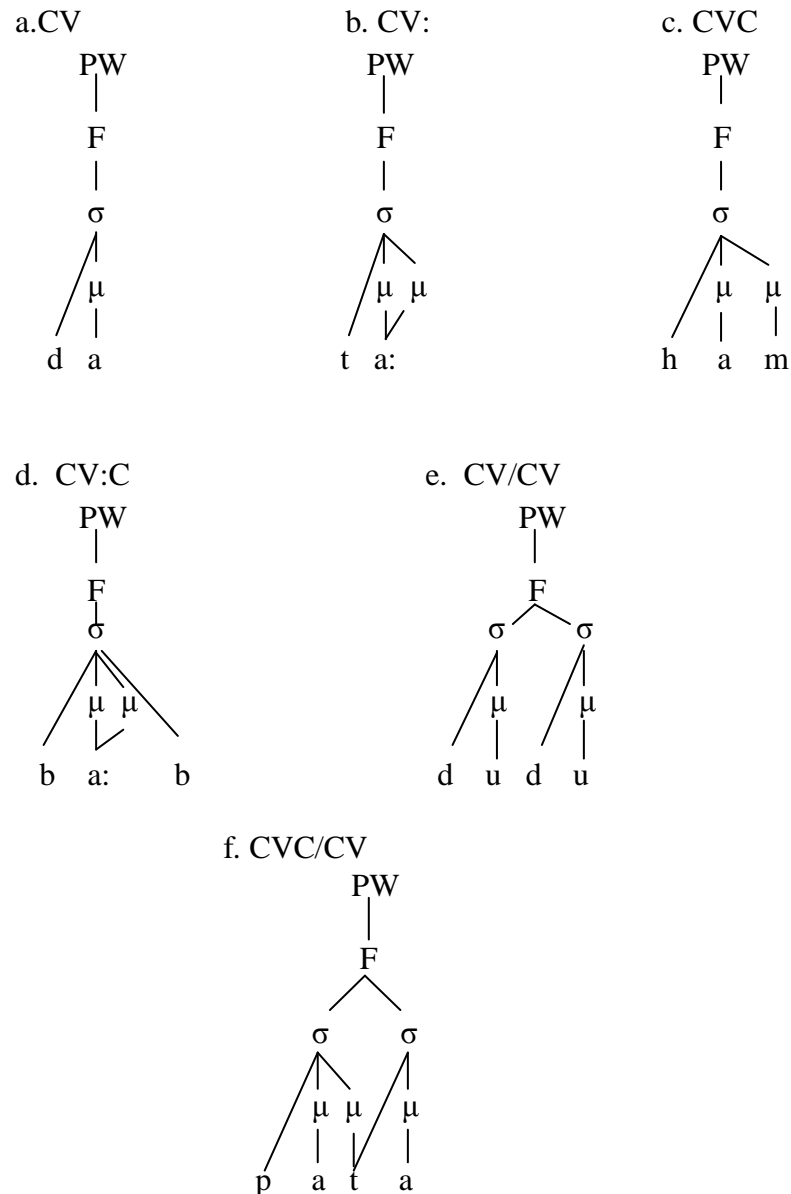


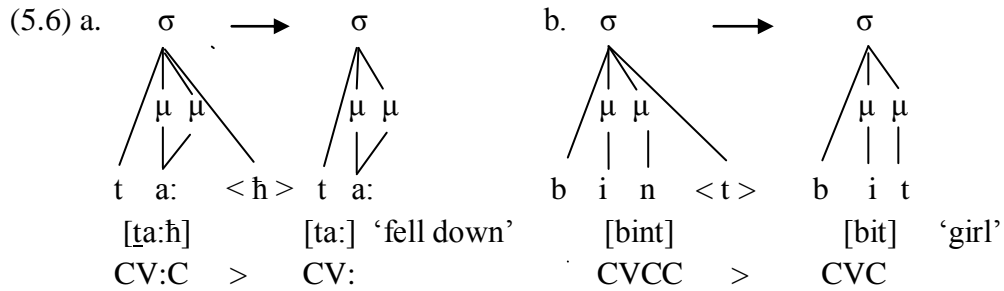
Figure 5.5 illustrates the prosodic structure of different word and syllable shapes in age group (1) data.

Figure 5.5 Prosodic structures of lexical items with different shapes



Some of the syllables produced by these subjects are light/monomoraic (CV) (5.5a); some are heavy or bimoraic (CV:, CVC, CV/CV, and CVC/CV); and very few are superheavy. They show preference for bimoraic syllables and this is expressed in terms of the Bimoraicity Constraint (see 3.10). Their initial productions of some nouns such as /nu:r/ 'light,' /mi:n/ 'who,' and /fi:l/ 'elephant' and verbs such as /ra:h/ 'he went,' and /ta:h/ 'it fell down' with CV:C structure are reduced to bimoraic minimal forms (CV:) by merely deleting the extrametrical

consonant as shown in (5.6a) (see also the examples given in (5.5)). Target words with the superheavy syllable, CVCC usually undergo reduction of the consonant cluster resulting in forms with CVC structure (e.g. bint > bit ‘girl’, gird > gid ‘monkey’) as illustrated in figure 5.6b). No instances of CVCC forms reduced to CVC were found in the data elicited from age group (1), but few were found in age group (2) and (3) data.



As to evidence for CL triggered by coda deletion from child Hij Ar, very few occurrences are evident in the early productions of age group (1). One explanation that could be given here is that many target words contain a long vowel preceding the coda (e.g. [be:t] ‘house,’ [ba:b] ‘door,’ [ʔa:t] ‘bring’). The child deletes the coda consonant, which is a metrical element in such structure, leaving a form with a bimoraic limit i.e. two moras as in (5.6a). Besides, children, at this early stage, tend to lengthen vowels for their productions are usually accompanied by a rising tone.

The analysis has demonstrated that CV, CVC, and CV/CV and CVC/CV forms represent the majority of early canonical shapes in the very early word productions of these Hijazi Arabic-speaking subjects. Not only the unmarked, monomoraic CV structure appears very early, but minimal/bimoraic words with CV:, CVC, CV/CV, and CVC/CV structures appear quite early in these children’s productions as well. Monosyllables are produced as [(CV)Ft]PW, or with vowel lengthening, as [(CV:)Ft]PW, or with a rhyming coda [(CVC)Ft]PW. These children’s preference for CV/CV and CVC/CV structures is obvious (see Figure 5.3). At this early stage, the subjects begin producing strong monosyllables (S), but there is also a preference for trochees (SW) (See examples in 5.7). No structures with iambs (WS) or (WSW), i.e. a trochee with an initial unfooted syllable have

been produced. The only WSW word found in the data is [ʔa'mi:na] ‘Ameena (a name)’ which is produced by one subject (Mar) whose production is characterized by an active vocabulary. Most of the monosyllabic words exhibit foot binarity either by the vowel length (CV:) or the presence of a postvocalic coda (CVC).

(5.7) Examples of some PW structures produced by age group (1) subjects

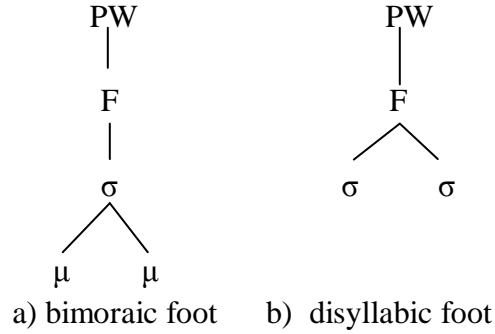
S			
/ˈbatta/	[ˈpa]	‘duck	(Nor 1;2.15)
/tufˈfa:ħa/	[ˈpa:]	‘apple’	~
/ˈba:b/	[ˈba:b]	‘door’	~
/ˈdub/	[ˈdub]	‘teddy bear’	(Moh’d 1;2.25)
/ˈbi:b/~sajˈja:ra/	[ˈbi:b]	‘car’	(Abdul 1;1.15)
SW			
/ˈmo:ja/	[ˈmo:ja]	‘water’	(Moh’d 1;2.25)
/ħaˈbi:bi/	[ˈbi:bi]	‘darling’	~
/ˈta:la/	[ˈta:ja]	‘Taala (PN)’	(Abdul 1;1.15)
/ˈdʒadda/	[ˈdadda]	‘grandma’	(Nor 1;2.15)

Monomoraic words are very few in the data. A possible explanation is that the lack of exposure to monomoraic targets and most of children’s initial productions frequently undergo lengthening even after truncations of di- and tri-syllabic words. Thus, we can say that foot binarity is fulfilled in these children’s early productions. All the bisyllabic words end with open syllables; coda appears as a final geminate consonant in the first syllable of words (CVC/CV) with medial geminates, even in cases in which the target form does not have a coda. These children show a preference for producing such type of PWs.

5.1.5.1 Word size restrictions: Minimality and maximality constraints

It has been proposed that children’s early words must be at least minimally bimoraic and maximally disyllabic (Demuth & Fee, 1995; Ota, 1998; Lleo, 2006) (see section 2.2.3) (see 2.29 and 2.30). The following figures exemplify minimal, and maximal structures with foot binarity:

(5.8)



The word productions of age group (1) subjects show variety of structures. They include few utterances with the unmarked monomoraic CV form, but they also demonstrate sensitivity to word-minimality effects and exhibit a minimal word stage of development where words are minimally one binary foot. Maximality effects are also active because maximally disyllabic words appear in the data too (see the examples from the data given in (5.7) and Table 5.2). Therefore, most of the monosyllabic and disyllabic words produced by them obey the minimality constraint that requires a binary foot. In other words, the forms actually satisfy the two-mora requirement. The few CV forms found in the data are the result of truncations of mono-, di- and trisyllabic forms as shown in (5.9). Examples of augmentation of CV targets to conform to a binary foot are not attested in the data. The occurrence of more bimoraic words than subminimal/monomoraic forms in the data could be attributed to language-particular evidence from Arabic which is being characterized by a low frequency of monomoraic words and high frequency of bimoraic words (i.e. words with long vowels and codas) and accordingly less exposure to CV forms. Variability in these children's productions of CV:C targets (e.g. [mi:n] ~ [mi:] 'Who?'; [laʔ] ~ [la:]) and CVCV targets (e.g. [ʔa:ti] ~ [ti] ~ [ʔa:] 'give me') is attested in the data too.

(5.9) Example of CV forms resulting from truncations of mono-, di-, and trisyllabic words:

CV:C → CV			
[mo:z]	[mə]	‘banana’	(Nor 1;2.15)
[be:t]	[be]	‘house’	(Shom 1.3)
<hr/>			
CV:C → CV:(C)			
[mi:n]	[mi:] ~ [mi]	‘who?’	(Nor 1;2.15)
[tu:t]	[tu:]	‘train’	(Lor 1;1)
[go:n]	[do:]	‘goal’	(Moh’d 1;2)
[ba:j]	[ba:]	‘goodbye’	(Tal 1;3)
<hr/>			
CV/CV, CVC/CV, CVC/CVC → CV			
[‘ha:ti]	[ti]	‘give me’	(Abdul 1;1.15)
[batta]	[p ^h a]	‘duck’	(Dem 1;0.15)
[dabba:b]	[ba]	‘bike’	(Nor 1;2.15)
<hr/>			
CVC/CV:/CV → CV			
[tuffa:ħa]	[pa] ~ [fa]	‘apple’	(Mar 1;2)
<hr/>			

The maximality effect is also evident in the data. The subjects produced target-like bisyllabic SW words. Some illustrative examples are given in (5.10).

(5.10) Examples of bisyllabic SW words: adult and child words (SW > SW)

[‘be:da]	[‘be:da]	‘egg’	(Mar 1;2 & Tal 1;3)
[‘si:du]	[‘ti:du]	‘grandpa’	(Maria 1;2 & Nor 1;2.18)
[‘ku:ra]	[‘buwa]	‘ball’	(Mar 1;2 & Ibr 1;3)
[‘mo:ja]	[‘bo:ja]	‘water’	(Moh’d 1;2.25)
[‘dʒadda]	[‘dadda]	‘grandma’	(Nor 1;2.15 & Shom 1;3)

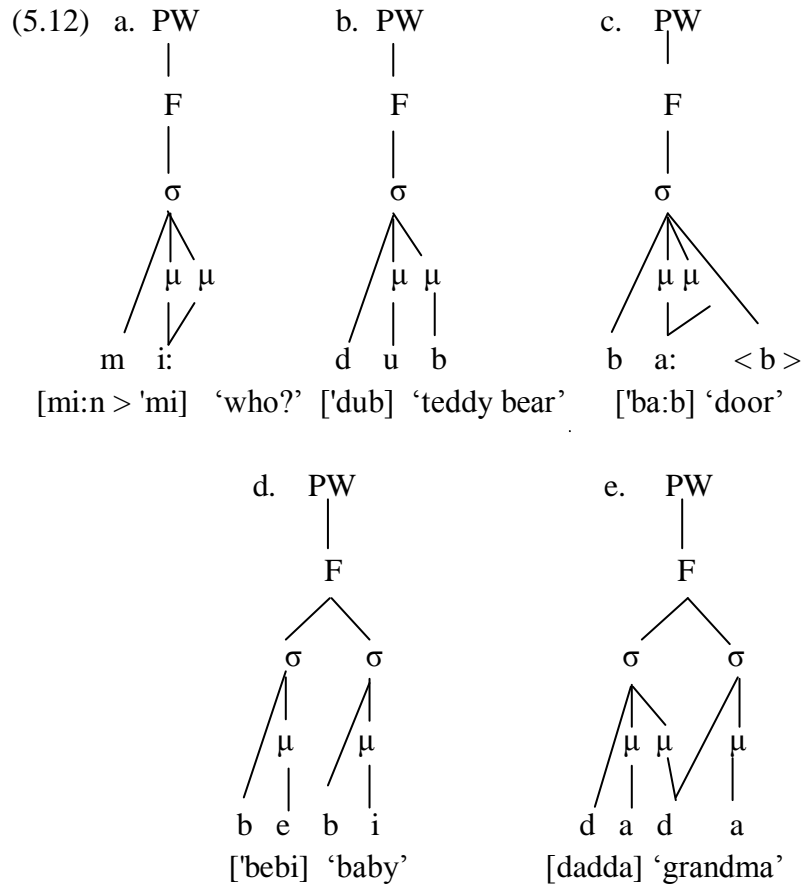
Other bisyllabic SW words are produced as a result of truncating trisyllabic target words. Few examples were found in the data (see 5.11) and these are given below.

(5.11) Examples of bisyllabic SW words resulting from truncations: WSW > SW

/ħa‘bi:bi/	[‘bi:bi]	‘darling’	(Moh’d 1;2.25)
/tuffa:ħa/	[‘wa:ħa]	‘apple’	(Nor 1;2.15)
/bal‘lo:na/	[‘no:na]	‘balloon’	(Mar 1;2.15)

At this very early stage, such productions given in (5.9, 5.10, and 5.11) indicate that these Hijazi Arabic-speaking children’s first words are maximally

disyllabic dominated by a single foot (moraic trochee). They appear in various forms: monosyllabic bimoraic forms with CV:, CVC, CV:C (5.12 a -c) and bisyllabic forms having CVCV and CVCCV structures (5.12d-e).



This is similar to the maximality effect found in English, Dutch (see Fikkert, 1994; Demuth, 1996; Pater, 1997), Spanish and Catalan (Lleo, 2006; Lleo & Prinz, 2000; Prieto, 2006).

No instances of prosodic words composed of more than one foot (i.e. trisyllabic and quadri-syllabic words) were found. Apart from the three trisyllabic words produced by Mar (e.g. [ʔami:na] 'her caretaker's name', [matati] 'shoes', and [ʔajjala] 'car') that are considered rare productions at this stage, no instances of tri-syllabic or quadri-syllabic words are found in the data. Even when these subjects attempted producing such a complex type of phonological words as in (5.13a) or a phonological phrase as in (5.13b), they employed a truncation process to truncate more than one syllable to yield these complex structures to CV or

CV/CV which is a common/preferred pattern at this early stage. Examples (5.13 a & b) are illustrative of such cases. Example (a) involves another process, vowel epenthesis to produce a word with CV/CV structure:

- (5.13) a. [ʔabdurrahma:n] [ma:na] ‘Abdulrahman’ (Moh’d 1;2)
 b. [ʔalhamdulilla:h] [la:] ‘Thanks to Allah.’ (Nor 1;2)

To sum up, this data analysis has shown that these subjects, aged between 1;0 and 1;3, produced a variety of structures (CV, CV:,CVC,CV/CV, CVC/CV) of which the trochaic disyllabic (SW) forms are the mostly preferred. Most of their productions whether mono- or di-syllabic forms are characterized with open syllables. Monosyllabic words closed with a coda are attested in the data, demonstrating that codas are acquired early but to a certain extent due to segmental difficulties. The canonical forms CVC, and CV/CV and CVC/CV constitute the majority of their early word shapes. This stage witnesses the occurrence of few monomoraic CV structures, but bimoraic and disyllabic words with CVC, CV/CV, and CVC/CV structures appear quite early as well.

5.2 Early stage: Second quarter of the second year (Age group (2))

5.2.1 The subjects’ phonemic inventories

Age group (2) subjects’ consonantal system is also very limited. It has mainly the phoneme classes universally acquired early: stops, nasals, and glides, including few fricatives as shown below.

(5.14) Consonantal system of age group (2) subjects

- Naw: [b, m, t, d, n, s, l, ʔ, h, w, j]
 Mays: [b, m, t, d, n, l, s, (ʃ), k, ʔ, h, w, j]
 Mar: [b, m, t, d, n, k, (g), s, (z), l, ʔ, h, w, j]
 Nor: [b, m, t, d, n, k, (g), s, (z), (ʃ), l, ʔ, h, w, j]
 Marm: [b, m, t, d, n, l, s, (ħ), ʔ, h, w, j]
 Rem: [b, m, t, d, n, l, k, (g), s, (ʃ), ʔ, h, w, j]
 Lin: [b, m, t, d, n, l, s, ʔ, h, w, j]
 Adb: [b, m, t, d, n, l, s, ʔ, h, w, j]
 Al: [b, m, t, d, n, l, s, ʔ, h, w, j]
 Tal: [b, m, t, d, n, l, (g), s, (ħ), ʔ, h, w, j]

In addition, velar stops [k, g], few fricatives such as the alveolar fricative [s, z, ʃ], the pharyngeal [ħ] and the alveolar lateral [l] began to appear. Some children (e.g. Mar and Nor), show mastery¹⁹ of the velar stop [k]. The appearance of [g, z, ħ, ʃ] is marked by inconsistency in the speech of some subjects for they appeared only once or twice in few positions. For example, the fricatives [z] and [ʃ] appear in two English words *shoes* and *pizza* produced by Nor and in a final position in words like [biʃ] ‘shower.’ In other words, the accidental or infrequent occurrence of these sounds indicates that they have not yet been controlled by these children. All the emphatic [t̤, d̤, s̤, z̤] sounds are still de-emphasized at this stage.

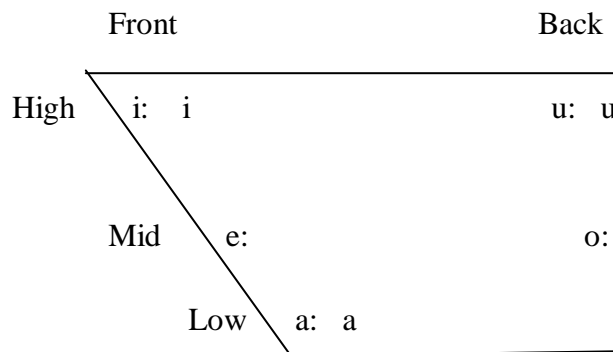
As to the segmental position of the phonemes acquired, very few sounds have appeared as codas (see 5.15). There is preference for the initial stops and nasals which also appear medially.

(5.15) Onset inventory: [b, m, n, t, d, ʔ]

Coda inventory: [b, t, m, n, s, (ʃ), ʔ, j]

In addition to the short vowels [a, i, u] and their long counterparts, The subjects’ vowel system includes mid front and back vowels [o:] and [e:] which are part of the Hij Ar vowel system (see Figure 5.6).

Figure 5.6: Vowel system of age group (2)



¹⁹ The criterion for mastery used here is the child’s correct production of sounds in three or two positions at least.

The subjects' acquired phonemes have shown correspondence to the adult phonemes, even in substitutions such as these: [k] realized as [b] or [t], [l] as [w] or [j], [s] as [t] or [d], [dʒ] as [d], [h] as [ɦ], [ʔ] as [ʔ] etc. Phonetically, some voiced sounds have been devoiced in final position or when assimilated to other sounds within the word (e.g. /batta/ > [patta] 'duck' and /kalb/ > [tap] 'dog' where [b] is realized as [p]). Some of the sounds were sometimes weakened to a glide by a weakening process (e.g. [ta:la] > [ta:ja] 'Taala'). Phonetic variation of some utterances was seen in these subjects' productions (e.g. [ku:ra] > [tula] ~ [buwa] 'ball').

Regarding the order of acquisition of contrasting consonants, the subjects' productions exhibited a universal consonantal opposition which is that of nasal and oral stop. With the acquisition of more consonants (e.g. some fricatives), the subjects have begun producing another consonantal opposition, that of stop and fricative opposition and stop and liquid opposition.

5.2.2 Gemination and consonant clusters (CC)

All the subjects attempted and produced many words with medial geminates in their spontaneous and attempted words (e.g. [nanna] 'food', [dadda] 'grandma,' [p^hatta] 'duck,'). As to initial and final CC, one example for each has been found (see (5.16)).

(5.16) Examples of consonant clustering in age group (2) data:

/mbuwa/	[mbuwa]	'water'	<i>Initial</i>	(Mays 1;5)
/bint/	[bint]	'girl'	<i>Final</i>	(Nor 1;6 & Mar 1;5)

Nor (1;6) produced two English words with final CC: *milk* and *hold*, but she simplified or broke the final clustering by vowel epenthesis in final position (*milk* > *milki*, and *hold* > *holdi*) for she has a tendency of adding the possessive morpheme {-i} 'my' to most of her nouns and the first or second person, feminine morpheme {-i} 'you' to the verbs. This could be attributed to the frequency of occurrence of such morphemes in the input received when addressed by her mother.

5.2.3 Word syllabic structure

The data analysis shows that the productions of this group are developmental and characterized by word complexity. There is a gradual increase in the number, type and order of syllables. The data shows that these children not only restrict their lexical productions to words having certain pattern or templates such as CVC, CV:C, CV/CV, CVC/CV, but they have also started producing few multisyllabic words i.e. tri- and quadri-syllabic words. Figure 5.7 shows that most of the words produced by these subjects are disyllabic (62.1%), followed by monosyllabic words (31.6%), tri-syllabic forms (5.9%), and very few quadri-syllabic words (.4%). Quadri-syllabic words are actually very rare at this stage of word acquisition. The portion of this type is very small (.4%) and its occurrence could be attributed to individual variation or to the frequency of occurrence of the lexical item in the input received.

Figure 5.7 Percentage of word syllabic types in age group (2) data

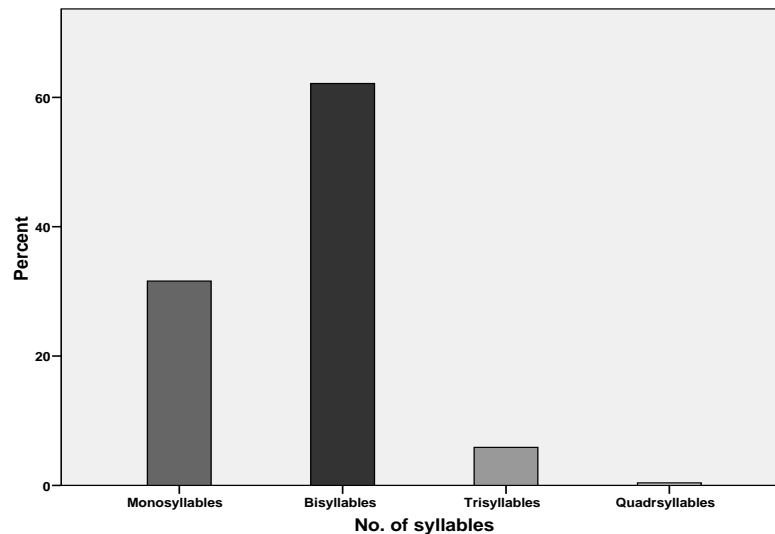


Table 5.4 Examples of the various syllable types and canonical shapes in Age group (2) data.

Monosyllables		
CVC	[ham] ‘food’	[kab] ‘dog’
CV:C	[ba:b] ‘door’	[be:t] ‘house’
Disyllables		
CV/CV	[kuku] ‘bird’	[buwa] ‘water’
CV:/CV	[si:du] ‘grandpa’	[ko:ka] ‘fork’
CVC/CV	[dadda] ‘grandma’	[ʔadda] ‘cushion’
CV/CVC	[ʔinam] ‘grapes’	[tahin] ‘plate’
CV:/CVC	[ba:lid] ‘cold’	[ta:til] ‘great’
CV/CV:C	[kita:l] ‘train’	[ʔali:b] ‘milk’
CVC/CVC	[sibsib] ‘slippers’	[ʔannab] ‘rabbit’
CVC/CV:C	[dabba:b] ‘bike’	[ʔaffu:l] ‘bird’
Tri-syllables		
CV/CV:/CV	[ʔalu:sa] ‘doll’	[hafa:da] ‘diaper’
CV/CV/CV	[ʔamaka] ‘fish’	[haloja] ‘candy’
CVC/CV:/CV	[sijja:la] ‘car’	[kabbu:na] ‘dog’
CV/CV/CV:C	[batalo:n] ‘trousers’	[ʔafalo:n] ‘telephone’

Table 5.5 shows the complexity of the word patterns used by age group (2) subjects. The most preferred word initial consonants are [+ front, + anterior] (i.e. labials and dental-alveolars) and the medial ones are mainly [+ front, + anterior] i.e. dental-alveolars. With the acquisition of more consonants such as velar stops and some of the fricatives [s, z, ʃ, h], other new patterns appeared with initial[+ back, + dorsal] consonants (e.g. the velar stop [k]) and medial/final [+ front, + anterior]. Most of the patterns demonstrate children’s preference for a ‘fronting’ strategy, yet there is a gradual development in producing more complex structures. Still at this stage, glottals and glides are freely used to replace other sounds initially and medially.

Table 5.5 Age group (2) subjects' most common word patterns

C1__ C1__	C1 __ C2 __	C1__C1/C2	C1__ C2__ C2/C3__
b__ b__	b/p__ t__	b__ b	h__ b__ b__
m__ m__	b__ d__	b__ s	h__ m__ m__
t__ t__	b__ w__	b__ t	?__ m__ m/n
d__ d__	b__ s__	d__ b	?/h__ f__ d__
n__ n__	d__ n__	d__ d	s__ j__ l__
k__ k__	m__ d__	m__ n	h__ l__ w__
w__ w__	m__ j__	k__ m	?__ m__ d__
	t__ b__	k__ b	t__ h__ n
	t__ d__	k__ k	d__ d__ b
	t__ l__	l__ s	ʃ__ ?__ l
	t__ h__	l__ h	k__ w__ l
	k__ b__	t__ j	k__ t__ l
	k__ l__	?__ n	?__ s__ m
	k__ s__	?__ s	?__ s__ m
	s__ d__	?__ b/p	
	s__ s__	?/h__ d/t	
	s__ b__	?/h__ m	
	z__ m__		
	f__ h__		
	h__ f__		
	j__ l__		
	?/h__ t/d/g__		

The word patterns in the first column are less frequent at this stage. The consonants in these word shapes show agreement in place and manner as a result of a reduplication process. Some are not fully identical as a result of partial reduplication. Variation also marks the vowels of these patterns. Either the consonants or the vowels vary (e.g. /nanna/ ~ /nanni/ 'food,' and /si:du/ ~ /didu/ 'grandpa'). Reduplication still operates at this stage but it is not as active as in the very early period of acquisition (i.e. 12-15 months). Consonant harmony and syllable structure simplification processes are more common at this stage; they operate actively in shaping or constraining the subjects' production of multisyllabic target words yielding most of the patterns given in the second, third, and fourth column. Some of these patterns contain consonantal place and manner contrasts.

Finally, we can say that though the phonetic inventories of these children have shown little expansion by including few velar stops and fricatives, yet they are still very limited. This limitedness along with the number of phonological processes employed such as consonant and vowel harmony and syllable structure simplification processes combine to produce these children's most common and frequent syllabic word structure, the disyllabic forms.

5.2.4 Onset and coda acquisition

The subjects' onset and coda inventories are given below in (5.17). All children produced word-final consonant in target-like manner though within their limited sound inventory.

(5.17) Onset inventory: [b, m, t, d, n, l, (s), z, k, ʔ, h, w, j]

Coda inventory: [b, m, t, d, n, l, s, ʔ, h, w, j]

Coda consonants emerge and develop gradually. Some consonants (stops [b, t, d, ʔ] and nasals [m, n]) appear before others in coda position. These subjects produced more codas than the younger subjects of age group (1). Though they produced nasals as codas but their performance was better on the least sonorant stop consonants than the liquids and the fricatives (see the Sonority Hierarchy in (5.4)). They also tend to delete the liquid [r] and most of the fricatives to leave the less sonorant consonant appear as the coda for the Sonority Sequencing Principle (SSP) prohibits increases in sonority from the nucleus to the edges of the syllable (see SSP in (5.18)). The production of the word-final liquid [l] was much better for these older subjects than the sound [r]. This suggests an effect of segmental development, especially for /r/ and a gradual development of word-final singleton consonants at this early stage.

(5.18) Sonority Sequencing Principle (SSP)

The level of sonority must not increase from the nucleus to the edges of the syllable.

Furthermore, these subjects produced codas not only in monosyllabic words (CVC and CV:C) as in the case of age group (1) word productions, but syllable finally in the first syllable and word-finally in bisyllabic and trisyllabic forms

C1VC2/C2V, C1VC2/C2VC3, C1V/C2VC3 structures (see examples given in (5.19). Still the majority of disyllabic words end with open syllables, but few began to appear with a word-final/coda consonant.

(5.19) Examples of the occurrence of coda consonants in different word structures

Monosyllabic words

CVC	[kab] ‘dog’	[laʔ] ‘No’
CV:C	[ba:b] ‘door’	[mo:s] ‘banana’

Disyllabic words

CVC/CV	[tanta] ‘bag’	[dadda] ‘grandma’
CV/CVC	[ʔinam] ‘grapes’	[tahn] ‘plate’
CV:/CVC	[ta:tis] ‘potato’	[ba:lid] ‘cold’
CV/CV:C	[kita:l] ‘train’	[ʔali:b] ‘milk’
CVC/CVC	[sibsib] ‘slippers’	[ʔattis] ‘sit down’
CVC/CV:C	[ʔaffu:l] ‘bird’	[sajnu:t] ‘olives’

Tri-syllabic words

CV/CV/CVC	[ʔukəlɪt]	‘chocolate’
CV/CV/CV:C	[batalo:n]	‘trousers’

There were attempts to delete the coda consonant resulting in bimoraic minimal truncations (CV:C > CV:) and disyllabic forms by merely deleting the extrasyllabic consonant or coda deletion as in (5.20 a-d) for example and/or compensatory vowel-lengthening as in (5.20 d-f). Such cases occur sometimes due to segmental difficulties i.e. when a coda consonant such as one of the liquids [l, r] has not yet been acquired by the child. It should be noted here that these children just deleted the coda consonant without applying a CL process sometimes.

(5.20) Examples of coda deletion in age group (2) data

CV:C > CV:

a./mi:n/	[mi:]	‘Who’	(Naw 1;4)
b./fi:l/	[bi:]	‘elephant’	(Mays 1;5 & Naw 1;4)
c./ʔasi:r/	[ʔasi:]	‘juice’	(Mar 1;5 & Nor 1;6)
d./liʔba/	[li:ba]	‘toy’	(Naw 1;4 & Rem 1;5.10)

CVC/CV > CV/CV

g./mimi:n/	[mimi:]	‘Mimeen (a name)’	(Mays 1;5)
h./ʔitne:n/	[ʔine:]	‘two’	(Naw 1;4)

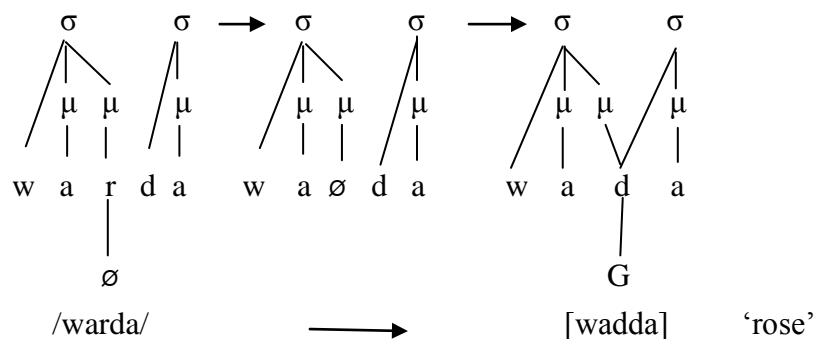
Coda deletion may result in prosodic restructuring and it provides another evidence for moraic conservation as shown in the previous examples of CL. There are other cases where loss of codas of the first syllable causes moraic conservation through compensatory lengthening of the following consonant, the onset of the second syllable instead of vowel-lengthening. The following examples drawn from the data are illustrative of CL in such cases:

(5.21) Examples of CL

/kalbu:na/	[kabbu:na]	‘dog’	(Nor 1;6)
/dabdu:b/	[daddu:b]	‘teddy bear’	~
/ʃaʃfu:ra/	[ʃaffu:na]	‘bird’	~
/sandal/	[saddal]	‘sandal’	(Mar 1;5)
/ʃurba/	[subba]	‘soup’	~
/ʃanta/	[satta]	‘bag’	~
/ʔarnab/	[ʔannab]	‘rabbit’	~
/dʒazma/	[damma]	‘shoes’	(Mays 1;5)

The deleted coda of the first syllable leaves a stranded mora that is linked to the following consonant and these results in CL i.e. lengthening of the following consonant as shown in (5.22). The coda consonant [r] is deleted leaving a stranded mora and creating a geminate by lengthening the following consonant [d] in a compensatory process.

(5.22) An example illustrating CL



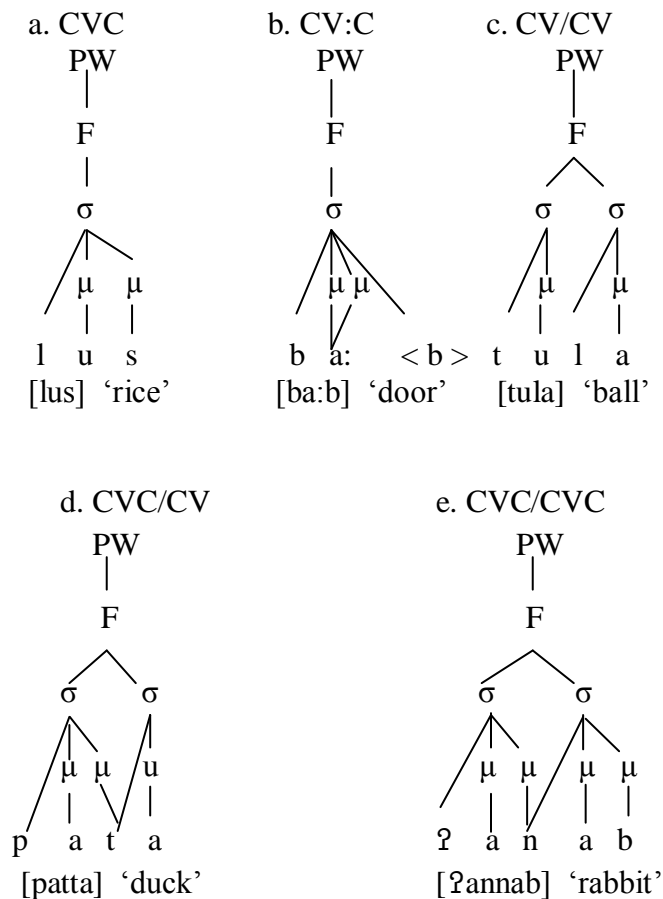
In child language, the production of fricatives is easier finally than initially or, in other words, when produced post-vocally rather than pre-vocally. This particular class of sounds has not yet been acquired by these subjects. Only [s] and very rarely [ʃ] occurred as a coda consonant in word final position. The only

example found ending with [ʃ] which is [bibiʃ] ‘shower’ produced by one of the subjects, Nor.

5.2.5 The prosodic structure of age group (2) subjects’ early words

As to the prosodic hierarchy of these children’s early words, Figure 5.9 illustrates the prosodic structure of different word shapes found in the data analyzed.

Figure 5.9: Prosodic structure of the most common lexical items in age group (2) data.



The analysis has demonstrated that these subjects’ word productions mostly contain disyllabic forms which constitute the majority of their early words (CV/CV, CV:/CV, CVC/CV, CV/CVC, CVC/CVC) and heavy/bimoraic and superheavy syllables in their monosyllabic forms (CVC, CV:C) (see Table 5.4 and Figures 5.7 and 5.8). Most of the monosyllabic words exhibit foot binarity either

by containing vowel length (CV:) or by the presence of a postvocalic coda (CVC). These forms are produced as [(CV)Ft]PW, or with vowel lengthening, as [(CV:)Ft]PW, or with a rhyming coda [(CVC)Ft]PW. Very few light/monomoraic CV forms (3%) have been found in the data analyzed. The unmarked (monomoraic) CV structure appears as a result of a number of phonological processes such as coda deletion and syllable structure truncations (e.g. initial or final syllable deletion, and unstressed syllable deletion). Minimal bimoraic forms with CVC, CV/CV, and CVC/CV structures appear quite early as the data analysis of age group (1) subjects' early words has shown. These forms continue to be the most dominant structures, but they appear with various templates as seen in age group (2) children's words productions (see examples given in Table 5.4).

Age group (2) subjects produced words with strong monosyllables (S), but there is a strong preference for trochees (SW). Structures with iambs (WS) and (WSW), i.e. a trochee with an initial unfooted syllable began to appear at this stage of word production (see examples from the data given below in (5.23)). FB and PH are fulfilled in these subjects' productions in such an early stage as shown in Figure 5.9. Most of the forms are disyllabic or bimoraic monosyllables. Lack of monomoraic words in the data could be attributed to the lack of exposure to monomoraic targets and to the fact that most of children's initial productions frequently undergo consonant and syllable deletion/truncations and vowel lengthening even after truncations of di- and tri-syllabic words.

(5.23) Examples of PW structures (S, SW, WS, & WSW) in group (2) data.

(S)				
CVC	/ˈkalb/	[ˈkab]	‘dog’	(Mar 1;5)
	/ˈlaʔ/	[ˈlaʔ]	‘No’	(Naw 1;4)
CV:C	/ˈmoːz/	[ˈmoːs]	‘banana’	(Nor 1;6)
	/ˈbeːt/	[ˈbeːt]	‘house’	~
(SW)				
CV/CV	/ˈmoːja/	[ˈbuwa]	‘water’	(Mays 1;5)
	/ˈkuːra/	[ˈtula]	‘ball’	~
CV:/CV	/ˈsiːdu/	[ˈtiːdu]	‘grandpa’	(Nor 1;6)
	/ˈʃoːka/	[ˈkoːka]	‘fork’	(Naw 1;4)
	/sajˈjaːra/	[ˈjaːla]	‘car’	~
CVC/CV	/ˈdʒadda/	[ˈdadda]	‘grandma’	(Nor 1;6)
	/maˈxadda/	[ˈʔadda]	‘pillow’	(Mays 1;5)
CV/CVC	/ʔinab/	[ʔinam]	‘grapes’	(Nor 1;6)
	/sahin/	[tahin]	‘plate’	(Nor 1;6; & Mar 1;5)
CV:/CVC	/baˈtaːtis/	[ˈtaːtis]	‘potato’	(Marm 1;5.10 & Nor 1;6)
	/ˈbaːrid/	[ˈbaːlid]	‘cold’	(Mar 1;5 & Mays 1;5)
CVC/CVC	/ˈsandal/	[ˈsaddal]	‘sandal’	(Mar 1;5)
	/ˈʔarnab/	[ˈʔannab]	‘rabbit’	~
(WS)				
CV/CV:C	/giˈtaːr/	[kiˈtaːl]	‘train’	(Mays 1;5)
	/huˈsaːn/	[ʔaˈsaːn]	‘horse’	~
CVC/CV:C	/ʔaʃˈfuːr/	[ʔaʃˈfuːl]	‘bird’	(Nor 1;6)
	/zaiˈtuːn/	[saiˈnuːt]	‘olives’	(Mar 1;5)
(WSW)				
CV/CV:/CV	/ʔaruːsa/	[ʔaˈluːsa]	‘doll’	(Nor 1;6)
	/huˈfaːda/	[ʔaˈfaːda]	‘diaper’	~
CVC/CV:/CV	/balˈloːna/	[balˈloːni]	‘balloon’	~
	/sajˈjaːra/	[sijˈjaːla]	‘car’	(Mar 1;5)

Some of the bisyllabic words end with open syllables but some end with closed syllables; coda appears medially in words (CVC/CV) with medial geminates or with two different consonant.

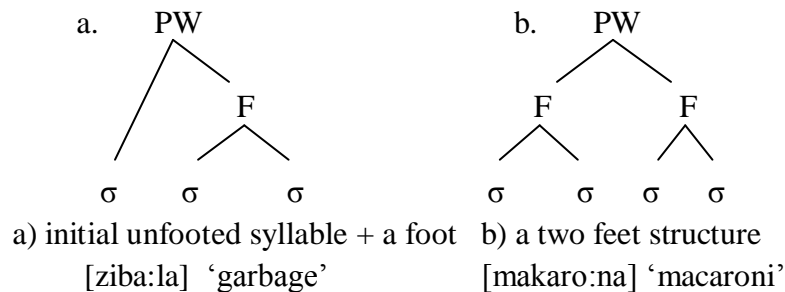
5.2.5.1 Word Size restrictions: minimality and maximality effects

These subjects’ productions demonstrate sensitivity to word minimality constraint and show an appeal to foot binarity as well. Therefore, most of their

monosyllabic and disyllabic words produced by them obey the minimality constraint that requires binary foot and the maximality constraint as well (see examples from the data in (5.22)). Their production of CVC, CV:C, CV/CV:C, CV/CVC, CVC/CVC, and CVC/CV:C target forms show that coda acquisition is slowly and gradually developing. But there are cases where attempts to produce codas fail sometimes and deletion takes place (CVC > CV; CV:C > CV:, CV/CVC > CV/CV) yielding forms constrained by the subminimality, minimality, and maximality constraints.

Few instances of prosodic words composed of more than a single foot (i.e. trisyllabic and quadri-syllabic words) have been found in the data. Examples to show the prosodic structure of such forms consisting of more than one foot are given below:

(5.24) Prosodic words composed of more than a single foot:



Example (5.24a) shows a trisyllabic structure with a single foot and an initial unfooted syllable, whereas example (5.24b) shows a quadri-syllabic structure requiring two feet.

A small portion of tri-syllabic words (10.2 %) have been found in age group (2) data. These words contain more than a foot: an initial unfooted syllable and one foot. Examples of these words that were found only in the data elicited from Mar (1;5) and Nor (1;6) are given in (5.25). They show identity with the adult targets in prosodic structure. More complex forms such as the quadri-syllabic forms that contain two feet as illustrated in example (5.24b) never occur at the second quarter of the child's second year. Apart from three quadri-syllabic words (e.g. [makalo:na] 'macaroni,' [ʔaddi:laha] 'give her,' and [masala:ma] 'goodbye,' no

instances were found in the data because these are considered rare productions at such an early stage.

(5.25) Examples of trisyllabic forms showing identity with adult's targets

/ħa'la:wa/	[ʔa'la:wa]	'candy'	(Mar 1;5)
/saj'ja:ra/	[sij'ja:la]	'car'	(Mar 1;5 & Mays 1;5)
/ħu'fa:da/	[ʔa'fa:da]	'diaper'	(Nor 1;6 & Lin 1;6)
/zi'ba:la/	[si'ba:la]	'garbage'	(Nor 1;6)
/samaka/	[ʔamaka]	'fish'	(Al 1;4.10 & Mays 1;5)

In most cases when these children attempted producing such a complex type of words, they employed truncation processes to truncate some syllables to yield these words to CV, CV:, CV/CV or CV:/CV structures (e.g. [samaka] > [ka] 'fish', [ziba:la] > [ba:la] 'garbage', [ballo:na] > [no:na] 'balloon,' [tuffa:ħa] > [wa:ħa] 'apple') of which the disyllabic forms are considered the most common/preferred patterns among these children's productions at this early stage. Thus, during this period, these subjects, similar to children speaking other languages such as Spanish and Catalan, display a maximality effect to a moraic trochee. Examples from this study data are the following:

(5.26) Example of disyllabic SW forms resulting from truncations of trisyllabic targets: CV/CV:/CV > CV:/CV (WSW > SW)

/saj'ja:ra/	[ja:la]	'car'	(Naw 1;4; Naw 1;5)
/ħu'fa:da/	[fa:da]	'diaper'	(Mays 1;5)
/ba'ħa:tis/	[ħa:tis]	'potato'	(Mar 1;5)
/ʔa'ru:sa/	[lu:sa]	'doll'	(Naw 1;4)
/bi'dʒa:ma/	[da:ma]	'pyjama'	(Nor 1;6)
/ma'xadda/	[ʔadda]	'pillow'	(Naw 1;4; Mays 1;5)

The analysis has also shown that there is a contrast in the production of iambic bisyllabic WS and trisyllabic WSW words. Though these subjects have fully produced WSW forms as in (5.25), but they have truncated some to conform to bisyllabic trochees. Moreover, some of the bisyllabic iambic WS targets have been truncated rendering (S) forms as in (5.27a) and some bisyllabic trochaic SW forms have also been truncated resulting in forms consisting of the weak syllable (W) as in (5.27b).

(5.27) Bisyllabic target words: (SW or WS > S)

a. CV/CV:C > CV:C			
/xa ¹ la:s/	[la:s]	‘finished’	(Naw 1;4)
/la ¹ zi:z/	[di:d]	‘delicious’	(Mays 1;5)
/bas ¹ ko:t/	[to:k]	‘biscuit’	(Nor 1;6)
/fus ¹ ta:n/	[ta:n]	‘dress’	~
/dʒaw ¹ wa:l/	[wa:l]	‘mobile’	~
/lai ¹ mu:n/	[mu:n]	‘lemon’	(Mar 1;5; Nor 1;6)

b. CVC/CVC > CVC & CVC/CV > CV			
/ʔarnab/	[nab]	‘rabbit’	(Mays 1;5)
/ʔanta/	[ta]	‘bag’	(Naw 1;4)

In (5.27a) examples, the initial weak/unstressed syllables are truncated showing a preference for the strong stressed syllable that is mostly preserved by children whereas examples in (5.27b) show that some subjects tend to truncate the stressed syllables sometimes though in all the examples given above, the final syllables are mostly the preserved ones.

(5.28) Trisyllabic target words: (WWS > S) and (SWW > SW, WS, or S)

a. WWS > S

/tilifo:n/	[fo:n] ~ [ʔo:n]	‘telephone’	(Nor 1;6 & Mays 1;5)
/burtuga:n/	[ka:n]	‘orange’	(Mar 1;5)
/ʔiskiri:m/	[ki:m]	‘ice cream’	(Mar 1;5 & Nor 1;6)

b. SWW > W or S

/samaka/	[ka]	‘fish’	(Mays 1;5)
/bagara/	[ba]	‘cow’	(Naw 1;4)

Thus, at this early period of word acquisition, these subjects display a maximality effect to a bisyllabic foot, be it trochaic or iambic. Most of the adult prosodic shapes given in (5.27) and (5.28) are truncated to conform to bimoraic minimal and bisyllabic outputs. The few CV forms found in the data are the result of truncations of mono-, di- and trisyllabic forms as shown in (5.28). There are no instances of augmentation of CV targets to conform to a binary foot. Few instances of CL occurred to compensate for coda deletion in truncated target forms and produce bimoraic outputs such as the following in (5.29):

(5.29) /ʔahmad/	[ʔa:]	‘Ahmad (a name)’	(Naw 1;4)
/taʕri:d/	[ta:] ~ [ta:j]	‘Taghreed (a name)’	~
/laʔ/	[la:]	‘No’	(Mays 1;5)

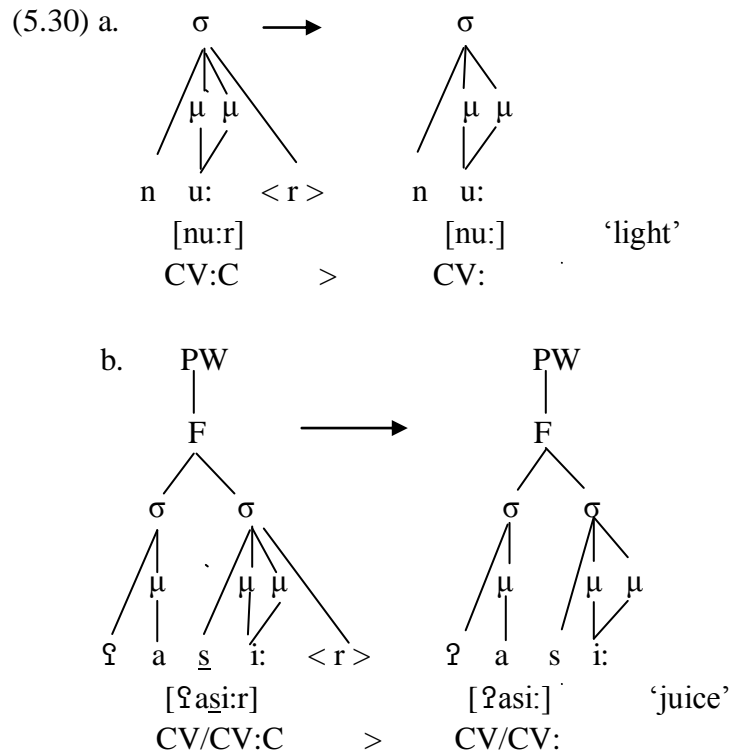
The occurrence of more bimoraic words than subminimal/monomoraic forms in the data could be attributed to language-particular evidence from Arabic which is being characterized by a low frequency of monomoraic words and high frequency of bimoraic words and accordingly less exposure to CV forms.

It is noticeable that these children mostly delete the initial unstressed syllable in bisyllabic WS and trisyllabic WSW words as shown in (5.25), (5.26), and (5.27). Very few truncations resulting in (W) S forms indicate that there are cases where violations of the maximality constraint take place; and such forms (i.e. WS and (W) S) are attested at this early stage. The analysis also shows that there is a preference for trochaic forms and this suggests that the moraic trochee is an active foot in child Arabic as it is in adult language. Truncated forms in child Arabic and truncation strategies employed for reducing proper nouns in adult Arabic, for instance, provide evidence in this respect. Most of the multisyllabic words have been reduced to a bimoraic or bisyllabic foot (WSW forms > SW forms, WWS > S forms, and WS > S).

Within the moraic theory framework, superheavy (trimoraic) syllables are considered marked syllables. This stage (i.e. 16-18 months) witnessed the occurrence of this type of syllables in monosyllabic and disyllabic forms in these subjects’ outputs whether as truncated or non-truncated forms (see examples in (5.21), (5.26), and (5.27)). In adult grammar, speakers sometimes resort to some phonological processes such as closed syllable shortening or epenthesis to avoid trimoraic syllables in concatenative forms (see section 3.2.2.1 for examples (3.18) and (3.19)).

No similar examples can be given here from the child data due to the fact that morphology and in particular, verbal morphology is not productive yet at this early age. Though these subjects’ outputs contain superheavy syllables of CV:C type as monosyllabic forms or as a part of bisyllabic forms or as truncated forms, sometimes these children tend to delete the extrasyllabic consonant (Watson, 2002;

Hayes, 1989) or this part of a degenerate syllable (Selkirk, 1981) as shown in (5.30) due to segmental difficulty (e.g. [nu:r] > [nu:], 'ʔasi:r > [ʔasi:] 'juice'). This in turn indicates the preference for bimoraic syllables and satisfies the bimoraicity constraint which states that syllables are maximally and optimally bimoraic.



In sum, the productions of age group (2) subjects have shown a variety of structures: few monomoraic CV forms and more bimoraic and disyllabic words demonstrating sensitivity to minimality and maximality effects and fulfilling the structural requirements of the prosodic word. The few trisyllabic words that occurred in the outputs of two subjects show structures exceeding the maximal size of a well-formed binary foot. In other words, these subjects go through a minimal word stage of phonological development where words are minimally one binary foot, and at the same stage, their productions start showing maximality effects which are active for producing maximally disyllabic words. Their target-like disyllabic outputs and the truncated forms show that there is a disyllabic maximum on prosodic words during this stage.

To conclude, age group (2) data analysis provides evidence for the presence of minimality and maximality constraints at this age (between 1;4 –1;6). The word

size maximum is a single binary foot. The subjects' productions display bimoraic outputs (S) and show a maximality effect to a bisyllabic foot, be it trochaic (SW) or iambic (WS). Many words have been truncated to conform to a bimoraic monosyllabic or bisyllabic outputs with open and closed syllables. Their early productions also show early, gradual acquisition of codas syllable finally and word finally and the occurrence of structures not only with two moras but with extrasyllabic consonants showing their capability of producing heavy and superheavy syllables. The canonical forms CVC, and CV/CV and CVC/CV with various templates constitute the majority of the early word shapes produced at this stage, and bimoraic syllable structures appear quite early as well. The children's preference for open trochaic syllable structures (CV/CV and CVC/CV) is obvious, yet gradually they start producing outputs with closed syllables and tri-syllabic words with more than a foot by approaching the second half of the second year.

5.3 Early stages: Third quarter of the second year (Age group (3))

5.3.1 The subjects' phonemic inventories

The phonemic inventory of age group (3) subjects is still limited, but marked with slight expansion. Their consonantal system includes stops, nasals, some fricatives, and glides (see Table 5.6 which presents one of the subjects' inventory (Nor 1;9) as an example).

Table 5.6 The consonant phonemes inventory of Nor (1;9)

	Labial	Labio- dental	Inter - dental	Dental- alveolar	Palatal	Velar	Uvular	Pharyn- geal	Laryn- geal
Stops	(p)* b			t d		k g			ʔ
emphatic									
Fricative		f		s z	ʃ			(ħ) (ʕ)	h
emphatic									
Nasal	m			n					
Lateral				l					
emphatic									
Tap				r					
Glide	w				j				

() = first/non-consistent appearance.

* = phonetically, but not phonemically distinct.

The consonantal system of each subject is given in (5.31).

(5.31) The consonantal system of age group (3) subjects

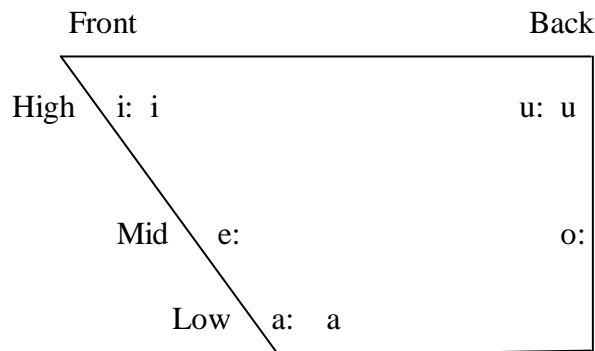
Fais:	[b, m, t, d, n, l, s, k, (g), ʔ, h, w, j]
Shah:	[b, m, t, d, n, l, s, z, k, ʔ, h, w, j]
Maw:	[b, m, t, d, n, l, s, z, ʃ, (ʒ), ʔ, h, f, k, (g), ʔ, h, w, j]
Nor:	[b, m, t, d, n, l, (r), s, z, ʃ, ʔ, h, f, k, (g), ʔ, h, w, j]
Mar:	[b, m, t, d, n, l, s, z, ʃ, (ʒ), ʔ, h, f, k, (g), ʔ, h, w, j]
Tal:	[b, m, t, d, n, l, s, z, ʃ, (ʒ), f, k, (g), ʔ, h, w, j]
Moh'd:	[b, m, t, d, n, l, s, z, (ʃ), k, (g), ʔ, h, w, j]
Trq:	[b, m, t, d, n, l, s, z, ʃ, (ʒ), ʔ, h, f, k, (g), ʔ, h, w, j]
Naw:	[b, m, t, d, n, l, s, z, ʃ, f, k, (g), ʔ, h, w, j]
Yas:	[b, m, t, d, n, l, s, z, ʃ, (ʒ), ʔ, h, f, k, (g), ʔ, h, w, j]

At this stage, the lateral liquid [l], the velar stop [k], the alveolar fricatives [s, z, ʃ], and the pharyngeal fricatives [ʔ] and [h] have been acquired. More sounds appeared in the sound inventory of some subjects (Mar, Nor, Tal, Trg, and Yas), and these are [f], [ʒ], and [r] though they do not show mastery of acquisition. The occurrence of some sounds is inconsistent in some subjects' repertoires (e.g. the velar stop [g], the liquid [r], and the fricatives [f], [ʒ], [h] and [ʔ]) for they do not appear in all positions. The sound [g] has appeared in medial position in one word only [ʔaggi] 'It's mine.' This indicates that these sounds are not yet controlled by some children. No long string vocalizations or polysyllabic non-words appeared at this stage. The emphatic sounds [t̤, d̤, s̤, z̤] are still de-emphasized at this stage and the pharyngeal sounds are still substituted by other glottal sounds [ʔ, h].

As to the segmental position of the phonemes acquired, in addition to stops and nasals, few other sounds have appeared as coda consonants. Still there is a preference for initial stops and nasals [b, m, n, t, d, k, ʔ] but also glides and the liquid lateral [l] appeared as onsets. Few fricatives [s, z, ʒ] appeared as onsets in the repertoire of some subjects (Mar, Nor, and Yas). All these sounds appeared medially too. Regarding the order of acquisition of contrasting consonants, the subjects' productions exhibited various oppositional contrasts: oral stop and nasal opposition, stop and fricative opposition, stop and liquid opposition, and stop and glide opposition.

These subjects' vowel system includes the short vowels [a, i, u] with their long counterparts and the mid front and back vowels [o:] and [e:] (see Figure 5.10).

Figure 5.10: The vowel system of age group (3)



The subjects' limited sound system indicates that their phonological development is a gradual process that coincides with their limited cognitive and maturational abilities. Consequently, this leads to a gradual increase in the complexity of their lexical development as we will see when analyzing the syllable and word internal structure of their word productions.

5.3.2 Gemination and consonant clusters

The data shows instances of the occurrence of gemination in medial position which appears early as manifested in age group (1) and (2) data. All the subjects attempted and produced spontaneously many words with medial geminates in their spontaneous and attempted utterances (e.g. [bissa] 'cat,' [kakku] 'open,' [ʔamma] 'aunt.').

As to CC, most of the target words with CC were subject to a reduction process. Very few instances of CC were found in this data (see 5.32).

(5.32) Examples of consonant clustering in age group (3) data:

Initial	/mbuwa/	[mbuwa]	'water'	(Fais 1;7, Shah, 1;8 & Mohd 1;9)
Final	/bint/	[bint]	'girl'	(Nor, Yas, Tal & Mar 1;9)
Final	/kalb/	[kalb]	'dog'	(Mar 1;9)
Final	/gird/	[gird]	'monkey'	(Mar 1;9 & Yas 1;9)

Another example of initial CC, [fr-] (fricative + liquid), which is not always attested in Arabic, is produced by Nor in her production of the English word *frog* as

[frogi] ‘my frog.’ The same child and another two (Yas and Tal) produced the final CC [-ps] (stop + fricative) in an English word, *chips* as [tips] and [sips].

5.3.3 Word Syllabic structure

The data analysis shows a degree of word complexity in the subjects’ productions similar to that of age group (2) subjects’ outputs. There is a gradual increase in the number, type and order of syllables. The data show that these children’s words are not restricted to certain patterns and canonical shapes such as CVC, CV:C, CV/CV, CVC/CV, but the subjects have started producing disyllabic words with various canonical shapes and multisyllabic words as well (i.e. tri- and quadrisyllabic words). Figure 5.11 given below shows that most of their words are disyllabic (64.2%), followed by monosyllabic words (22.1%), tri-syllabic words (13.5%), and quadrisyllabic forms (.1%). The occurrence of quadrisyllabic forms at this stage (i.e. 19-21 months) is actually very rare.

Figure 5.11 Percentage of word syllabic types in age group (3) data

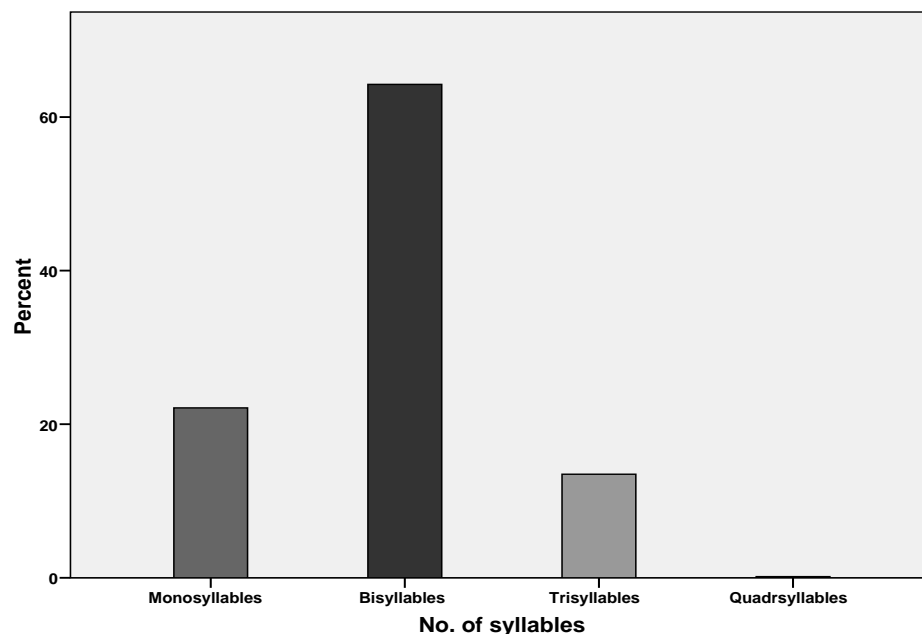
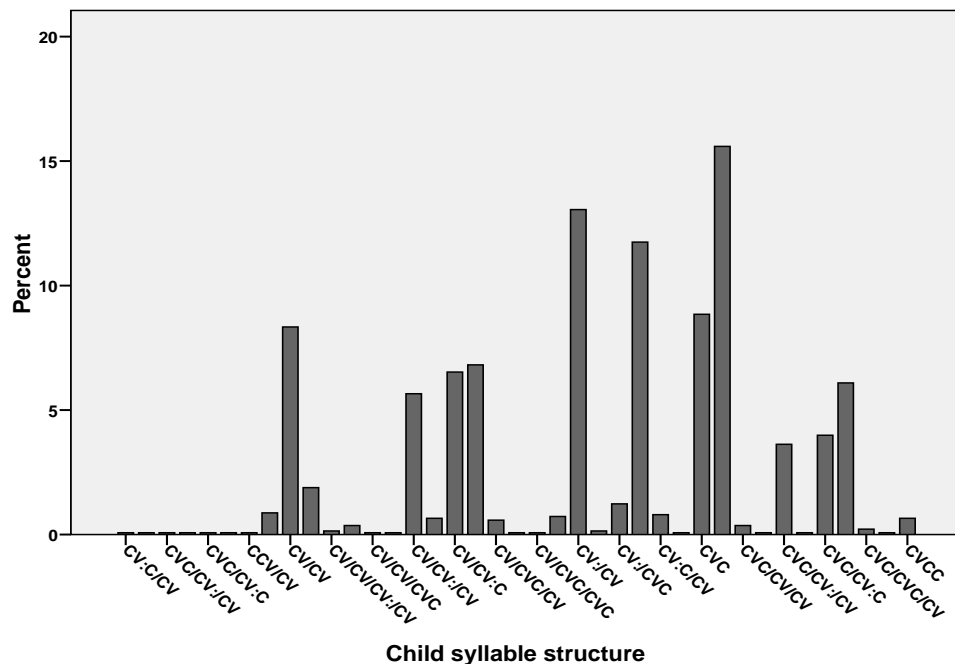


Figure 5.12 and Table 5.7 show the various canonical shapes and syllable types of these children's lexical items provided with some examples from the data. The majority of words produced are disyllabic (64.2%) with various canonical shapes: CVC/CV (15.6%), CV:/CV (13.1%), CV/CV (8.3%), CV/CVC (6.8%), CVC/CVC (6.1%), CV/CV:C (6.5%), and CVC/CV:C (4%). The other preferred word types to these children are monosyllabic words (22.1%) with these two syllable shapes: CVC (8.8%), CV:C (11.7%), CV: (.7%), and CV (.9%). The trisyllabic forms (13.5%) have few canonical shapes: CV/CV:/CV (3.6%), CVC/CV:/CV (3.6%) and CV/CV/CV (1.9%). Two of the subjects did not produce any tri-syllabic words. The proportion of CV (.9 %) and CV: (.7%) is very small. Quadrisyllabic forms (CV/CV/CV:/CV) constitute a very small portion (.1%).

Figure 5.12 Percentage of syllabic/canonical shapes in age group (3) data



Most of the words with CV, CVC, CV:C, CV/CV, and CV:/CV structure are di-syllabic words reduced to mono- syllabic or tri- and quadri-syllabic words

reduced to CV:C or CV/CV or CV:/CV structure via phonological processes such as syllable truncation (e.g. [dʒawwa:l] > [wa:l] ‘mobile phone’ and [basko:t] > [ko:t] ‘biscuit,’ and [[ʃəkala:ta] > [ka:ta] ‘chocolate.’ These children’s word patterns are similar to those of age group (2) (see Table 5.5 in section 5.2.3). There has been a gradual development and an increase in the complexity of word patterns depending on the gradual acquisition of sounds. Word pattern expansion is noticeable at this stage. Various contrasting patterns were used by the subjects (e.g. stop + nasal; nasal + stop; stop + fricative; or stop + glide). They have expanded their word patterns by analogy or overgeneralization process which plays a significant role in the acquisition of phonology at this stage.

Table 5.7 Examples of the different syllable types and canonical shapes

<i>Monosyllables</i>		
CVC	[kab] ‘dog’	[bis] ‘cat’
CV:C	[be:t] ‘house’	[wa:l] ‘mobile phone’
<i>Disyllables</i>		
CV/CV	[buwa] ‘water’	[tula] ‘ball’
CV:/CV	[ko:ta] ‘biscuit’	[wa:wa] ‘candy’
CVC/CV	[bissa] ‘cat’	[makwa] ‘iron’
CV/CVC	[ʔuʃut] ‘comb’	[ʔakil] ‘food’
CV:/CVC	[ta:tis] ‘potato’	[wa:hid] ‘one’
CV/CV:C	[ʔasi:l] ‘juice’	[ʔasa:n] ‘horse’
CVC/CVC	[ʔabbas] ‘wear’	[ʔannab] ‘rabbit’
CVC/CV:C	[subba:k] ‘window’	[daddu:b] ‘teddy bear’
<i>Tri-syllables</i>		
CV/CV:/CV	[kabi:ra] ‘big’	[ʔafa:da] ‘diaper’
CV/CV/CV	[kamaka] ‘fish’	[bagala] ‘cow’
CVC/CV:/CV	[ballo:na] ‘balloon’	[takki:na] ‘knife’
CV/CV/CV:C	[batalo:n] ‘trousers’	—

It should be noted here that word patterns in which the consonants show identity in place and manner are less frequent at this later stage due to less application of the reduplication and consonant harmony processes. Both processes still operate at this stage but they are not as frequent and active as in the very early period of word acquisition (i.e. 12-15 months and 16-18 months). Sound

substitution and syllable structure simplification processes are more common and frequent at this stage; they operate actively yielding most of the patterns given above. Still at this stage, glottals and glides are freely used to replace other sounds initially, medially and finally.

5.3.4 Onset and coda acquisition

The subjects' onset and coda inventory is given below in (5.33).

(5.33) Onset inventory: [b, m, t, d, n, l, s, z, h, k, ʔ, w, j]

Coda inventory: [b, m, t, d, n, l, s, ʃ, h, k, ʔ, h, j]

All the words elicited have initial onsets (stops, nasals, glides, and very few fricatives). The subjects produced word-final consonants in target-like manner but within their own limited sound inventory. Many of their di- and tri-syllabic words end with open syllables due to templatic factors, but a considerable number of words began to appear with a coda consonant. Few consonants appear as codas in word final position in CVC and CV:/CVC words, and some consonants began to appear in syllable final position in the first syllable of CVC/CV and CVC/CVC structures (i.e. C1VC2/C3V and C1VC2/C3VC4). Medial onsets are deleted sometimes due to segmental difficulty (e.g. [ʔabʌa] > [ʔaba] 'I want').

These subjects produced more codas than the younger subjects of age group (1) and (2). Their performance was better on the least sonorant stop consonants though their usage of nasals, liquids and the few fricatives acquired was remarkable. The production of the word-final liquid [l] was much better than the trill liquid [r] for these older subjects because the latter sound is still considered a marked segment at this stage. Most of these children tend to delete this sound and some of the fricatives or substitute them by other sounds. The palatal glide [j] occurred as coda in very few words. As to fricatives, these subjects' performance was better in producing them in medial and final position rather than in initial position. All this indicates the gradual development of codas at this period.

Codas appeared in these subjects' monosyllabic, disyllabic, and trisyllabic outputs not only word finally but also syllable finally as shown in (5.34). Real medial codas began to appear at this stage. Very few instances were found in the

data (e.g. /ʃanta/ > [tanta] ~ [santa] ‘bag’ (Fais 1;7 & Mar 1;9), /makwa/ > [makwa] ‘an iron,’ /gahwa/ > [kahwa] ‘coffee’, and /zahma/ > [zahma] ‘crowded’ (Maw 1;8). /ʃaʕri/ > [taʕli] ‘my hair’ (Fais 1;7). Similar to age group (2) subjects, these subjects, in most cases, produced medial codas/closed syllable final coda as part of a geminate consonant (e.g. /ʕamma/ > [ʕamma] ‘aunt,’ (Tal 1;9) batta [p^hatta] ‘duck’ (Shah 1;7) which is a feature of Arabic structure or after applying a CL process in some cases as shown in the examples given in (5.35).

(5.34) Occurrences of coda consonants in different word shapes

Monosyllables

CVC	[kab] ‘dog’	[ʔan] ‘car’	[bis] ‘cat’
CV:C	[ki:m] ‘ice cream’	[ba:b] ‘door’	[wa:l] ‘mobile phone’

Disyllables

CV/CVC	[magas] ‘scissors’	[kumsum] ‘nose’
CV:/CVC	[ba:lid] ‘cold’	[lazi:z] ‘delicious’
CV/CV:C	[ʔasi:l] ‘juice’	[husa:n] ‘horse’
CVC/CV	[makwa] ‘iron’	[zahma] ‘crowded’
CVC/CVC	[ʔabbas] ‘wear’	[ʔattis] ‘sit down’
CVC/CV:C	[ʔaffu:l] ‘bird’	[daddu:b] ‘teddy bear’

Tri-syllables

CVC/CV:/CV	[ballo:na] ‘balloon’	[takki:na] ‘knife’
CV/CV/CV:C	[batalo:n] ‘trousers’	[tafalo:n] ‘telephone’

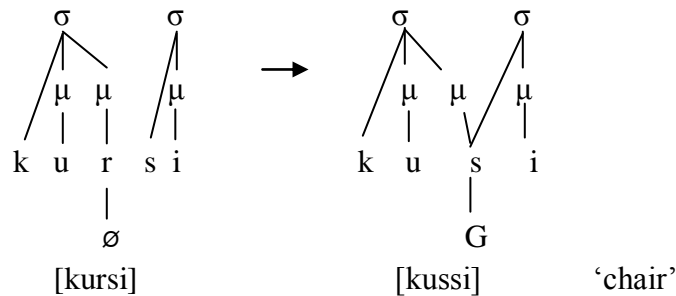
There were no attempts to delete word final codas in monosyllabic CVC forms or extrasyllabic consonants in CV:C structures which usually results in bimoraic minimal truncations (CVC > CV: and CV:C > CV:). Attempts to assimilate a syllable final coda in the first syllable of disyllabic words to the onset of the following syllable or delete it are more frequent, and for the sake of moraic conservation, a CL process takes place to compensate for coda loss and restructure the words prosodically (see section 5.2.3)(see the examples in 5.35).

(5.35) Examples of CL

/ʔalbas/	[ʔabbas]	‘wear’	(All subjects)
/ʔarnab/	[ʔannab]	‘rabbit’	(Nor 1;9)
/mufta:h/	[mutta:h]	‘key’	(Nor 1;9 & Tal 1;9)
/kursi/	[kussi]	‘chair’	(Maw 1;8 & Yas 1;9)

The deleted coda of the first syllable leaves a stranded mora that is linked to the following consonant and this process results in consonant lengthening of the following consonant as illustrated in (5.36).

(5.36) An example illustrating CL

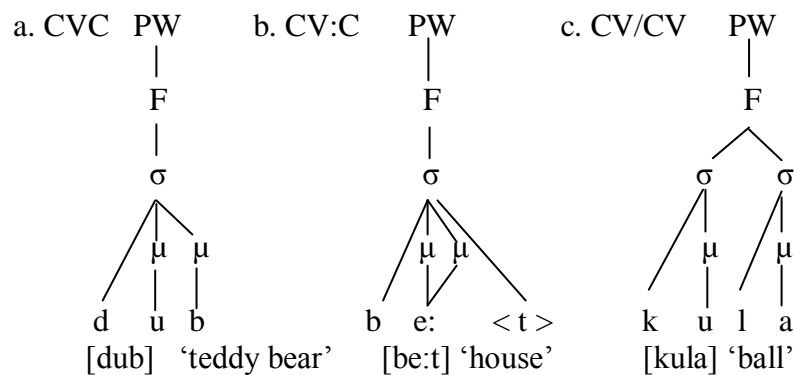


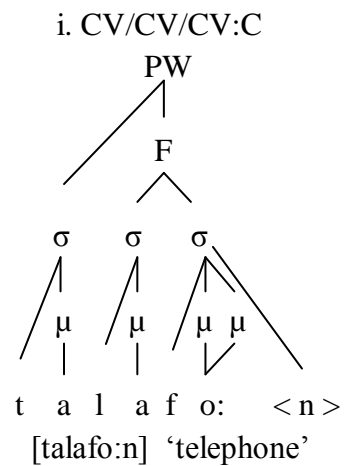
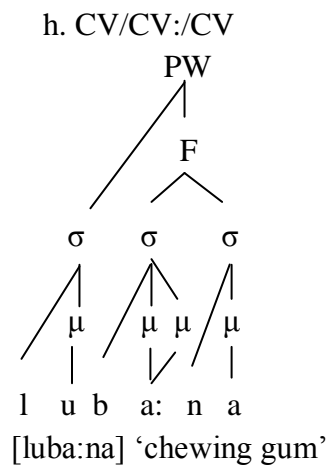
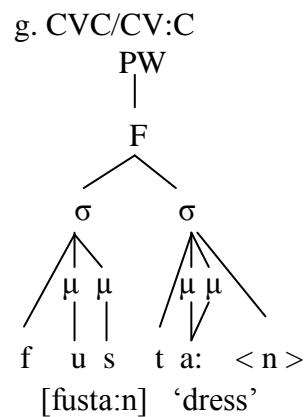
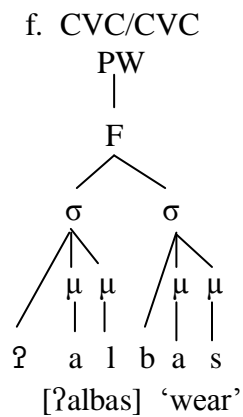
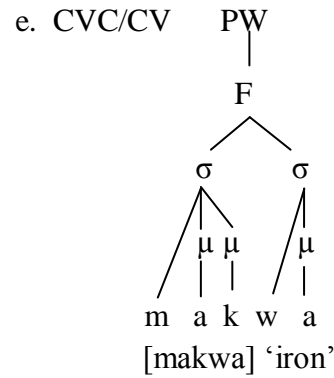
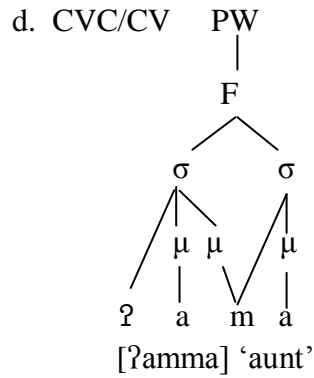
The coda consonant [r] is deleted leaving a stranded mora and creating a geminate (G) by lengthening the following consonant [s] in a compensatory process.

5.3.5 The prosodic structure of age group (3) subjects' early words

Figure 5.13 provides the hierarchical prosodic structure of different word shapes found in age group (3) data.

Figure 5.13: Prosodic structure of early words in age group (3) data





The analysis has demonstrated that these subjects' word productions contain monosyllabic, disyllabic and few trisyllabic forms of which the disyllabic ones constitute the majority of their outputs. The figures given above show that these words contain three types of syllables: light, heavy/bimoraic, and superheavy syllables that differ in their degree of prominence in prosodic phenomena

depending on mora count (see examples in Table 5.7 and Figure 5.13). Some of them contain a geminate consonant (G), and some short or long vowels. Some end with open syllables and some with closed syllables.

Under syllabic and prosodic/moraic analysis, these subjects produced very few monomoraic CV forms (.9%). Most of these appeared as truncated forms by a number of phonological processes such as coda deletion and syllable structure truncations. Their monosyllabic words are bimoraic forms with a single foot. These forms are produced either with a long vowel as [(CV:)Ft]PW, or with a rhyming coda [(CVC)Ft]PW as shown in (a & b). Some of these monosyllabic forms consist of a superheavy syllable with a long vowel and closed with an extrasyllabic consonant [(CV:C)Ft]PW. Minimal bimoraic forms with CV:, CVC structures and disyllabic words with CV/CV, and CVC/CV structures appear quite early as demonstrated in the data analysis of age group (1) subjects' early words. These word shapes continue to appear in age group (2) and (3) productions but with more complexity in structure and in various templates (see examples given in Table 5.7 and Figure 5.13).

As to foot structure, there is a strong preference for syllabic trochee (SW) in age group (3) subjects' outputs. Structures with (S), iambs (WS) and a trochee with an initial unfooted syllable (WSW) also occurred in their word productions (see examples from the data in (5.37)). FB is fulfilled in these subjects' productions as shown in Figure 5.13. Most of the forms are bimoraic monosyllabic words and disyllabic forms. Many of these forms were the result of reduction processes and strategies (e.g. coda and syllable deletion/truncations and CC reduction) employed by the subjects to truncate multisyllabic targets i.e. di-, tri- and quadrisyllabic words. There is a preference of trochaic forms (SW) in these subjects' outputs, but there are instances of iambic utterances (WS) as well. Superheavy syllables usually occur as final syllables and they often carry the primary stress. Some of the early words of these subjects are identical to some extent to disyllabic target forms with this type of syllable (see examples in (5.34)). A tendency to realize the existence of a pretonic syllable began to appear at this stage. This is evident in their production of trisyllabic words with a weak unfooted syllable (WSW) as shown in (5.37)). The

few examples found are mere truncations of multisyllabic targets. Some of the bisyllabic and few of the trisyllabic words end with open syllables but some end with closed syllables.

(5.37) Examples of PW structures (S, SW, WS, & WSW) in group (3) data.

(S)				
CVC	/ ^l ruz/	[^l lus]	‘rice’	(Nor 1;9)
	/ ^l laʔ/	[^l laʔ]	‘No’	(Shah 1;7)
CV:C	/ ^l mo:z/	[^l mo:s]	‘banana’	(Maw 1;8)
	/ ^l ʔe:ʃ/	[^l ʔe:s]	‘bread’	(Fais 1;7)
(SW)				
CV/CV	/ ^l mo:za/	[^l mo:sa]	‘banana’	(Fais 1;7)
	/xudi/	[^l ʔudi]	‘take’	(Shah 1;7)
CV:/CV	/ ^l be:da/	[^l be:da]	‘egg’	(Nor 1;9)
	/bas ^l ko:t/	[^l ko:ta]	‘biscuit’	(Fais 1;7)
	/ ^l ka:sa/	[^l ka:sa]	‘glass’	(Maw 1;8)
CVC/CV	/dʒadda/	[^l dadda]	‘grandma’	(Nor 1;9)
	/ ^l ʃanta/	[^l tanta]	‘bag’	(Fais 1;7)
CV/CVC	/magas/	[magas]	‘scissors’	(Nor 1;9)
	/ ^l ʃahin/	[^l tahin]	‘plate’	~
CV:/CVC	/ba ^l ta:tis/	[^l ta:tis]	‘potato’	(Fais 1;7)
	/ ^l wa:hid/	[^l wa:hid]	‘one’	(Maw 1;8)
CVC/CVC	/ ^l ʔalbas/	[^l ʔabbas]	‘wear’	(Fais 1;7)
	/ ^l ʃibʃib/	[^l sibsib]	‘slippers’	(Nor 1;9)
(WS)				
CV/CV:C	/gi ^l ta:r/	[gi ^l ta:l]	‘train’	(Nor 1;9)
	/hu ^l sa:n/	[ʔa ^l sa:n]	‘horse’	(Maw 1;8)
CVC/CV:C	/ʔa ^l fu:r/	[ʔaf ^l fu:l]	‘bird’	(Nor 1;9)
	/bas ^l ko:t/	[bakku:t]	‘biscuit’	~
(WSW)				
CV/CV:/CV	/hu ^l fa:da/	[ʔa ^l fa:da]	‘diaper’	(Maw 1;8)
	/lu ^l ba:na/	[lu ^l ba:na]	‘chewing gum’	(Nor 1;9)
CV/CV:/CVC	/tama:tim/	[tama:tin]	‘tomato’	~
	/ba ^l ta:tis/	[bata:tis]	‘potato’	~
CVC/CV:/CV	/sakki:na/	[takki:na]	‘knife’	~
	/tuffa:ha/	[tuffa:ha]	‘apple’	~

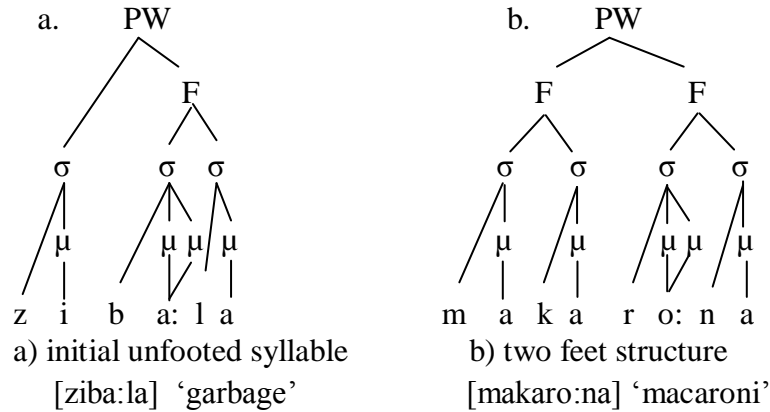
Results of age group (1) and (2) data analysis have shown that coda appears very early. Both final and medial coda appeared early. Codas appeared medially in words with geminate consonants (C1VC2/C2V). The occurrence of final codas was controlled by the sonority principle and the limited sound inventory of the subjects. The data analysis of age group (3) provides similar results but it has shown more complexity in word structure, i.e. an increase of words closed with word final coda segments, and medial or syllable final codas as a geminate consonant (C1VC2/C2V) or a different consonant (C1VC2/C3V).

5.3.5.1 Word size restrictions: Minimality and maximality effects

Age group (3) subjects have shown an appeal to foot binarity and an awareness of word minimality constraint. Most of their monosyllabic and disyllabic words obey the minimality constraint requiring two moras and the maximality constraint requiring disyllabic foot (see examples from the data given in (5.38) and Figure 4.15). Their production of CVC, CV:C, CV/CVC, CV/CV:C, CVC/CVC, and CVC/CV:C target forms show the degree of increase in structure complexity and how coda acquisition process is still gradually developing though there are cases where attempts to produce codas fail sometimes and deletion takes place (CV:C > CV:, CV/CVC > CV/CV) yielding bimoraic and bisyllabic forms constrained by minimality, and maximality constraints.

Instances of prosodic multisyllabic words composed of more than one foot have been found in the data. Trisyllabic words constitute (13.5%) of the data, but quadrisyllabic words are very few and they constitute (.1%). Figure 5.14 shows the prosodic structure of such forms:

Figure 5.14 Prosodic words composed of more than foot



A trisyllabic word consists of an initial unfooted syllable and a trochaic foot as in (5.14a). A quadri-syllabic word requires two disyllabic feet as shown in (5.14b). Few instances of tri-syllabic words (13.5%) occurred in age group (3) data. Examples of these were found mostly in the data elicited from Maw (1;8) and Nor (1;9) are given in (5.38). They manifest trisyllabic structures with a single foot and an initial unfooted syllable and they show identity with the adult targets in prosodic structure as illustrated in (5.14a).

(5.38) Trisyllabic words from age group (3) data

/hu'fa:da/	[ʔa'fa:da]	'diaper'	(Maw 1;8)
/ha'la:wa/	[ha'la:wa]	'candy'	~
/zi'ba:la/	[si'ba:la]	'garbage'	(Nor 1;9)
/ka'bi:ra/	[ka'bi:ra]	'big'	(Maw 1;8)

While attempting such complex types of structures, the subjects have employed truncation processes where one syllable is deleted or more syllables are truncated reducing trisyllabic and quadrisyllabic words to the most preferred monosyllabic and disyllabic structures CV:, CV:C, or CV:/CV structures (e.g. [ʔahmad] > [ʔa:] 'Ahmad (a name),' and [ziba:la] > [ba:la] 'garbage') at this early stage. Shah (1;7) is the only subject who reduced some disyllabic and trisyllabic targets into CV structure (e.g. [ku:ra] > [ku] 'ball,' [luba:na] > [ba] 'chewing gum'). Quadri-syllabic forms with two feet rarely occur at this early stage. The only few quadri-syllabic words found in the data are produced by Nor (1;9) (e.g. [makalo:na] 'macaroni,' [tukala:ta] 'chocolate,' [sala:matik] 'get well soon,' and the phonological phrase [masala:ma] 'good bye.'

Similar to children speaking other languages such as Spanish, Catalan, and Japanese (Lleo & Prinz, 1996; Ota, 2003; Lleo, 2006; Prieto, 2006), these subjects' outputs display a maximality effect to a moraic trochee at this stage (see the examples given in (5.39)). The analysis has also shown that there is a contrast in the production of iambic bisyllabic WS and trisyllabic WSW words. Though these subjects have fully produced WSW forms as in (5.38), there are attempts where they have truncated some to conform to bisyllabic trochees (SW) as given in (5.39).

(5.39) Examples of disyllabic forms resulting from truncations of trisyllabic and quadrisyllabic targets:

WSW > SW

/lu ^h ba:na/	[^h ba:na]	'gum'	(Shah 1;7)
/ħu ^h fa:da/	[^h da:da]	'diaper'	(Maw 1;8)
/ħa ^h ma:ma/	[^h ma:ma]	'pigeon'	(Shah 1;7)
/bid ^h ʒa:ma/	[^h ʒa:ma]	'pyjama'	(Maw 1;8)

WWS > WS

/ba ^h ta:lo:n/	[ʔa:lo:n]	'trousers'	(Maw 1;8)
/bu ^h tu:ga:n/	[bu ^h ka:n]	'orange'	(Nor 1;9)
/ti ^h li:fo:n/	[ti ^h fo:n]	'telephone'	~

WWSW > SW

/ʃu ^h ka ^h la:ta/	[ka:ta]	'chocolate'	(Fais 1;7)
/ba ^h la ^h ko:na/	[ko:na]	'balcony'	(Maw 1;8)

Some of the bisyllabic forms whether trochaic (SW) or iambic (WS) targets have also been truncated rendering monosyllabic forms (CVC, CV:C) by deleting either the first syllable or the second syllable sometimes whether it is weak or strong as illustrated in (5.40). In most cases, the initial weak/unstressed syllables are truncated showing a preference for the strong stressed final syllable that is mostly preserved by children. In Arabic, final superheavy syllables often carry the primary stress in bisyllabic words.

(5.40) Examples of bisyllabic target words rendered to monosyllabic forms
CV/CVC or CVC/CVC > CVC (WS > S)

/ma'gas/	[kas]	'scissors'	(Fais 1;7)
/ʔaŋ'kab/	[kab]	'spilt'	(Nor 1;9)

CVC/CV:C > CV:C

/dʒaw'wa:l/	[wa:l]	'mobile'	(Fais 1;7)
/lai'mu:n/	[mu:n]	'lemon'	(Nor 1;9)
/muf'ta:h/	[ta:h]	'key'	(Maw 1;8 & Nor 1;9)
/basko:t/	[ku:t]	'biscuit'	(Maw 1;8)
/jas'mi:n/	[mi:n]	'Jasmine (a name)'	(Nor 1;9)

The preference for the stressed final syllable is also manifested in monosyllabic forms resulting from truncations of trisyllabic words as shown in the examples given in (5.41).

(5.41) Trisyllabic target words reduced to monosyllabic words: (WWS > S)

/tilifo:n/	[fo:n]	'telephone'	(Maw 1;8 & Nor 1;9)
/ʔiskiri:m/	[ki:m]	'ice cream'	(Maw 1;8 & Nor 1;9)

The data analysis has so far shown that at this stage, these Arabic-speaking subjects' outputs fulfill foot binarity and display a maximality effect to a bisyllabic foot, be it trochaic or iambic. Most of the adult prosodic shapes such as those given in (5.39-5.41) are truncated to conform to bimoraic minimal and bisyllabic outputs. No instances of augmentation of CV monosyllabic forms were found in the data due to the lack of such forms in the input received and in consequence less exposure to CV forms on the part of the child. There are very few instances of augmentation of CV syllables in disyllabic utterances where CL took place to compensate for coda deletion yielding bimoraic outputs as illustrated in (5.42):

- (5.42) a. [ʔaħmad] [ʔa:] 'Ahmad (a name)' (Shah 1;7)
b. [taħri:d] [ta:] 'Taghreed (a name)' ~

Similar to age group (2) subjects, these children have a tendency of preserving the stressed and final syllable and they mostly delete the initial unstressed syllable in bisyllabic WS and trisyllabic WSW words. Truncations, resulting in monosyllabic (S) forms attested in the data, indicate that violations of the maximality constraint take place sometimes. The analysis also shows that

although the subjects of this group began to realize the existence of weak unfooted syllables, but still there is a preference for trochaic forms. This suggests that moraic trochee is an active foot in child Arabic as it is in adult language (see section 5.2.5). Most of the multi-syllabic words have been reduced to a bimoraic or bisyllabic foot (WSW forms > SW forms, WWS > S forms, and WS > S).

Within the moraic theory framework, superheavy (trimoraic) syllables are considered marked syllables. In this stage (i.e. 19-21 months), such type of syllables occurred in monosyllabic, disyllabic, and trisyllabic forms in these subjects' outputs whether as truncated or non-truncated forms (see examples in (5.39– 5.41). Adults often employ certain processes such as closed syllable shortening or epenthesis to avoid trimoraic syllables in concatenative forms (see examples 3.18 and 3.19). Similar examples cannot be found in these child data because these children's morphology has not yet developed at this stage of language acquisition. These subjects' outputs contain superheavy syllables of CV:C type as monosyllabic forms or as a part of bisyllabic forms or as truncated forms. Despite this and unlike age group (2) subjects, who have the tendency of deleting the extrasyllabic consonant due to segmental difficulty (CV:C > CV: \emptyset) (Watson, 2002; Hayes, 1989) (e.g. [nu:r] > [nu:] 'light,' [ʔaʃi:r] > [ʔaʃi:] 'juice'), these subjects tend to produce this part of a degenerate syllable (Selkirk, 1981) (see examples given in (5.39-5.41). This indicates an increase of word structure complexity and the growing development of codas at this stage of early word production.

To summarize this section, we can say that these subjects' word productions contain monosyllabic, disyllabic and multisyllabic words with various templates containing light, heavy, and superheavy syllables. They have shown a variety of structures: bimoraic minimal forms fulfilling the bimoraicity and minimality constraints, and disyllabic words fulfilling the structural requirements of the prosodic word and showing an awareness of minimality and maximality effects. The trisyllabic words and the few quadrisyllabic words found in some of the subjects' repertoire show structures exceeding the maximal size of a well-formed binary foot: structures with a single foot and an initial unfooted syllable and two

feet structures. In other words, these subjects go beyond the minimal word stage of phonological development where words are minimally one binary foot, and produce more complex structures showing maximality effects and exceeding the maximal size too. Their target-like disyllabic and trisyllabic outputs as well as the truncated forms show that there is a disyllabic maximum on prosodic words during this stage in addition to realizing the existence of weak unfooted syllables.

5.4 Summary of the findings

This section summarizes the findings of the data analysis of the three age groups regarding the phonological structure and representational nature of early words and the developmental stages of the phonological structure. These findings are:

1. At the initial stages, the subjects have a very limited segmental system which develops slowly and gradually. This limitedness plays a role in shaping their early words. The subjects' segmental inventories been found to be highly similar to those found crosslinguistically, and these consist of a small subset of consonants (stops, nasals and glides primarily) and cardinal vowels [a, u, i] which are produced by most children in most languages.

2. The prevalence of disyllabic forms rather than monosyllabic ones marks the subjects' early productions as shown in Table 5.8. This confirms the findings of other languages such as Japanese and Romance languages (e.g. Spanish and Catalan) and provides counter evidence to the observation about the prevalence of monosyllables in Germanic languages such as English and Dutch.

Table 5.8 Percentage of syllables in the subjects' forms in the three age groups (1,2, & 3).

Syllables	Age group (1)	Age group (2)	Age group (3)
Monosyllables	38.2%	31.6 %	22.1 %
Disyllables	60.9%	62.1 %	64.2 %
Trisyllables	.9%	5.9 %	13.5 %
Quadrisyllables	-----	.1 %	.4 %

3. Among the monosyllabic forms, the high frequency of the bimoraic words of CVC structure and CV:C structure in the data of the three age groups is remarkable (see Table 5.9). These forms indicate the unmarkedness of these syllabic structures in Arabic, and their early occurrence indicate the early emergence of final coda in Arabic.

4. The analysis of age group (1) and (2) data has shown that the period from 16 to 18 months is a transitional period from stage I of age group (1) (i.e. 12-15 months) when children begin producing simple structures (CV, CV:, CVC, CV:C, CV/CV, CVC/CV) that are marked by open syllables, the appearance of medial codas, and the absence of final coda in disyllabic forms to stage II of age group (2) (i.e. 16-18 months) when the subjects begin producing more complex structures with various templates and canonical shapes (see Tables 5.9 and 5.10) given below.

Table 5.9 Canonical shapes of monosyllabic words in all age groups' data

Canonical shapes	Age group (1)	Age group (2)	Age group (3)
CV	10 %	3.0%	.9 %
CV:	2.2 %	1.6 %	.7 %
CVC	19.7 %	14.1%	8.8%
CV:C	7.0%	13.1%	11.7%
CVCC	-----	-----	-----
CCVC	-----	-----	-----

Table 5.10 Canonical shapes of disyllabic words in all age groups' productions.

Canonical shapes	Age group (1)	Age group (2)	Age group (3)
CV/CV	29.1 %	17.6 %	8.3 %
CV:/CV	10.6 %	14.0 %	13.1 %
CVC/CV	17.6 %	19.8 %	15.6 %
CV/CVC	-----	2.3 %	6.8 %
CV/CV:C	-----	3.0 %	6.5 %
CV:/CVC	-----	.5%	1.2 %
CVC/CVC	-----	2.2%	6.1 %

5. The absence of multisyllabic forms is obvious at the initial stage. Multisyllabic words began to appear in age group (2) and (3) data (see Table 5.11) by the age of 1;6. This indicates the gradual appearance and development of early canonical shapes and emergence of final codas as well.

Table 5.11 Canonical shapes of multisyllabic words in all age groups' productions.

Canonical shapes	Age group (1)	Age group (2)	Age group (3)
CV/CV/CV	-----	1.5 %	1.9 %
CV/CV:/CV	-----	3.0 %	5.7 %
CVC/CV:/CV	-----	1.7%	3.6 %
CV/CV/CV:C	-----	-----	.7 %
CV/CV/CV/CV	-----	-----	.1 %
CV/CV/CV:/CV	-----	.1%	.1 %
CVC/CV:/CV/CV	-----	-----	.1 %

6. Stage I and II are marked by early word productions consisting of a single foot, and gradually at stage III, children gradually tend to enlarge their words to multisyllabic structures with light, heavy; and superheavy syllables as shown in Table 5.11 (i.e. trisyllabic and quadrisyllabic words) allowing more complicated structures with unfooted syllables and two feet despite the fact that most of the multisyllabic targets were subject to truncations yielding disyllabic trochaic (SW) and iambic (WS) words.

7. There is a gradual acquisition of initial unstressed syllables in WS and WSW words despite the fact that there is a very strong tendency among children to delete the weak/unstressed syllable in disyllabic and trisyllabic WSW words. The emergence of unstressed syllables is considered another transitional stage of word acquisition in child Arabic.

8. The subjects' early productions satisfy FB and PH and they are constrained by the minimality and maximality constraints. Their words display bimoraic minimal outputs (S) with heavy and superheavy syllables and show a maximality effect to a bisyllabic foot, be it trochaic (SW) or iambic (WS). Their multisyllabic outputs with unfooted syllables and two feet (WSW, WWS, WWSW) show more development and complexity of word structure.

9. There is great similarity between stage (II) (i.e. age group (2) data) and stage (III) (i.e. age group (3) data) in many aspects: the production of various monosyllabic, bisyllabic, and trisyllabic forms, the production of truncated forms, obeying the minimality and maximality constraints, the disyllabic maximum of

words, and the preference of trochaic forms. At stage III, the phonological development noticeable in the subjects' word syllabic structure, coda acquisition, and foot structure indicates their progress toward producing target-like forms with few truncated patterns.

These findings will be thoroughly discussed in the following chapter in the light of the Prosodic Theory and comparisons of the results to those of other child language studies (e.g. Germanic and Romance languages and Japanese) will be held, too.

CHAPTER SIX

Discussion and Theoretical Implications

6.0 Introduction

This study explores the phonological structure of first words in Arabic with the goal of arriving at a better understanding of first word acquisition and whether early word patterns are universal or specific to the ambient language. It examines the syllabic and word internal structure of early words, word size restrictions, and the developmental stages of word acquisition within the Prosodic Theory. It also investigates word representations and examines the representational relationship between the child and adult's forms. Cross-sectionally, it studies the early word productions of twenty-two monolingual Hijazi Arabic-speaking children whose ages range from the onset of speech (1;0) till the age of 1;9.

This chapter provides a thorough discussion of the data analysis findings in the light of the Prosodic Theory and Moraic Theory. The findings will also be compared to those reported in the literature in other languages such as Germanic languages (English, Dutch, and German), Romance languages (Spanish, Portuguese, Catalan, French), Japanese, and Hebrew whenever possible. Such comparison helps in deciding whether these findings are universal or language specific to Arabic. The chapter will be divided into five sections. Section 6.1 discusses the role of subjects' phonetic inventories in determining first word shapes. Section 6.2 deals with the representations of early words in child Arabic within the framework of the Prosodic Theory. Section 6.3 discusses the development of early word internal structure focusing on the prosodic structure of the subjects' outputs and the prosodic constraints restricting them. Section 6.4 focuses on the stages of development of early syllable structure whereas section 6.5 deals with the developmental stages of HijAr subjects' word prosodic structure. Section 6.6 comments on individual variation and gives illustrative instances from the data. Section 6.7 points out briefly some implications and drawbacks of the Prosodic Theory.

All these aspects of child phonology discussed and all the controversial issues raised such as the prevalence of monosyllables in early word production, for instance, will provide evidence for crosslinguistic differences related to these aspects and shed light on the relationship between child and adult phonology. This also gives an answer to the question of whether Arabic children follow the same universal path of acquiring first word syllabic structures (i.e. the universal hierarchical structure: CV > CVC > CVCC > CCVCC) starting with the “unmarked” structures and ending up with the more “marked” at later stages, or whether their productions are influenced by language specific features of Arabic. The following sections will answer the research questions set for this study (see section 2.4 for research questions) in order to give a whole picture of early word acquisition in child Hij Ar.

6.1 Segmental inventory

This section discusses the subjects’ segmental inventories at different stages of acquisition, their gradual emergence and the effect of this on their word productions and the phonological processes that play a role in shaping these words as well. In the light of the findings of this current data analysis, I attempt to answer the first specific question (A) stated as follows:

A: Does segmental acquisition affect children’s word syllabic structure?

Concerning children’s segmental acquisition, the limited segmental inventories of the subjects have been found to be highly similar to those found cross-linguistically. Many studies report that the earliest consonants acquired are generally stops, nasals, glides, and laryngeals (see Table 6.1) and the earliest vowels acquired are the cardinal vowels /a/, /i/, and /u/ (Jakobson, 1968; Ferguson & Farewell, 1975; Ferguson, 1978; Omar, 1973; Stoel-Gammon, 1987; Amayreh, 1998; Amayreh & Dyson, 2000). Consonants often occur in the following order: labials > dentals > velars in early phonology (Ferguson & Farewell, 1975:435).

Table 6.1 The phonetic inventories of young children presented in eight studies

Language	Age	Study	Position	Consonants
Jordanian Ar	13-24 m	Amayreh & Dyson (2000)	(I)	/b, d, t, ʔ, m, l, w, j, h/
			(F)	/b, t, ʔ, m, n, (w), j, (ʃ), h/
Egyptian Ar	12- 24 m	Omar (1973)	---	/b, m, w, j, ʔ, h, t, d, n t, d, l, s, z, k, g/
Hijazi Ar	8-22m	Bakalla (1975)	---	/b, m, w, t, d, n, l, r, s, f, h, ʕ, j, k, g, x, h, ʔ/
English	13-18 m	Winitz & Irwin(1973)	---	/b, p, d, t, g, k, m, n, w, f, s, h/
English	16-18 m	Paschall (1983)		/b, p, d, t, g, k, m, n, l, ʀ, s, h/
English	17-26 m	Ingram,(1981)	(I)	/b, p, d, t, (g), k, (m), n, w, (f), (s), h/
English	24m	Stoel-Gammon (1987)	(I)	/b, d, t, g, k, m, n, w, f, s, h/
			(F)	/p, t, k, n, r, s/
English	24-39m	Dyson (1988)	(I)	/b, p, d, t, g, k, m, n, w, j, l, (r), (ts), (tʃ), f, s, (ʃ), h/
			(F)	/p, d, t, (g), k, ʔ , m, n, r, ((s),tʃ, f, (v), s, z, ʃ/

Note: This table is adapted from Amayreh & Dyson (2000: 207) with some modifications and addition of other studies. (Ar = Arabic, m = month, I = initial, F = final).

This study results support the findings of previous studies investigating English, Arabic, and other languages. At the first half of the child's second year, the subjects' segmental system is very limited and it gradually and slowly develops. In the second half, more consonants (e.g fricatives, velar stops, etc.) appear as shown in age group (2) and (3) data. Voiceless consonants often appear earlier. This can be explained in terms of universal grammar, based on Jakobson's (1968) prediction that voiceless consonants are acquired before voiced ones. For example, voiceless fricatives /f, s, ʃ/ are the first to be acquired and mastered by children (Jakobson, 1968; Moskowitz, 1973) and the stability of the voiced fricative /v/ is relatively late in phonological development in English. Amayreh (1998) reports that the ages of customary production, acquisition, and mastery of most Arabic consonants are similar to those of English, but with a few exceptions: the

consonants /f, l/ are acquired earlier in Arabic than in English, while /dʒ/ is later in Arabic than in English (Omar, 1973; Amayreh, 1998; Amayreh & Dyson, 2000).

There are some common features in the consonant distribution in all children's utterances. For instance, dental and bilabial stops and nasals are the most frequent in words and non-word productions. Some of the consonants are often used as substitutes for other consonants, and these are the glottal laryngeals [ʔ, h], the palatal approximant [j], and the lateral liquid [l]. Emphatic sounds [t̤, d̤, s̤, z̤] are reported to be of late development, almost at the age of 3;6 (Omar, 1973, Bakalla, 1975, Amayreh, 1998, and Amayreh & Dyson, 2000). This study findings support this view for these sounds did not appear at all in the data of all groups, but they went through a de-emphasization process and they were realized in their non-emphatic counterparts [t, d, s, z] in initial, medial, and final position as shown in the following examples given in (6.1). This can be used to argue for the late acquisition of the feature [+ emphatic] [- emphatic] in child Arabic, like that of voicing in Arabic as well as other languages in the early stages of word acquisition.

(6.1) De-emphasization in early word production in child Arabic

/batt̤a/	[p ^h atta]	'duck'	(All subjects)
/be:da/	[be:da]	'egg'	(All subjects)
/sall̤i/	[salli]	'pray'	(Mar 1;8, Maw 1;8)

This limited segmental set and the markedness of some sound segments (e.g. /r/, /ʁ/, /ʕ/) play a great role in shaping children's early words to the extent that segment markedness might lead not only to segment deletion but also to total syllable deletion. Some good illustrative examples from the data are the following:

(6.2) Examples of segment or syllable deletion due to segmental effect

/ʔabʁa/	[ʔaba]	'I want'	(All subjects)	CVC/CV > CVC/∅V
/liʕba/	[li:ba]	'toy'	(Naw 1;4)	CVC/CV > CV:∅/CV
/ħa:r/	[ha:]	'hot'	(Mar 1;2, Tal 1;3)	CV:C > CV: ∅
/ʕaʕi:r/	[ʔasi:]	'juice'	(Nor 1;5, Naw 1;7)	CV/CV:C > CV/CV:∅
/makaro:na/	[mako:na]	'macaroni'	(Nor 1;8)	CV/CV/CV:/CV > CVCV:∅CV

Ferguson (1978) states that this limitedness makes children produce the word as a whole unit not as sequences of speech sounds. Moreover, infrequent and/or marked segments contribute to late acquisition or difficulty of learning at the

initial stages and lead to the occurrence of deletion, substitution, and consonant harmony processes. For example, fricatives are acquired relatively later than stops and nasals as indicated in this study of Arabic and many other studies (Ferguson, 1973, 1986; Ingram, 1978; Moskowitz, 1973; Fikkert, 1994; Amayreh, 1998) and the latter often serves as substitutes for the former. Jakobson (1968) claims that stops are acquired before fricatives and they serve as substitutes for them. Thus, stops are prerequisite for the existence of fricatives. Eilers et al. (1977) also report that infants appear to have great difficulty in discriminating acoustic attributes that differentiate fricatives. The same can be said about the class of emphatic sounds that are acquired very late due to the markedness of these sounds and their absence from the subjects' segmental inventories. Children and even adults employ a substitution process in such cases.

6.2 Representations of early words

One of the main goals of this research is concerned with the relationship between child phonology and adult phonology, and one of its aims is to examine the representational nature of early words in child HijAr. This section and its subsections provide an answer to a main research question (1) and two related specific ones: (B) and (C) which are stated as follows:

1) *Can the characteristics of early words in child Hijazi Arabic be accounted for within the framework of adults' prosodic phonology and can their syllable and word structure be determined by the same representational units and principles found in adult language?*

B. Do Hijazi Arabic-speaking children's early outputs contain the same prosodic organizational units of adults' prosodic phonology?

C. Are Hijazi Arabic-speaking children's early words subject to the same prosodic constraints, imposed on the children's early phonological representations (e.g. the minimality and maximality constraints), that determine their word structure?

The literature investigating the prosodic word structure in child phonology has provided evidence that children's phonological system includes similar

prosodic units as those in adults' prosodic phonology (Demuth & Fee, 1995; Fee, 1995; Pater, 1997; Fikkert, 1994; Lleo, 2006) (see sections 2.2.1.1, 2.2.1.2, and 2.2.1.3). Based on the findings of a number of cross-linguistic studies investigating child English, Dutch, German (Allen & Hawkins, 1978; Echols & Newport, 1992; Demuth & Fee, 1995; Pater, 1997; Fikkert, 1994; Lleo, 2006), child Spanish, child Catalan (Lleo, 2006; Prieto, 2006), and child Japanese (Ota, 1998, 2003), I believe that early phonology in child HijAr has the same basic prosodic organizational units (i.e. feet, syllables, and moras) of adults' prosodic phonology.

The data analysis has shown that the early PWs produced by Hijazi Arabic-speaking children satisfy the PMH and the TSC (McCarthy & Prince 1990). They consist of the same organizational units of adult phonology and their prosodic structure is governed by similar organizational principles and restricted by the same constraints found in the adult system. Evidence has been provided that feet and moras are representational constituents of the prosodic structure of the subjects' early words.

This section discusses the representational properties of the syllable and word structure of early words in child Arabic. Section 6.2.1 discusses the internal syllable structure of the subjects' early words demonstrating the existence of moraic structure and size limit on early syllables in child Arabic phonology. Section 6.2.2 discusses the representational properties of their early word structure.

6.2.1 Representations of the syllable internal structure

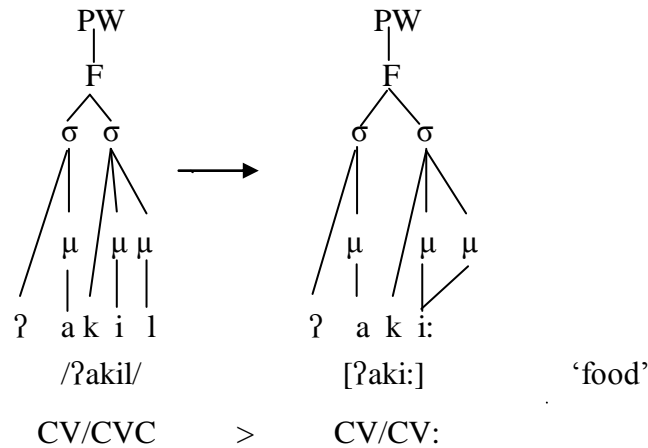
The question raised here is whether the prosodic structure of early syllables in child Arabic PWs is structured in terms of the representational units and principles found in adult grammar. For this purpose, I argue that syllables in child Arabic have the same prosodic units (i.e. the moras) found in the adult model. Three aspects of the data have been examined: compensatory lengthening (CL) phenomenon, syllable size restrictions and the developmental order of codas. I argue that these findings provide evidence for (a) moraic conservation, and (b) a bimoraic size restriction on syllables.

6.2.1.1 Evidence for mora in child Arabic early words

6.2.1.1.1 Moraic conservation and compensatory lengthening

The data analysis has shown that the subjects' early phonology has the other sub-word level constituents in the prosodic hierarchy. The analysis of their word syllabic structure has provided evidence for the existence of mora in child Arabic phonology. Moraic conservation is observed in the subjects' outputs and this is supported by the occurrence of CL patterns. There are instances where coda deletion and diphthong reduction trigger vowel lengthening (e.g. [ʔakil] > [ʔaki:] 'food,' [laʔ] > [la:] 'No,' and [laimu:n] > [li:mu:n] 'lemon,' [zaitu:n] > [si:nu:t] 'olive') and consonant lengthening of an adjacent consonant in CVC/CV structures (e.g. [dʒazma] > [damma] 'shoes', [dʒubna] > [dunna] 'cheese,' [ʔalbas] > [ʔabbas] 'wear,' and [ʔarmi] > [ʔammi] 'throw'). These phonological processes lead to the preservation of the moraic structure as stated by Hayes (1989:285) that 'compensatory lengthening processes conserve mora count.' This is shown in the representations given in Figure (6.1).

Figure 6.1 Moraic conservation through CL



When there is a loss of a coda consonant or a vowel in diphthongs, it is compensated elsewhere in the child or adult's outputs through a process of V- or C-lengthening. The following examples provide evidence for moraic structure in child Arabic and illustrate the CL phenomena attested in the data.

(6.3) Examples of CL demonstrating moraic conservation in child Arabic data

a. V-lengthening

/laʔ/	[la:]	‘No’
/liʔba/	[li:ba]	‘toy’

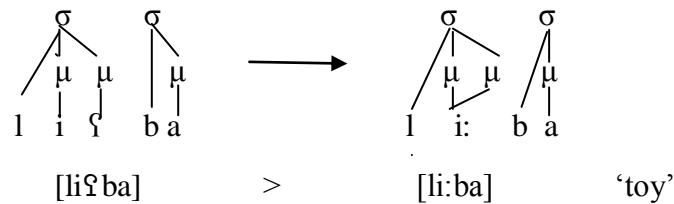
b. C-lengthening

/kalba/	[tabba]	‘dog’
/dʒazma/	[damma]	‘shoes’
/dabdu:b/	[daddu:b]	‘teddy bear’

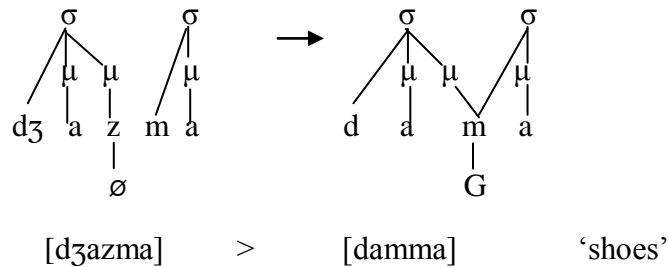
The following figures illustrate how the prosodic structure of the words is maintained via V- and C-lengthening and how moraic conservation takes place.

Figure 6.2 CL: V- lengthening and C-lengthening

a. V-lengthening



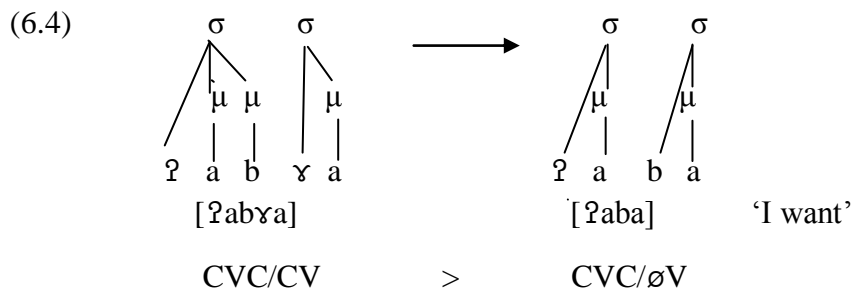
b. C-lengthening



These are two cases of moraic conservation. The coda loss in the closed syllable causes V- lengthening in (a) and C- lengthening in (b). The mora projected by the coda is left stranded by the segment deletion, and it reassociates itself with the preceding vowel which carries two moras as a consequence or with a following consonant as shown in the above figures. The subsyllabic prosodic structure is preserved by moraic conservation even when the segmental position of the syllable is altered.

If the child’s syllable internal prosodic structure is regulated by the principles of moraic theory, we expect to see onset-coda asymmetry in CL. The prediction that could be given in this respect is that lengthening is induced only by

deletion of mora-bearing segment such as codas and vowels, but not onsets. Deleting an onset consonant does not trigger any CL because it is not a mora-bearing segment. An illustrative example from the data is the following.



Onset deletion in this example (CVC/CV > CVC/∅V) does not cause any lengthening. It leaves no stranded mora, and therefore, it does not lead to any CL. The structural position of a segment in a syllable determines if it projects a mora or not. Codas and vowels are moraic and their deletion, especially the second vowel in a diphthong, triggers CL. Languages such as Arabic, characterized by gemination and contrastive vowel length, allow moraic segments which reflect the reassociation of moras.

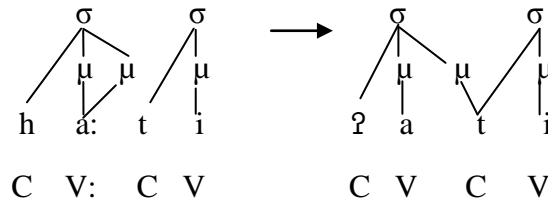
Another prediction based on moraic theory for CL is that deletion of a vowel in the second half of a diphthong leads to CL too. The only two examples found in age group (3) data exhibiting a reduction of a diphthong to a pure vowel are given below.

(6.5) CL: V-reduction in diphthongs

/laimu:n/	[li:mu:n]	‘lemon’	(Nor 1;9)
/laimu:n/	[la:mu:n]	‘lemon’	(Yas 1;9)
/zaitu:n/	[si:nu:t]	‘olive’	(Mar 1;8)

They tend to either lengthen or shorten vowels. In the data, however, it has been observed that age group (1) subjects sometimes produced /ha:ti/ as [ʔa:ti] or [ʔatti] ‘give me.’ When they shorten the vowel of the first syllable, they employ a CL process which is C-lengthening for moraic conservation, and thus preserving the same moraic structure as illustrated below in Figure 6.3. The failure to realize long vowels, in most cases, is accompanied by CL.

Figure 6.3 Moraic conservation: V- shortening & C-lengthening



The same phenomenon has been reported by Ota (2003) in child Japanese (see examples of V- shortening and C-lengthening from child Japanese in (6.6)).

(6.6) V-shortening and C-lengthening in child Japanese (Ota, 2003:66)

/ke:ki/	[kɪkɪ]	‘cake’	Takeru	(1;10.2)
/çiko:ki/	[kokki]	‘plane’	Tekeru	(1;10.16)

Both of the above patterns are considered manifestations of moraic structure. In the case of C-lengthening which involves coda deletion, the deleted coda consonant of the first syllable leaves a stranded mora, which is linked to the following consonant. In the case of V-shortening, the shortening of a long vowel frees a mora, which is then linked to the following consonant, again creating the environment for C-lengthening.

As to the CL phenomenon, holding a comparison between Arabic and other languages, the results of this study lend support to the findings of previous studies dealing with child English (Stemberger, 1992; Demuth, 1995), child Dutch (Fikkert, 1994), and child Japanese (Ota, 2003). Stemberger (1992) reports that her subject deletes the coda consonant, and she often changes a target short vowel to a long tense vowel.

(6.7) Examples from English data (Stemberger, 1992)

a. Vowel lengthening

pig	[p ^h i:]	(2;0)
kiss	[t ^h i:]	(2;0)
swim	[si:]	(2;0)

b. Diphthong reduction

bite	[bi:t]	(2;3)
grape	[di:p]	(2;3)

Fikkert (1994), investigating child Dutch, also reports that deletion of target sonorant codas leads to V-lengthening as shown in her data examples from her subject, Jarmo given in (2.13). In child Japanese, CL takes place where the target

nasal coda (only non-geminate codas) is deleted after a short vowel as shown in some examples from Ota's data collected from three Japanese children(1;0-2;0) given in (2.11-2.15) and those given above in (6.6).

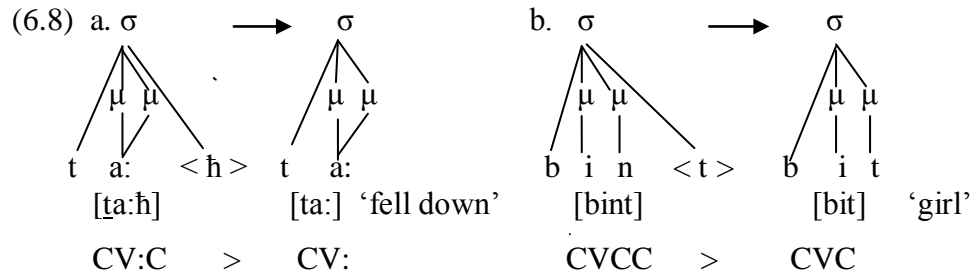
In this study and the previous ones, onset deletion causes no lengthening effects, and to my knowledge, there are no such cases reported in any child language. This might confirm the prediction that onset deletion does not lead to any prosodic adjustments across child languages.

6.2.1.1.2 Bimoraic maximality

Another argument for moraic phonology in child Arabic phonology comes from the size of syllables. Arabic dialects such as Egyptian Arabic and Hij Ar are good examples for varieties imposing an upper size limit. Speakers of these dialects employ some phonological processes such as closed syllable shortening or epenthesis to avoid trimoraic syllables. This can be described through some illustrative examples from both dialects (see examples given in (3.18 & 3.19) and section 3.2.2.1). In these dialects, the strong preference for bimoraic syllables underlies a number of phonological processes, including closed vowel shortening and epenthesis. The bimoraic maximum on syllable size provides an explanation of these phenomena, and these processes can be seen as a prosodic adjustment to keep the syllable bimoraic.

At this early stage of word acquisition, children's verb morphology has not yet developed. Therefore, counter examples to those found in the adult system have not been found in the child Arabic data analyzed. This study subjects' initial productions of some target CV:C nouns such as [nu:r] 'light,' [mi:n] 'who,' and [fi:l] 'elephant' and verbs such as [ra:h] 'he went,' and [ta:h] 'it fell down' are bimoraic maximum. The superheavy target forms were reduced to bimoraic minimal forms (CV:C > CV:) by merely deleting the extrasyllabic consonant as shown in (6.8a). Target words of CVCC structure, another type of superheavy syllables in Arabic, have undergone reduction of the consonant cluster resulting in forms with CVC structure which satisfies bimoraic maximality (e.g. bint > bit 'girl', gird > gid 'monkey') as shown in (6.8b). Few of these CVCC forms reduced

to CVC were found in the data elicited from age group (2 & 3) in the second half of the second year (between 1;5 – 1;9).



6.2.2 Representations of the internal structure of words

This section continues discussing the representational nature of first words in Arabic. It provides arguments and evidence for foot structure and shows how the early word structure is governed by the same prosodic constituents and representational principles proposed for adult phonology.

Evidence provided for the internal structure of children's first words comes from two observations: (1) Bimoraic minimality effects and (2) Disyllabic maximality effects attested in child data. Support for these comes from avoiding truncating words to monomoraic size, and truncations of words to bimoraic structure or disyllabic size (see section 2.2.1.2). Supporting evidence comes from child Dutch (Fikkert, 1994), child English (Demuth, 1995; Pater, 1997; Salidis & Johnson, 1997), and child Japanese (Ota, 1999) where researchers use truncation data from children aged from 1;0 to 2;0 (see section 2.2.1.3 for these arguments and examples given in (2.16 - 2.20)). From child Arabic data, the following section provides another evidence for foot structure in early phonology, which has received strong support from other cross-linguistic backgrounds.

6.2.2.1 Evidence for foot structure in child Arabic

Evidence offered for the existence of foot structure in child Arabic comes from: (1) Bimoraic minimality effects attested in this study data and manifested in the lengthening of monomoraic lexical items, and (2) Disyllabic maximality effects attested in the early productions of multisyllabic words. Support for this comes

from lack of monomoraic words in the subjects' outputs, few truncations to monomoraic size, and truncations of early words to bimoraic structure or size.

6.2.2.1.1 Minimality effects

The minimal structure of the child's first words should satisfy the requirements of PH and FB (see section 2.1) and the minimality constraint is a prosodic constraint on the lexicon and it requires a single foot (McCarthy & Prince, 1986, 1990; Demuth & Fee, 1995; Pater, 1997; Fikkert, 1994; Ota, 2003). Arabic, like many languages, requires trochaic stress feet; therefore, the minimal stem will be a single foot (moraic trochee), or two moras ($W_{\min} = F = [\mu\mu]$). Here I argue that if the child's first words consist of single binary feet, the Prosodic Theory predicts that these words are likely to be bimoraic and/or disyllabic. The representations of such structures are given in (2.31).

In many languages such as child English, Dutch, Spanish, and Japanese, the minimality constraint is at work. Arabic is a bimoraic language (Watson, 2002) and it respects word minimality and it enforces a bimoraic upper limit on syllables and there is avoidance of trimoraic syllables (see examples given in (3.18) and (3.19) in section (3.2.2.1). Monomoraic structures are not frequent in Arabic. McCarthy and Prince (1990:18) report that there are a few counterexamples to the minimality stem requirement and these are too small monomoraic forms such as non-words (*wa* 'and,' *bi* 'in/with') and imperatives such as *li* (imp. 'near') to which the minimal word constraint does not apply. If monomoraic forms are infrequent in Arabic and CV: and CVC structure are more frequent, then we predict that the children's early outputs would lack monomoraic forms, and minimal bimoraic (i.e. consisting of a single foot) will constitute the majority of their lexicon. In other words, it is predicted that early words must be minimally bimoraic if the early prosodic structure conforms to PH and FB.

The data analysis has shown that the minimality effects are observed in child Arabic and provided instances of bimoraic structures. The low occurrence of monomoraic outputs is obvious in the productions of the three age groups (see Table 5.8). Most of the children's productions are minimally bimoraic (CV:, CVC,

CV:C). The minimality condition seems to be at work in all stages of early word acquisition and this is manifested in the early productions of codas and also in children's deletion of coda segments and in truncation of syllables as well. The following are examples from this study Arabic data illustrating these minimality effects.

(6.9) Bimoraic outputs identical to target forms

/da:/	[da:]	'this'	(All subjects)
/laʔ/	[laʔ] ~ [la:]	'No'	(All subjects)
/ʔam/	[ʔam] ~ [ham]	'food/eat'	(Most of the subjects)
/ʔan/	[ʔan]	'car/car sound'	(Abdul 1;1 & Mohd 1;2)
/dub/	[dub]	'teddy bear'	(Mays 1;5)
/ruz/	[lus]	'rice'	(Naw 1;5)

These forms have the same prosodic size as the target. Some of the words given below in (6.10) are bimoraic words resulting from truncated adult forms. Some of these are cases of CL which has taken place after the truncated outputs resulted in CV (i.e. monomoraic) syllables.

(6.10) Bimoraic outputs resulting from truncations in child Arabic

a. CV:

[^l batt̪a]	[^l p ^h a:] ~ [p ^h a]	'duck'	(Nor 1;2.15)
[tuf ^f fa:h̩a]	[^l pa:]	'apple'	(Nor 1;2.15)
[bagara]	[pa:] (I)	'cow'	(Mar 1;1)
[ballo:na]	[ba:] ~ [bo:] (I)	'balloon'	(Moh'd 1;2)
[ʔaħmad]	[ʔa:]	'Ahmad (a name)'	(Shah 1;7)
[taɣri:d]	[ta:]	'Taghreed (a name)'	(Shah 1;7)

b. CVC

[ma ^l gas̩]	[kas]	'scissors'	(Fais 1;7)
[^l galam]	[gam]	'pen'	(Maw 1;8)
[ʔaŋkab]	[kab]	'spilt'	(Nor 1;9)
[muf ^f ta:h̩]	[ta:h̩]	'key'	(Maw 1;8 & Nor 1;9)
[bas ^l ko:t]	[ku:t]	'biscuit'	(Mar 1;5)

Using truncation data from English data collected from a child between 0;11 and 1;7, Salidis and Johnson (1997) provides similar argument and evidence for bimoraic minimal structure. In some languages such as Japanese (Ota, 1998, 2003), not only truncated forms display this minimality effect and support the

MWH, but also augmentation of monomoraic target forms (see examples given in (6.11)).

(6.11) Lengthening of monomoraic targets in child Japanese (Ota, 2003:138)

/me/	[me:]	‘eye’	Hiromi (1;9.11)
/me/	[me:]	‘eye’	Takeru (1;8.13)
/te/	[te:]	‘hand’	Takeru (1;11.2)
/dʒi/	[di:]	‘letter’	Kenta (2;2.27)

6.2.2.1.2 Disyllabic maximality effects

Another evidence for for foot structure in child Arabic comes from disyllabic maximality effects in the subjects’ early productions of multisyllabic words. This is evident in the disyllabic truncated forms that constitute the majority of all age group subjects’ word productions.

The data analysis has shown that disyllabic outputs dominate the word productions of each age group as shown in Table 5.8. The question that should be raised here is whether the dominance of these disyllabic forms is a reflection of the word size in the target language or not. The data analysis has shown that a considerable proportion of the children’s productions are disyllabic forms identical to the target word size, and thus reflecting disyllabic target forms as shown in the examples given in (6.12).

(6.12) Disyllabic words mirroring disyllabic targets

['be:da]	['be:da]	‘egg’	(Mar 1;2)
['si:du]	['ti:du]	‘grandpa’	~
['mo:ja]	['bo:ja]	‘water’	(Moh’d 1;2.25)
['batta]	['p ^h atta]	‘duck’	(Nor 1;2.15)
['dʒadda]	['dadda]	‘grandma’	~
['bissa]	['bissa]	‘cat’	(Mar 1;2.15)

The rest are truncated outputs of the multisyllabic target forms (see examples given in (6.13)). These are the outcome of truncation processes such as coda deletion and syllable structure truncation. The disyllabic SW words were produced as a result of truncating trisyllabic and quadrisyllabic target words.

(6.13) Truncations of trisyllabic and quadrisyllabic target words

Trisyllabic targets: WSW > SW			
/tuf ^f fa:ħa/	['wa:ħa]	‘apple’	(Nor 1;2.15)
/bal ^l lo:na/	['no:na]	‘balloon’	(Mar 1;2.15)
/saj ^j ja:ra/	['ja:la]	‘car’	(Naw 1;4 & Naw 1;5)
/ħa ^l la:wa/	['la:wa]	‘candy’	(Mays 1;5)
/bi ^d dʒa:ma/	['da:ma]	‘pyjama’	(Nor 1;6)
/lu ^l ba:na/	['ba:na]	‘gum’	(Shah 1;7)
/ħu ^l fa:da/	['da:da]	‘diaper’	(Maw 1;8)
/ba ^l ta:tis/	['ta:tis]	‘potato’	(Fais 1;7 & Maw 1;8)
<hr/>			
WWS > WS			
/bantalo:n/	[ʔalo:n]	‘trousers’	(Maw 1;8)
/burtuga:n/	[buka:n]	‘orange’	(Nor 1;9)
<hr/>			
WWSW > SW			
/ʃuka ^l la:ta/	[ka:ta]	‘chocolate’	(Fais 1;7)
/bala ^l ko:na/	[ko:na]	‘balcony’	(Maw 1;8)
<hr/>			

At the early stages of word acquisition, the multisyllabic target words are truncated to disyllabic forms, indicating that there is a disyllabic maximum on prosodic words. At the same time, some disyllabic forms are produced targetlike and they maintain both syllables, whereas some are truncated to monosyllabic bimoraic forms. The early word production period is characterized by prosodic words that are minimally bimoraic [Ft (σμμ)] and maximally disyllabic [Ft(σσ)]. The results of the data analysis have shown that most of the adult prosodic shapes are truncated to conform to bimoraic minimal and bisyllabic outputs. Hij Ar-speaking children’s productions display a minimality effect to bimoraic structures and maximality effects to a bisyllabic foot. Thus, the findings of this study add another support for the MWH and FB.

As mentioned earlier, Hijazi Arabic-speaking subjects’ productions display a maximality effect to a bisyllabic foot, be it trochaic (SW) or iambic (WS). The examples given above in (6.12) and (6.13) show children’s preference for the trochaic pattern (SW). In most cases, the initial weak/unstressed syllable is deleted showing a preference for the strong stressed syllable that is mostly preserved by

children even in truncating not only disyllabic target forms but trisyllabic targets as well as shown in the examples given in (6.14) (see also more examples in (5.27) and (5.28).

(6.14) Truncations of bisyllabic and trisyllabic target words:

a. WS > øS

[xa'la:s]	[la:s]	'finished'	(Naw 1;4)
[dab'ba:b]	[ba:b]	'bike'	(Mays1;5)
[fus'ta:n]	[ta:n]	'dress'	(Nor 1;6)
[bas'ko:t]	[to:k]	'biscuit'	~
[dʒaw'wa:l]	[wa:l]	'mobile'	~

b. WWS > S

[tilifo:n]	[fo:n] ~ [ʔo:n]	'telephone'	(Nor 1;6 & Mays 1;5)
[burtuga:n]	[ka:n]	'orange'	(Mar 1;5)
[ʔiskiri:m]	[ki:m]	'ice cream'	(Mar 1;5 & Nor 1;6)

Children show preference for stressed and final syllables and they tend to preserve them. In the examples given above, children tend to truncate the weak/unstressed syllables and preserve final syllables. This indicates that both stress and syllable position have a role in word truncations. The role of these prosodic factors will be discussed in a later section.

To conclude, evidence has been presented for the internal word structure in child Arabic: bimoraic minimality effects and disyllabic maximality effects. The arguments come from the observation that the subjects' early words consist of a single binary foot and also truncations of multisyllabic target words to disyllabic feet. This shows that early prosodic word structures in child Arabic phonology are controlled by the same units and principles governing prosodic words in adult phonology: PH and FB. Children often employ repair strategies such as CL and truncations to conform to the minimality and maximality restrictions. The disyllabic forms contain either light and heavy syllable or light and superheavy syllables. Mostly they are trochees (SW) and few are iambs (WS). The preference for the former pattern (i.e. trochaic) is noticeable which might reflect the effect of foot frequency on the children's outputs, and thus reflecting the language-specific foot structure in Arabic.

Another issue this study is concerned with is the course of development of the syllable structure and word structure of early words in HijAr. Investigating these aspects gives a detailed picture of how early words develop till they become more adult-like and shows if this developmental process is determined by universal features or influenced by the subjects' language specific phonologies. Section 6.3 focuses on the developmental stages of word structure in child HijAr and section 6.4 is concerned with its syllable structure development.

6.3 Stages of word structure development in child Arabic

In the light of the evidence and arguments given in section 6.2, this section describes and discusses the developmental stages of the internal structure of early words in child Hij Ar. While identifying the stages of development of word structure, this section raises a number of questions and addresses some issues related to the differences between child and adult words. The question we raise here is whether Hijazi Arabic-speaking children start with a monosyllabic stage first and then move towards disyllabic and multisyllabic stages as in the case of the Germanic languages (child English and Dutch) or not.

The following sections address and provide answers to another main research question (2) and the related specific question (D):

(2) Do Hijazi Arabic-speaking children go through the same developmental stages of acquiring syllable structure and word structure reported in the acquisition literature and/or are their early word productions sensitive to their language-specific phonology?

D. Do Hijazi Arabic-speaking children follow a universal order in acquiring the syllable structure (i.e. the universal hierarchical structure CV > CVC > CVCC > CCVCC) and word internal structure (i.e. a monosyllabic stage > disyllabic forms > multisyllabic forms), or are they sensitive to their language-specific phonologies?

6.3.1 Early productions: A monosyllabic stage or a disyllabic one?

Crosslinguistic evidence from a number of studies investigating early words in child English (Ingram, 1978; Ferguson & Farewell, 1975 ; Vihman, 1991; Vihman et al., 1994; Demuth & Fee, 1995), child Dutch (e.g. Elbers & Ton, 1985; Fikkert, 1994; Levelt, Schilller & Levelt, 2000) and child German (Leopold, 1939; Lleo, 2006; Lleo & Prinz, 2000) lend support to the impression that there is a monosyllabic stage (see section 2.2.2.2) In these Germanic languages, the first acquired syllable shape and the most frequently used is the core syllable (CV) – the least marked syllable cross-linguistically. On the contrary, there is more cross-linguistic evidence from Romance languages (e.g. French, Spanish, and Catalan) and Japanese for the prevalence of disyllabic words rather than monosyllabic ones at the very early stage (Vihman, 1991; Lleo, 2006; Gennari & Demuth, 1997; Prieto, 2006; Freitas, 2006, Ota, 1998, 2003). It has been suggested that there is a language-specific bias in the input and the prevalence of certain syllabic forms at the initial stage may reflect the size and the phonetic structure of the words in the input received.

One of the purposes of this study is to compare Arabic to other languages (e.g. English, Dutch, Spanish, Japanese etc) and to examine the crosslinguistic differences in the development of PWs among these languages. Some of the questions addressed are the following: Do Hijazi Arabic-speaking children follow the same path in acquiring words as that reported in studies dealing with Germanic languages? Is there a prevalence of monosyllabic forms at the initial stage in child Arabic? Or does Arabic, like Spanish and Japanese, provide counter evidence to the claim of the predominance of monosyllabic forms in early words?

Arabic is a Semitic language where CVC structure is considered unmarked and more frequent than the universal unmarked CV structure (McCarthy & Prince, 1986, 1990). This might lead us to predict that Hijazi Arabic-speaking children would go through a monosyllabic stage before producing disyllabic and multisyllabic target words in their early word productions. The question raised in this respect is: Do these children's early productions reflect universal features or language specific influence?

The child Arabic data analysis confirms the findings of studies dealing with Japanese and Romance languages rather than the Germanic ones and accordingly confirms the observation about the prevalence of disyllabic words in early stages. Table 5.8 shows that percentages of mono-, di-, and multisyllabic forms in HijAr data. Disyllabic words constitute 60.9% of age group (1) subjects' outputs, 62.1% of age group (2) vocabulary, and 64.2% of age group (3) subjects' word productions. Monosyllables come second in frequency though they somehow show high frequency (38.2%) in age group (1) production and (31.1%) in age group (2). The prevalence of disyllabic words could be attributed to the fact that Arabic is a language characterized by disyllabic forms and to the frequency of disyllabic forms in the input received by the child.

The data analysis of age group (1) has shown that none of the subjects exhibited a dominance of monosyllabic words in this early stage. 38.2 % of their production is monosyllabic words and 60.9% of them are disyllabic forms. The monosyllabic words include few monomoraic syllables (CV) and the majority consists of a single binary foot. They are either heavy monosyllabic words containing a long vowel or a coda (i.e. bimoraic) (CV:, CVC) or superheavy syllables ending with an extrasyllabic consonant (CV:C) (see Table 5.9). Examples of monosyllabic forms from the data are given in (6.15).

(6.15) Early production of Monosyllabic words (CV:, CVC, CV:C)

/da:/	[da:]	'this'	(All subjects)
/ʔan/	[ʔan]	'car'	(Abdul 1;1 & Moh'd 1;2)
/laʔ/	[naʔ]	'No'	(Abdul 1;1)
/bi:b/	[bi:b]	'car'	(Fais 1;5)
/ba:b/	[ba:b]	'door'	(Mar 1;2)

Some of these monosyllabic forms deviate from the adult model by deleting the extrasyllabic consonant in monosyllabic targets without violating the prosodic structure, i.e. obeying the Bimoraicity Principle and Foot Binarity. This involves deleting some final marked consonants such as [r, h] or replacing them by other substitutions which preserves the same structure of the target word (e.g. /nu:r/ > [nu:j] 'light', and /ta:h/ > [ta:h] 'fell down'). Other monosyllabic forms result from truncations of target forms as shown in the examples given below in (6.16).

(6.16) Truncations resulting monosyllabic forms

a. CV:C > CV:

/ta:h/	[ta:]	‘fell down’	(Abdul 1;1.15)
/go:n/	[do:]	‘goal’	(Moh’d 1;2.25)
/nu:r/	[nu:]	‘Noor (a name)’	(Nor 1;2.15)

b. CV/CV > CV:

/ʔa:ti/	[ti:] ~ [ʔa:]	‘bring’	(Moh’d 1;2)
/mo:ja/	[bu:]	‘water’	(Abdul 1;1.15)

c. CVC/CV:/CV/CV > CV:

/tuffa:ha/	[pa:] ~ [tə]	‘apple’	(Nor 1;2)
/ballo:na/	[bo:] ~ [bom]	‘balloon’	(Mar 1;2)

The disyllabic forms constitute the majority of these children’s productions. Some of these do not undergo any augmentation or truncations. They are produced in a targetlike manner and with the same prosodic structure (see examples given in (6.17).

(6.17) Early productions of disyllabic targets

/mo:ja/	[mo:ja]	‘water’	(Moh’d 1;2.25)
/dʒadda/	[dadda]	‘grandma’	(Nor 1;2.15 & Nor 1;9)
/be:da/	[be:da]	‘egg’	(Mar 1;2 & Nor 1;9)
/ka:sa/	[ka:sa]	‘glass’	(Maw 1;8)
/giʔa:r/	[giʔa:l]	‘train’	(Nor 1;9)
/huʔsa:n/	[ʔaʔsa:n]	‘horse’	(Maw 1;8)

Some result from truncations of trisyllabic target forms as illustrated in the examples elicited from age group (1&2) data and given in (6.18). All their disyllabic outputs whether truncated or not are a combination of heavy and light syllables (i.e. bimoraic and monomoraic). As to foot structure, they all have a trochaic pattern (SW).

(6.18) Disyllabic forms resulting from truncating trisyllabic targets

/balʔlo:na/	[no:na]	‘balloon’	(Mar 1;2.15)
/ʔaʔru:sa/	[lu:sa]	‘doll’	(Naw 1;4)
/sajʔja:ra/	[ja:la]	‘car’	(Naw 1;4 & Naw 1;5)
/huʔfa:da/	[fa:da]	‘diaper’	(Mays 1;5)
/baʔta:tis/	[ta:tis]	‘potato’	(Mar 1;5)

Despite the fact that these findings show that disyllabic forms constitute the majority of all age groups’ productions, the close percentage of monosyllabic words (38.2%) and disyllabic forms (60.9%) found in age group (1) production

data (between 1;0 and 1;3) (see Table 5.8) reflects or shows that mono- and disyllabic early word forms are in a somehow close balance. This might indicate the possibility of the occurrence of a monosyllabic stage in children's early word production. In fact, there are no other studies on early child Arabic and no diary studies that could provide us with data confirming the existence of a monosyllabic stage or reporting that early child Arabic words are limited to monosyllabic forms.

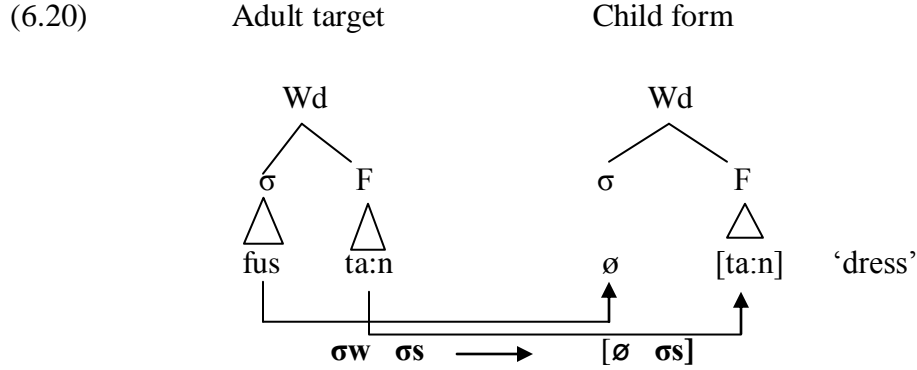
As to the disyllabic forms, there is more than one factor contributing to their occurrence in the data: the high frequency of certain lexical items in the input received and/or some phonological processes such as reduplication (e.g. /ħala:wa/ > [wawa] 'candy,' and /sajja:ra/ > [ja:la]) and syllable truncations (see also the examples given in (6.18 and 6.19). Another observation that is worth mentioning here is that some disyllabic targets having the iambic pattern (WS) are truncated in early child Arabic and produced as monosyllabic at the age of 1;6 before children start realizing weak/unstressed syllables as shown in the examples given below (6.19). The weak initial syllable is deleted, and the most prominent/stressed syllable is maintained.

(6.19) Truncations of disyllabic targets resulting in superheavy monosyllables

(WS > S)

/ħa'li:b/	[li:b]	'milk'	(Naw 1;5)
/fus'ta:n/	[ta:n]	'dress'	(Nor 1;6)
/dʒaw'wa:l/	[wa:l]	'mobile'	(Fais 1;7)
/muf'ta:h/	[ta:h]	'key'	(Maw 1;8 & Nor 1;9)

In these iambic forms (WS), the weak initial unfooted syllable is deleted, and the most prominent/ stressed syllable is maintained. The child selects the segmental material from the most salient syllable that constitutes a foot which is then mapped onto the child's template forming a minimal word as shown below in (6.20).



This process shows resemblance to the process of Prosodic Circumscription (McCarthy & Prince, 1990). The ‘prosodically circumscribed’ foot containing the stressed syllable is mapped onto the child’s template and the segmental material containing it is copied. The ‘residue’ of the word is not realized because it is not ‘prosodically licensed’ by the template at the initial stage; therefore, it is subject to ‘stray erasure’ i.e. deletion.

Another phenomenon observed in the data is that some children tend to add an extra syllable in final position of the foot template in monosyllabic forms as in (6.21 d & e) and even in the truncated forms as in (6.21 a-c). This is accomplished by vowel epenthesis as illustrated in the following examples:

(6.21) Examples of extra final syllables

- | | | | |
|--------------------|----------------------------------|--------------|----------------|
| a. /ħali:b/ | [li:b] \longrightarrow [li:bu] | ‘milk’ | (Tal 1;0) |
| b. /ʔaŋkab/ | [kab] \longrightarrow [kaba] | ‘spilt’ | (Shom 1;3) |
| c. /ʔabdurraħma:n/ | [ma:n] \longrightarrow [ma:na] | ‘a name’ | (Moh’d 1;2.25) |
| d. /ʃams/ | \longrightarrow [samsi] | ‘sun’ | (Nor 1;6) |
| e. /ʔap/ | \longrightarrow [ʔapə] | ‘up/hold me’ | (Nor 1;2.18) |

This tendency has also been observed in some of the subjects’ early productions of English monosyllabic words having CVC, CV:C, and CVCC structures (See examples from the data given in (6.22)).

(6.22) Examples of extra final syllables in loan words

/kaw/	[kawu]	‘cow’	(Tal 1;3)
/dʌk/	[daki]	‘duck’	(Tal 1;3)
/dʒu:s/	[du:si]	‘juice’	(Tal 1;3)
/ʃu:z/	[su:si]	‘shoes’	(Tal 1;3)
/milk/	[mikki]	‘milk’	(Nor 1;6)

Monosyllabic adult targets have been produced as disyllabic trochaic forms (i.e. (quantity-insensitive) trochaic foot (SW)). The extra syllable often fills the weak branch of the foot. Moreover, these examples also show that the child does not copy segmental material with its prosodic structure. The ‘prosodically circumscribed’ foot in di- and trisyllabic forms is often at the right edge of the adult target word, not at the left edge. For example, forms such as the following are not attested in the data (see (6.23)):

- (6.23) a. /tuffa:ha/ *[tufa] ['wa:ha] ~ ['fa:ha],
b. /sajja:ra/ *[sa:ja] ['ja:la] ~ ['la:la]
c. /ziba:la/ *[siba] ['ba:la]

The previously mentioned phenomenon has been reported by Ingram (1978) who suggests that adding an extra vowel finally makes the production of the final consonant easier and Fikkert (1994) who provides a prosodic explanation. As to Ingram’s view, if vowel epenthesis word-finally makes the realization of the final consonant easier, then we expect to find extra syllables in disyllabic words with initial stress ending in a consonant too, but such forms are not attested in the data. These examples given above not only add another possible explanation for the predominance of disyllabic forms in the data, but they also provide further evidence for the trochaic bias hypothesis in early word productions (see section 6.4.4 for more details on the last point).

6.3.2 Multisyllabic target words: Trisyllabic and quadrisyllabic forms

At the age of 1;5, the subjects began producing very few multisyllabic target words. These constitute 1% of age group (1) word productions, 10.2% of age group (2) data, and 11.4% of age group (3) outputs as shown in Table 5.8. The examples given in (6.24) are trisyllabic targetlike outputs from age group (1&2) data. At later stages, children begin expanding their prosodic words at the second half of their second year. They go beyond producing words consisting of a single binary foot. Some children begin producing trisyllabic and quadrisyllabic words.

(6.24) Productions of trisyllabic (WSW) targets

CV/CV:/CV			
/hu'fa:da/	[ʔa'fa:da]	‘diaper’	(Maw 1;8)
/ha'la:wa/	[ha'la:wa]	‘candy’	(Maw 1;8)
/zi'ba:la/	[si'ba:la]	‘garbage’	(Nor 1; 9)
/lu'ba:na/	[lu'ba:na]	‘chewing gum’	(Nor 1;9)
<hr/>			
CV/CV:/CVC			
/ta'ma:tin/	[ta'ma:tin]	‘tomato’	(Nor 1;9)
/ba'ta:tis/	[ba'ta:tis]	‘potato’	(Nor 1;9)
<hr/>			
CVC/CV:/CV			
/sakki:na/	[takki:na]	‘knife’	(Nor 1;9)
/tuf'fa:ha/	[tuf'fa:ha]	‘apple’	(Nor 1;9)
<hr/>			

They start producing prosodic structures consisting of more than a single binary foot: structures with an unfooted syllable and a single foot (i.e. trisyllabic) and others with two feet (i.e. quadrisyllabic). The representations of such structures are given in (5.24).

At the same stage, children still keep on truncating tri- and quadrisyllabic target words to producing mono- or disyllabic words as shown in the following examples in (6.25).

(6.25) Truncations of multisyllables targets into mono-, di-, and trisyllabic forms

CV/CV/CV → CV			
a. [ʔsamaka]	[ka]	‘fish’	(Mays 1;5)
b. [ʔbagara]	[ba] (I)	‘cow’	(Mar 1;5)
<hr/>			
CV/CV/CV:C → CV:C			
c. [tilifo:n]	[fo:n] ~ [ʔo:n]	‘telephone’	(Nor 1;6 & Mays 1;5)
d. [burtuga:n]	[ka:n]	‘orange’	(Mar 1;5)
e. [ʔiskiri:m]	[ki:m]	‘ice cream’	(Mar 1;5 & Nor 1;6)
<hr/>			
CV/CV:/CV(C) → CV:CV(C)			
f. [luʔba:na]	[ʔba:na]	‘gum’	(Shah 1;7)
g. [huʔfa:da]	[ʔda:da]	‘diaper’	(Maw 1;8)
h. [baʔta:tis]	[ʔta:tis]	‘potato’	(Fais 1;7 & Maw 1;8)
<hr/>			
CV/CV/CV:/CV → CV:/CV			
i. [ʔukaʔla:ta]	[ʔka:ta]	‘chocolate’	(Fais 1;7)
j. [balaʔko:na]	[ʔko:na]	‘balcony’	(Maw 1;8)
<hr/>			
CV/CV/CV:/CV → CV/CV:/CV or CV/CV/CVC			
k. [makaro:na]	[maʔko:na]	‘macaroni’	(Mar 1;5)
l. [ʔukaʔa:ta]	[ʔukulit]	‘chocolate’	(Nor 1;6)

Despite the fact that the few examples found in the data are not enough to conduct a detailed analysis, two generalizations can be drawn. First, targets with three or more syllables are generally truncated to disyllabic outputs. Second, the preferred forms are the trochaic forms. It is obvious that stress plays a role in determining word shapes. The syllables deleted are mostly the weakest or the least prominent ones. Children tend to preserve the prominent syllables in the target words. These syllables happen to be heavy and superheavy in Arabic. Syllable position is another factor in truncating words and determining the syllables preserved in the output and, in turn, the size of early words too. Section 6.4.4 will discuss in detail the role stress and syllable position play in determining the syllable preserved and in limiting word size.

To conclude, we can say that the data analysis does not provide strong evidence for the existence of an early monosyllabic stage in child Arabic. Yet it adds another crosslinguistic evidence for the predominance of disyllabic words in early stages reported in studies investigating Romance languages and Japanese. At

the same time it questions the existence of a monosyllabic stage as a universal aspect of child phonology. To justify the findings of this study and other studies, Vihman's view (1991) about the impact of the ambient language/the input has been adopted. For instance, Germanic languages stand as an exception, as monosyllables appear to be the most common in these languages. Vihman (1991) suggests that the monosyllabic stage reported in child English and Dutch could be a reflection of the high frequency of monosyllabic targets rather than output restrictions. Therefore, researchers point to the input bias and the influence of the relative frequency of syllabic/prosodic structures in the input language. In some studies, the differences between children speaking different languages such as Germanic and Romance languages have been accounted for by the relative frequency of prosodic structure in the input language (Demuth, 2001; Gennari & Demuth, 1997; Lleó & Demuth, 1999; Lleó, 2006; Prieto, 2006). The same could be said about the disyllabic stage in Romance languages and Arabic.

6.4 Stages of syllable structure development in child Arabic

Early syllables in child Arabic have the same prosodic units found in adult phonology (See section 6.1 for evidence). Considering that both child and adult phonological systems have the same prosodic representational units, and children do not show the same richness of syllable structure that is found in most adult languages, this section provides an account of the development of early syllable structure in Arabic child phonology demonstrating how early surface structure forms deviate from the adult syllable structure (i.e. the underlying representational structure) and the strategies employed by children to map between their own phonological system and the adult's system. This section gives answers to two specific questions (E & F):

E. Do Hijazi Arabic-speaking children follow universal tendencies and/or employ language specific repair strategies and phonological processes in relating the underlying representations to the surface representations, as those reported in other studies?

F. Do Hijazi Arabic-speaking children follow universal tendencies and/or employ language specific repair strategies and phonological processes in relating the underlying representations to the surface representations, as those reported in other studies?

The main characteristics of the child's syllable structure in comparison with those of the adult model are lack of target coda, simplification/reduction of the target complex onsets and codas, and reduction of diphthongs to monophthongs (see section 2.2.2.1). These help in tracing the development of early syllable structure and pointing out the main steps of syllable acquisition. First, the stage characterized by a lack of coda or post vocalic consonants will be considered and discussed in section 6.4.1 and 6.4.1.1. The acquisition of medial and final codas will be discussed in section 6.4.1.2 to see if children acquiring Arabic go through similar stages reported in child English, Dutch, and German and other languages and to find out if coda loss or maintenance provides evidence for any prosodic adjustments in syllable structure. The role of segmental loss, stress, and syllable position are considered in this respect. This stage is accompanied by a stage of geminate pattern productions. This is marked by occurring geminate patterns produced at a very early stage and subsequent stages: those in which the coda is part of a geminate consonant, and those in which the deletion of non-final codas induces CL. Second, the development of syllable structure with complex onset and coda will be considered in section 6.4.1.3. Third, the development of syllable structures containing diphthongs will be discussed in 6.4.1.4.

6.4.1 Early stages: open and closed syllables

The development of the rhyming structure is the first issue considered and questioned in early word acquisition. Recent studies (Fikkert, 1994; Demuth, 1995; Grijzenhout & Joppen, 1999; Lleo, 2003, 2006; Lleo & Prinz, 1996, 2001; Rose, 2000; Freitas et al., 2001) have focused on coda acquisition because they stand at the intersection of universal tendencies and language-particular diversity (see section 2.2.2.1.1). The CV syllable is universally considered the core syllable or the unmarked syllable in all accounts and codas, by implication, are considered

marked. Lack of codas is one of the features marking the child's early structure in child English, Dutch, and some other languages. Subsequent research on the acquisition of English supported this claim but demonstrated that consonant-final forms are available at a relatively early age for at least some children (Brannigan, 1976; Ingram, 1976, 1986; Lleo, 2006). Despite the universality of certain syllable shapes and phonological principles, coda acquisition is characterized by individual variation and different appearances in some languages. Even in languages such as Arabic, Hebrew, and Spanish that allow structures with a rhyming coda very early and have a high frequency of the unmarked CVC syllable structure in Semitic languages, children tend to delete codas. The following sections focus on the development of closed syllable/coda acquisition in child Hijazi Arabic.

6.4.1.1 Predictions on codas in child Arabic

Given some main characteristics of Arabic (i.e. gemination and vowel length contrast) and its various syllable shapes (see section 3.2.1), I predict that early syllables in child Arabic are bimoraic forms produced with a rhyming coda. Since Arabic codas occur finally as well as non-finally and since both final and medial codas require a branching rhyme, it is expected that children will acquire codas in final and medial positions at the same time. Accordingly, we might predict that both types of codas develop at the same time. But in the case of the medial codas, being linked to the following consonantal onsets, they involve a certain degree of a representational complexity of structure (Bernhardt & Stemberger, 1998) which makes us predict that medial codas might be acquired later than final codas in child Arabic.

Here I argue that medial and final codas in Arabic, as in some languages such as Spanish and Japanese, do not have a Place of Articulation (PA) at the early stages. They are placeless or they assimilate to the place of the following consonant. According to a distinction made by Goad and Brannen (2000) and Rose (2000), that placeless consonants belong to codas, whereas consonants specified for PA should be represented as onsets of empty syllables. Only consonants with PA

specification would justify the postulation of such empty syllables, according to such hypothesis.

6.4.1.2 Development of closed syllables (coda acquisition)

At the initial stage of word acquisition (1;0 -1;3), as shown in age group (1) data analysis, Hijazi Arabic-speaking children produce a variety of syllable types: open syllables and closed syllables (see Table 5.2). They begin producing medial codas and final codas early at the same time. Their utterances contain very few target words with codas, and the very few attempted codas are systematically deleted. At the later stages more words are produced with final codas (monosyllabic and disyllabic forms). It has been mentioned previously that coda consonants develop gradually when they begin to emerge, and some consonants appear before others in coda position. Therefore, few consonants appear as codas in word final position in CVC and CV:/CVC words, and some consonants begin to appear in syllable final position in the first syllable of CVC/CV and CVC/CVC structures (i.e. C1VC2/C3V and C1VC2/C3VC4). The data analysis of age group (1) has shown that open syllables (CV (10%), CV: (1.2%), CV/CV (29.1%), CV:/CV (10.6%)) constitute the majority of the subjects' early word productions. Though a considerable amount of closed monosyllables structures (CVC (19.7%) and CV:C (7.1%)) appear in group (1) data (see examples given below in (6.26), yet there are cases where codas are missing in some of the subjects' early monosyllabic and disyllabic productions as shown in some examples given below in (6.27).

The data analysis has shown that Arabic-speaking children produce codas in medial and final position early. At the initial stage, children's utterances contain very few target words with codas, and the few attempted codas are systematically deleted. At the later stages more words are produced with final codas (monosyllabic and disyllabic forms). It has been observed that most of the codas occur in stressed syllable and few medial codas have been produced in unstressed syllables at the later stages (i.e. by the age of 1;9).

In these children's productions, the laryngeals [h,ʔ], the fricative [s], and the glide [j] have been counted as substitutes for the coda consonants not yet

acquired. This phenomenon can be illustrated by a number of examples from the data (e.g. /nu:r/ > [nu:j] ‘light,’ /ʕe:f/ > [ʕe:s] ‘bread,’ /ta:h/ > [ta:h] ‘fell down’). Similar examples are found in Spanish (e.g. rana ‘frog’ [hajna] ~ [ʔajna]). Lleo (2003) reports a massive production of codas as glides in Spanish at the early stages. In this study data, there are very few productions of codas as glides. Lleo (2003: 276) suggests that such substitutions imply that when the coda position is available to the child, it is segmentally a defective position, in the sense that it cannot license consonantal features. The question that should be raised here is: Should these be given the same credit as target-like codas? Though these substitutions might indicate a sign of an incomplete mastery of codas, but they still should be given credit in the analysis because they clearly occupy a position in the rhyme, i.e. the coda position. In the case of glides, they are not to be analyzed as codas but as the second part of a diphthong sometimes; therefore, they would then occupy a complex nucleus position. In both cases there is branching, either branching of the rhyme or branching of the syllabic nucleus, which implies a higher degree of complexity than say CV as regards syllabic structure.

(6.26) Early productions of closed syllable outputs

/ʔam/	[ʔam] ~ [ham]	‘food/eat’	(All subjects)
/bi:b/	[bi:b]	‘car’	(Abdul 1;1.15)
/dub/	[dub]	‘teddy bear’	(Mays 1;5)
/ruz/	[lus]	‘rice’	(Naw 1;5)
/ba:b/	[ba:b]	‘door’	(Nor 1;2.15)
/mi:n/	[mi:n] ~ [mi:]	‘who’	(Moh’d 1;2.25)
/nu:r/	[nu:n] ~ [nu:j] ~ [nu:]	‘light’	(Nor 1;2.15)

The tendency of deleting final sonorant consonants, particularly after a long vowel, is noticeable and attested in the data (see the examples given below in (6.27)).

(6.27) Coda deletion in early productions of child Arabic

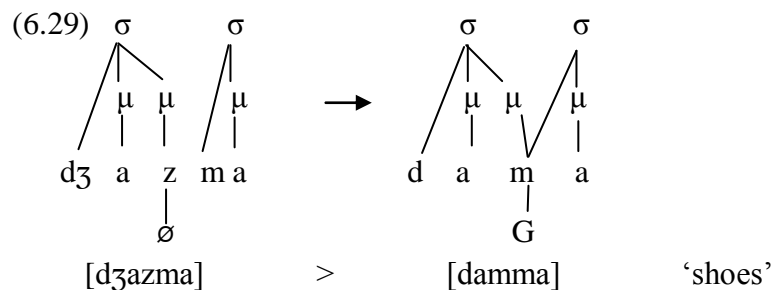
a. /ta:h/	[ta:]	‘fell down’	(Abdul 1;1.15)
b. /mi:n/	[mi:]	‘Who?’	(Nor 1;2.15)
c. /fi:l/	[bi:]	‘elephant’	(Mays 1;5)
d. /nu:r/	[nu:]	‘Noor (a name)’	(Nor 1;2.15)
e. /ʕasi:r/	[ʕasi:]	‘juice’	(Mar: 1,2)
f. /ʔitne:n/	[ʔine:]	‘two’	(Naw 1;4)

If we consider medial codas, we find that Hijazi Arabic-speaking children go through three stages. At the initial and in subsequent stages, they produce target geminate words containing obstruent and nasal geminates such as those given in (6.28). These medial codas are part of a geminate consonant in C1VC2/C2V structure. At the very early stage (between 1;0 and 1;3), some children tend to reduce these target geminate to target singletons sometimes by deleting the first half of the geminate i.e. the coda closing the first syllable. (e.g. /dʒadda/ > [dada] ‘grandma,’ /nanna/ > [nana] ~ [nani] ‘food’), but they do not spend a long time producing such forms.

(6.28) Production of target obstruent and nasal geminates

/dʒadda/	[dadda]	‘grandma’	(Nor 1;2)
/sittu/	[tittu]	‘grandma’	(Shah 1;5)
/ʕamma/	[ʔamma]	‘aunt’	(Mar 1;2)
/batta/	[p ^h atta]	‘food’	(All subjects)
/bissa/	[bissa]	‘cat’	(Fais 1;7)

At a later stage (i.e. at the age 1;5), children began attempting target medial codas that have a PA, but they fail to do so, and instead they produce place assimilated consonants to the place of articulation of the following onset consonant after applying a CL process (C1VC2/C3V > C1VC2/C2V) as shown in the examples given in (6.30). The following figures in (6.29) illustrate the changes imposed on the word structure by the assimilation or CL process.



(6.30) Examples of medial codas in child Hijazi Arabic

/kalba/	[kabba]	‘dog’	(Nor 1;6)
/dabdu:b/	[daddu:b]	‘teddy bear’	(Nor 1;6)
/warda/	[wadda]	‘rose’	(Nor 1;6)
/ʃanta/	[tatta]	‘bag’	(Nor 1;2)
/marjam/	[majjam]	‘Mariam (a name)’	(Mar 1;5)
/dʒubna/	[dunna]	‘cheese’	(Maw 1;8)

As mentioned earlier, when the coda position is available to the child, it is segmentally a defective position, in the sense that it cannot license consonantal features. In order to be licensed, consonantal features must be linked to the following onset, as predicted by the Coda Condition, operative in many languages (Ito, 1986; Goldsmith, 1990). According to the Coda Condition, the coda cannot license (non-coronal) place features (Ito, 1986). The codas produced medially often share PA features with the following onset. Another point worth mentioning here is that the segmentally defective position emerges under stress. Medial codas in trochees appear first before final codas for they are codas of stressed syllables. This is important because the stressed syllable constitutes the head of a foot, and stressed head syllables license complexity of the rhyme. This is consistent with the constraint Stress-to-Weight (McCarthy & Prince, 1986; Hayes, 1989) which predicts that a stressed syllable should be heavy, that is containing a branching rhyme comprised of a vowel and a coda or a branching nucleus.

Such structures are observed for a long period of time occurring till the age of 1;9 and 2;0. During this period, these children's productions exhibit an interesting asymmetry found between these two types of geminates discussed above. By the age of 1;8 or 1;9, some subjects began producing medial codas (non-geminate) that have a PA, but not as a coda consonant assimilated to the following onset consonant. Very few instances were found in the data (see (6.31)).

(6.31) Production of target medial codas

/la ^h ma/	[la ^h ma]	'meat'	(Nor 1;9)
/ʃa ⁿ ta/	[ta ⁿ ta]	'bag'	(Fais 1;7)
/ma ^k wa/	[ma ^k wa]	'iron'	(Nor 1;9)
/ga ^h wa/	[ka ^h wa]	'coffee'	(Maw 1;8)

Between 1;7 and 1;9, the subjects of age group (3) produce more words ending with word-final consonants in a target-like manner though still within their own limited sound inventory (i.e. stops, nasals, few fricatives, glottals, and glides) for some codas are substitutions for other sounds. Codas appear in these subjects' monosyllabic, disyllabic, and trisyllabic outputs due to templatic factors. They appear not only word finally but also syllable finally (see the examples given in (5.19) and (5.36)).

I claim here that stress plays a role in the development of closed syllables whether in medial or final position and that there is a direct relationship between the production or deletion of codas and the word position of the syllable bearing the coda, as well as whether or not it is stressed. Children's truncations provide evidence in this respect. Most of the stressed syllables preserved by the subjects end with codas as shown in the following examples:

(6.32)	/xa'la:s/	[la:s]	'finished'	(Naw 1;4)
	/la'zi:z/	[di:d]	'delicious'	(Mays 1;5)
	/fus'ta:n/	[ta:n]	'dress'	(Nor 1;6)
	/dab'ba:b/	[ba:b]	'bike'	(Mays 1;5)
	/bas'ko:t/	[to:k]	'biscuit'	(Nor 1;6)
	/lai'mu:n/	[mu:n]	'lemon'	(Mar 1;5, Nor 1;6)

For instance, medial codas in trochees are produced earlier because they are codas of stressed syllables. The data analysis has shown that at the initial stage medial codas appear in medial stressed positions only. At a later stage both medial and final codas appear in stressed and unstressed syllables. Children produce coda presumably because it appears in word final position or in unstressed syllables as the final syllable of disyllables or trisyllables.

6.4.2 Development of syllable structure with complex onset and coda in child

Hijazi Arabic

Children acquiring languages with complex onset and coda structures, such as Germanic languages (e.g. English and Dutch) and Romance languages (e.g. Spanish and French) often go through an intermediate stage where singleton codas are preserved, while coda clusters are reduced to singletons (Fikkert, 1994; Demuth & Fee, 1995; Lleo & Prinz, 1996; Rose, 2000; Lleo, 2006). Based on the findings of previous studies, this question, that relates to question (D), is raised here again:

D. Do Hijazi Arabic-speaking children follow the same path in acquiring a syllable structure with complex onset and coda?

This section discusses this issue in the light of the findings of this study data analysis and the findings of similar studies from other languages.

The occurrence of consonant clusters in the data is very rare because they are acquired very late in the second year. The data analysis has shown that apart

from one word only, which is [mbu] ~ [mβu] ~ [mbuwa] ‘water,’ there is no evidence for the occurrence of any consonant clustering in initial position. At the initial stage (1;0 –1;3), no instances of final consonant clustering have been attested in age group (1) data.

As in other languages such as Germanic and Romance languages, simplification of a cluster takes place by deleting all the members at the initial stage, and/or one of its members reducing it to a single consonant, by assimilating one of its members, or by inserting a vowel between the two consonants. Usually the direction of the deletion is predictable in many instances. As in English and other languages, one of the most regular patterns is the deletion of sonorants when they occur in combinations with stops unless the child has a preference of a certain sound. At the very early stage of word acquisition, deletion of both final consonants is a frequent process employed by age group (1) subjects resulting in these word shapes: CV and CV/CV. At the intermediate stage, children tend to delete one of the members in a cluster according to the ‘sonority pattern’ reducing the target cluster to the least sonorous segment i.e. by deleting the sonorant consonant as shown in section 2.2.2.1.2.1 where sonority effects in cluster reduction are explained. The example given in (6.33), which is the only one found in age group (1) data, illustrates the final CC reduction in which the sonorant consonant has been deleted.

(6.33) /kalb/ [kab] ~ [tab] ‘dog’ (Mar 1;2 & Tal 1;3)

Similarly, following the general sonority scale, the most sonorous segments have been deleted in the examples attested in age group (2) and (3) data (e.g. /-lb/ > [b] in /kalb/ ‘dog, /-nt/ > [t] in /bint/ ‘girl’, and /-rd/ > [d] in /gird/ ‘monkey’).

These processes described above show more differences existing between the adult word form and the child's rendition of the target words. They also affect syllable structures of early words yielding CV and CV/CV structures during the initial stages. At later stages (1;7-1;9), some children in age group (2) and (3) produced very few final CC (See the examples in (6.34)).

(6.34) Final CC reduction

CVCC → CVC

/bint/	[bit]	‘girl’	(Nor 1;6)
/kalb/	[tab] ~ [kab]	‘dog’	(Nor 1;6, Mar 1;5, Naw 1;7)
/gird/	[gid]	‘monkey’	(Nor 1;6)
/ʔard/	[ʔad]	‘floor’	(Nor 1;6, Yas, 1;9 & Maw 1;8)
/taħt/	[tat]	‘down’	(Mar 1;5 & Nor 1;6)

The word, bint /bint/ ‘girl’ is produced by Hijazi Arabic-speaking adults as [bit] sometimes, whereas in some dialects such as Lebanese or Syrian Arabic it is produced as [binit]. In the former example, deletion of one member of its CC takes place, but in the latter, vowel epenthesis is used to break the cluster. The deletion process has been employed by age group (2) and (3) subjects and it resulted in reduction of CVCC structures to CVC outputs as shown in (6.34) .

As to initial CC, very few examples have been attested in the data and the same process has been used to reduce CCV:C forms to CV:C outputs as shown below:

(6.35) Initial CC reduction

CCV:C → CV:C

/gri:s/	[gi:s]	‘Grace (a name)’	(Nor 1;6)
/nru:h/	[lu:h] ~ [ju:h]	‘we go’	(All subjects)

Thus, consonant clusters are acquired very late in the second year; therefore, occurrences of words with CC in the data are very rare. Because of this, a detailed analysis in this respect cannot be conducted due to the small amount of data on CC.

6.4.3 Reduction of diphthongs to monophthongs

One of the differences between child and adult syllable structure is the reduction of diphthongs to monophthongs (Bernhardt & Stemberger, 1998; Ota, 1998, 2003). Syllables containing diphthongs are not produced with a target-like structure, but they are reduced to monophthongs by deleting the second vowel and lengthening the first vowel. Illustrative examples from other languages such as Japanese, for instance, are given in (2.2.2.1.3). Monophthongization of diphthong targets occurred in this study Arabic data, but their occurrence is very rare and inconsistent. Apart from three subjects in age group (3), most of the subjects have

not attempted any targets with diphthongs. Very few examples have been found and these are given below in (6.36).

(6.36) Production of diphthongs in child Arabic

a./laimu:n/	[li:mu:n]	‘lemon’	(Nor 1;9)
b./zaitu:n/	[si:tu:n]	‘olive’	(Nor 1;9)
c./laimu:n/	[laimu:n]	‘lemon’	(Mar 1;8)
d./zaitu:n/	[sainu:t]	‘olive’	(Mar 1;8)
e./laimu:n/	[lamu:n]	‘lemon’	(Yas 1;9)

The production of diphthongs is marked by inconsistency. Diphthong targets are realized as a long vowel as in (6.36a & b) where one of the vowels is deleted and the other lengthened or as a short vowel as in (6.36e). Monosyllabic targets with diphthongs are not attested in the data, and it is not clear whether V-lengthening is caused by syllable-internal requirements or by a word-level minimality condition. In Egyptian Arabic, monophthongization is applied by adults to reduce diphthongs to short vowels (e.g. /laimu:n/ > [lamu:n] ‘lemon,’ /zaitu:n/ > /zatu:n/ ‘olive’), whereas in Tunisian Arabic, reduction of the diphthong and V-lengthening take place (e.g. /daima/ > [di:ma] ‘always’). Similarly, diphthongs in adult HijAr are reduced to long vowels (e.g. /ʔaiʃa/ > [ʔe:ʃa] ‘Aisha (a name) and /ʔaila/ > [ʔe:la] ‘family’).

Some individual differences have been observed in these subjects’ production. Apart from one of subjects (Mar), for example, who managed to produce diphthongs at the age of 1;8, most children disallowed diphthongs in their repertoire and favored reduction. This indicates that diphthongs are acquired late as their occurrence in the data is very rare. Therefore, a detailed analysis in this respect cannot be conducted.

To conclude, it seems that the sonority pattern is a cross-linguistic phenomenon. Crosslinguistically, there is a tendency among children to reduce syllable-initial and final clusters to singletons and preserve the least sonorous segment in the surface form. Despite the range of variation of different patterns reported in some studies of cluster acquisition, which might reflect different grammar types, the ‘sonority pattern’ types are still observed in many languages, including Arabic.

6.4.4 Truncation factors: Marked segments, stress, and syllable position

This section sheds light on the factors contributing to truncations/syllable deletion in the child Arabic data. It provides causes of truncations away from the templatic factor, the upper size limit on early words. These factors are:

I. Marked segments

The analysis has shown that HijAr-speaking children tend to substitute or delete certain marked segments (e.g. velar stops, alveolar and pharyngeal fricatives and the liquid trill) in onset or coda position at the very early stage of word production. In some cases deletion of a segment causes total omission of syllables as shown below in (6.37 a-c). Segmental deletion that consistently leads to syllable deletion involves mostly the marked sounds that are not yet acquired by the subjects such as the voiced trill / r / and the alveolar and pharyngeal fricatives /ʕ, ɣ/, for instance.

(6.37) Examples of syllable deletion

- a. /dʒawwa:l/ [wa:l] ‘mobile’ (Tal 1;3)
- b. /makaro:na/ [mako:na] ‘macaroni’ (Mar1;5)
- c. /gambari/ [gambi:] ‘shrimp’ (Shom 1;3)

There are reasons that syllable deletion might be caused by segment markedness, not by a templatic output condition. First, some children occasionally produce the final syllable with a substitute consonant for the marked segment (e.g. /ku:ra/ > [tula] ‘ball’ /ʕasi:r/ > [ʔasi:l] ‘juice’ /sajja:ra/ > [ja:la] ‘car’). In such cases, the prosodic structure of the target is not the issue. Second, words with the same prosodic structure, CV:CV, for example, do not undergo such truncation during the same period of production (e.g. /ku:ra/ > [tula] , /sa:ʕa/ > [sa:ʔa] ‘watch’) (see more examples in (5.10)) for there is nothing problematic about the prosodic shape CV:/CV. Finally, the truncation process continues for a long period even when children start producing more complex or longer targets. Here we conclude that

segmental markedness, not templatic effects, may play a role in syllable truncations.

II. Syllable position

Syllable position often interacts with truncation patterns. It has been reported that word-final syllables are less susceptible to omission (Allen & Hawkins, 1979; Macken, 1992; Echols, 1993; Pater, 1997; Fikkert, 1994; Demuth, 1995; Ota, 2003). The effect of syllable position also interacts with stress sometimes. The child Arabic data of this study confirms the findings in previous research. Final syllables are likely to be preserved than other syllables in the subjects' early productions. The effect of syllable position and its interaction with stress is apparent in disyllabic and multisyllabic forms as shown in the examples given below in (6.38). Final heavy syllables in Arabic often attract and carry primary stress, and therefore, they are more likely to be preserved (see more examples from the data in (5.26), (5.27), and (5.28)).

(6.38) Syllable truncations of disyllabic and multisyllabic targets

Disyllabic targets

/magas/	[kas]	'scissors'	(Fais 1;7)
/ʔaŋ ^h kab]	[kab]	'spilt'	(Nor 1;9)
/muf ^h ta:h/	[ta:h]	'key'	(Maw 1;8 & Nor 1;9)
/dab ^h ba:b/	[ba:b]	'bike'	(Mays 1;5)

Multisyllabic targets

/tilifo:n/	[fo:n] ~ [ʔo:n]	'telephone'	(Nor 1;6; Mays 1;5)
/burtuga:n/	[ka:n]	'orange'	(Mar 1;5)
/ʔiskiri:m/	[ki:m]	'ice cream'	(Mar 1;5; Nor 1;6)

There is also the possibility of omitting initial, medial, or final syllables in multisyllabic words, but final syllables are more likely to be preserved than medial syllables. Initial syllables are more likely to be retained than medial syllables in

some children's data (e.g. Nor, Mays, Shah & Naw) at the very early stage of acquisition. This indicates that medial syllables are sometimes more likely to be deleted than final syllables (see examples in (6.39)). Another observation of worth mentioning here is that initial weak syllables in disyllabic targets are more susceptible to deletion than final syllables in most cases.

- (6.39) a. /'batta/ [pa] ~ [ta] 'duck' (Nor 1;2 & Naw 1;4)
 b. /'samaka/ [ka] 'fish' (Mays 1;5)
 c. /ha:ti/ [ti] 'give me' (Abdul 1;1)
 d. /maka'ro:na/ [ma'ko:na] 'macaroni' (Mar 1;5)

Here we conclude that syllable position may play a role in syllable deletion, but by itself it does not cause syllable truncation for being a factor that depends on target size.

III. Stress

In Arabic, stress is assigned in function of syllable weight, i.e. the heaviest syllable often attracts stress (see section 3.2.1.3 for more information on stress assignment in Arabic). Even in loanwords, primary stress often falls on final heavy syllables. Stress plays an important role in shaping or constraining early word productions. The stress system of Arabic also shows that there is a stress pattern that has prominence on the left edge, bimoraic feet (a quantitative trochee).

The data analysis results support the findings of previous research concerning stress effect on truncations. There is sensitivity to differences between stressed and unstressed syllables (Ingram, 1976; Stoel-Gammon & Dunn, 1985; Allen & Hawkins, 1980; Echols, 1993; Echols & Newport, 1992; Levey & Schwartz, 2002). There is bias toward a trochaic pattern (SW) and strong-weak-weak prosodic structure (SWW). Omission of weak initial syllable is more frequent in weak-strong-weak (WSW) prosodic structure. Young children frequently produce the stressed portion of bisyllabic words (e.g. /magas/ > [gas] 'scissors' and / fusta:n/ > [ta:n] 'dress'). It has also been observed that both disyllabic and multisyllabic

targets are subject to truncation in child Arabic, but the data analysis reveals the crucial role stress plays in truncating multisyllabic target words (i.e. tri- and quadrisyllabic targets. Preservation of stressed syllables is not affected by their positions within the word. No matter what position they occupy in the target word, stressed syllables often tend to escape deletion (see the examples given above in (6.38) for truncations of disyllabic targets. The following examples are illustrative of truncations of trisyllabic targets to trochaic patterns.

(6.40) Truncations of trisyllabic targets

/saj'ja:ra/	['ja:la]	'car'	(Naw1;4; Naw 1;5)
/ʕa'ru:sa/	['lu:sa]	'doll'	(Naw1;4)
/hu'fa:da/	['fa:da]	'diaper'	(Mays1;5)
/ba'ta:tis/	['ta:tis]	'potato'	(Mar 1;5)

The data analysis has shown that the subjects continue truncating disyllabic targets rendering (S) forms and trisyllabic target forms to conform to bisyllabic trochees (SW) at times even when they have fully started producing iambic (WS and WSW) words. The data analysis reveals that stress falling on heavy syllables protects them from deletion in disyllabic and multisyllabic /long targets. Therefore, the highly stressed syllables in the subjects' outputs have been preserved leaving the weakest part subject to deletion.

In conclusion, we can say that truncations and the preservation effect of stressed syllables depends on a number of factors: stress, syllable position and segment markedness, including target size.

6.5 Stages of the development of HijAr subjects' word prosodic structure

Despite universality, individual variation in the early period of word acquisition may resist any coherent formulation in terms of universal phonetic or phonological principles, even across children acquiring a single language. Therefore, it has been suggested that providing general stages of acquisition is a

useful way to explain the acquisition process (Ingram, 1976; Ferguson, 1978; Schwartz, 1984; Stoel-Gammon & Dunn, 1985).

Children acquire phonology with the acquisition of their first words and they go through a number of stages till they reach the level of producing target-like forms of the adult model. It has been assumed that children's initial grammars are unmarked (Jakobson, 1968), and during the acquisition process, children acquire the marked aspects of their native language over time and through developmental stages (Jakobson, 1968; Stampe, 1969; Smith, 1973; Fikkert, 1994; Ota, 1998, 2003) (see section 2.2.4). This section provides an answer to the following fundamental question:

(2) Do Hijazi Arabic-speaking children go through the same developmental stages of acquiring syllable structure and word structure reported in the acquisition literature and/or are their early word productions sensitive to their language-specific phonology?

It discusses the stages of development of Hijazi Arabic-speaking children's prosodic phonology which starts at the onset of speech in the light of the models offered by Demuth (1995), Demuth and Fee (1995), and Fikkert (1994) who capture early word development in terms of the Prosodic Hierarchy and identify four stages in the development of prosodic structure for English and Dutch (see Table 2.5). They suggest that similar stages of development may be found in the acquisition of all languages.

The stages of prosodic development of Arabic early words in this work have been explored within a representational view/approach, where children might be seen to gradually gain access to different levels of prosodic structure over time. The overall word shapes used by the subjects at three periods starting from 1;0 till 1;9 helped in differentiating various stages of early word acquisition in child Hij Ar. The data analysis has identified a number of stages of prosodic structure development of child Hij Ar (see Table 6.2) which do not totally conform to those reported in the literature and identified by Demuth (1995) and Fikkert (1994), and in particular the initial stage.

Table 6.2 Stages of the development of prosodic structure in child
Hijazi Arabic

Stage I	Minimal words/Binary feet a. Closed syllables: CVC & CV:C b. Open disyllables: CV/CV & CVC/CV (SW) c. Few CV forms (resulting from truncations) d. Early appearance of medial and final codas
Stage II	Minimal words & maximally disyllabic words (Binary Feet) a. Open syllables: CV/CV, CV:/CV, CVC/CV b. Closed mono- & disyllables: CVC, CV/CVC, CVC/CVC, CVC/CV:C (SW) & (WS) c. Vowel length distinctions: CV:
Stage III	Prosodic words - larger than a binary foot (WSW), (SWW), (WWSW)
Stage IV	Prosodic Words – targetlike forms

The analysis has shown no correspondance to the initial stage which is marked by the prevalence of monosyllabic words consisting of the core syllable CV as reported in the studies dealing with Germanic languages. Stage I witnesses the early occurrence of minimal bimoraic words, consisting of a single foot (binary foot), with closed monosyllables (CV:, CVC, CV:C) and open disyllabic forms (CV/CV, CVC/CV). This stage is also marked by the early appearance of final coda in monosyllables despite the instances of coda deletion attested in the data. Most of the subjects' forms are onomatopoeic words and words used in child directed speech register (e.g. ham, bi:b, tu:t, dudu), and some targetlike forms (e.g. [dadda] 'grandma,' [ʔamma] 'aunt,' [mo:ja] ~ [bo:ja] 'water'). Few CV forms (10%) were observed in the data, but these failed to characterize the majority of the forms produced at this very early stage. Similarly, Stage II is characterized by more complex forms: minimal words composed of binary foot (the unmarked form of prosodic words) and maximally disyllabic forms whether target-like productions or truncations (CV/CV, CV:/CV, CVC/CV, CV/CVC, CV/CV:C, CV:/CVC, CVC/CVC, CVC/CV:C). Stage III is composed of mostly disyllabic forms and few prosodic words larger than a binary foot. This is a stage when they start producing words with unfooted syllables (tri- syllabic forms) and a single foot (CV/CV/CV,

CV/CV:/CV, CVC/CV:/CV) and very few words with two feet (quadri-syllabic forms) (CV/CV/CV:/CV). At later stages, children approach the adult model by producing more complex target words. It should be noted here that Stage IV, identified in Demuth's model and Fikkert's as well, is not dealt with in this study since it mainly focuses on early word production during the single word period (1;0-1;9).

In general, the data analysis has shown similar patterns of acquisition for all children in each stage, with minimal differences. They begin by producing trochaic words (monosyllabic and disyllabic forms) and then they tend to enlarge their PWs to structures allowing an unfooted syllable. Children of age group (1) produce PWs of the shape S and SW (trochaic forms), some of which are the result of truncating disyllabic and trisyllabic target words. The productions of age group (2) show gradual phonological development toward the emergence of more phonetic segments and more complex syllable structures. In addition to trochaic forms, they begin realising initial weak/unstressed syllables and produce iambic words of the shape WS and WSW forms at the same time. The latter (WSW) allows an unfooted syllable. Very few subjects in age group (3) did not attempt any trisyllabic forms with an unfooted syllable (WSW). PWs with two feet are the last to be acquired/learned. Very few attempts to produce two feet words (i.e. quadrisyllabic words) were found in the data.

6.5.1 Stage I

At this stage, the subjects produce minimal bimoraic forms (CVC, CV:C) and they show preference for certain disyllabic patterns: CV/CV, CVC/CV, some of which were created by reduplication and consonant harmony (e.g. wawa, bibi, dudu, nunu, tata, nanna). Some of these words are mostly onomatopoeic words (e.g. ham/?am, bi:b, tu:t). Few appear as matching adult words (e.g. [dadda] 'grandma,' [mo:ja] ~ [bo:ja] 'water'). The few CV forms observed in these children's repertoire failed to characterize the majority of the monosyllabic forms produced in the data. Such forms were mostly truncations of disyllabic and

trisyllabic target words. Sometimes, these forms alternate with CV: forms in some cases as shown in (6.41).

(6.41) Examples of the subjects' CV forms in Stage I

/mo:z/	[mə]	'banana'	(Nor 1;2.15)
/be:t/	[be]	'house'	(Maria 1;1.25)
/mi:n/	[mi:] ~ [mi]	'who?'	(Nor 1;2.15)
/dabba:b/	[ba:] ~ [ba]	'bike'	(Nor 1;2.15)
/tuffa:ħa/	[pa:] ~ [pa]	'apple'	(Mar 1;2)

During the initial stages of phonological development, the words often used by children from different linguistic backgrounds (e.g. English, Dutch, and German) are predominantly CV monosyllables. In general, it is reported that UG provides these children with the unmarked core syllable or subminimal/monomoraic word (CV) ($\sigma\mu$) (Fee, 1995, Fikkert, 1994). Here, based on this study findings, I claim that representation of the core syllable might take place at an earlier stage i.e. before the onset of speech or during the babbling stage. Variability marks the very early productions of the subjects' CV forms (see examples in (6.41)) due to the fact that at the initial stage, children do not have complete control over vowel production in their utterances. This has also been reported in child English and Dutch (Demuth & Fee, 1995; Fikkert, 1994) (see examples in (2.27) and (2.28)). Some of their CV: outputs may result from V-lengthening after coda deletion in CVC targets, syllable truncation, or merely deleting the extrametrical consonant in superheavy syllables (CV:C) (e.g. [mi:n] > [mi:] 'who,' and thus satisfying the bimoraicity principle ($\sigma\mu\mu$)).

The analysis of child Arabic data has shown that this stage witnesses the early appearance of post-vocalic consonants (obstruents and nasals) in medial and final position despite the fact that instances of final coda deletion occurred in the data (see examples in 6.42).

(6.42) Examples of coda deletion in mono- and disyllabic words

CV:C → CV:			
a./mi:n/	[mi:] ~ [mi]	‘who?’	(Nor 1;2)
b./tu:t/	[tu:]	‘train’	~
<hr/>			
CV:C → CV			
c./mo:z/	[mə]	‘banana’	(Nor 1;2)
d./be:t/	[bə]	‘house’	~
<hr/>			
CV/CV:C → CV/CV:			
e./ʕasi:r/	[ʕasi:]	‘juice’	(Mar 1;2)
f./mira:l/	[mija]	‘Miral (a name)’	~
<hr/>			

This indicates that Hijazi Arabic-speaking children can represent coda consonants early, and as a consequence, some minimal words take the form of CVC structures.

At this very early stage, it is not clear whether open CV and CV: syllables are often accompanied by lengthening as a syllable-internal requirement or caused by a word-level minimality condition. In many cases, CV: syllables found result from deleting the final consonant which is an extrametrical element in superheavy monosyllabic target words (CV:C forms) (e.g. [mi:n] > [mi:] ‘who?’, [ta:h] > [ta:] ‘it fell down’) keeping the minimal bimoraicity structure.

Stage I is characterized by the early acquisition of coda, both in medial and final position though there are instances of final coda deletion occurring in the data. Medial codas appear in words having medial obstruent and nasal geminates (e.g. mamma, nanna, dadda, tuttu) which occur early in Arabic. Some of these geminates are identical to adult targets (see examples in (6.43)) or a place assimilated consonant to the following onset as shown in the examples given in (6.44).

(6.43) Productions of target-like CVC/CV forms with medial geminates

/dʒadda/	[dadda]	‘grandma’	(Moh’d 1;2)
/ʕamma/	[ʕamma]	‘aunt’	(Abdul 1;1)
/ʔanna/	[ʔanna]	‘grandma’	(Mar 1;2)

(6.44) Productions of medial geminates resulting from place assimilation

/ʔabʕa/	[ʔabba]	‘I want’	(Nor 1;2.15)
/ʃanta/	[tatta]	‘bag’	(Mar 1;2)
/ʕabdu/	[ʔaddu]	‘Abdo (a name)’	(Nor 1;2.15)

that Arabic is a language characterized by vowel length contrast and the unmarkedness of CVC structure. When children are exposed to languages that have closed syllables such as Arabic, they can represent coda consonant early, and accordingly minimal words take the form of CVC structure. This accompanies the CV/CV stage which is realized for a period of time as a means for producing minimal words when some coda consonants cannot yet be represented due to segmental markedness in some cases (see Table 5.10 for percentage of CV/CV frequency in all the three age groups).

Concerning the word size and prosodic structure of early words, the bimoraic foot is the word size maximum in these Hijazi Arabic children's early word productions. The subjects show an appeal to the minimality constraint ($W_{\min} = F = [\mu\mu]$) (e.g. $[ta:h] > [ta:]$ 'fell down', and $[mi:n] > [mi:]$ 'who?'), and demonstrate sensitivity to maximality constraints ($W_{\max} = F = [\sigma\sigma]$) (e.g. $[si:du] > [ti:du]$ 'grandpa' (Mar 1;2), and $[d\text{ʒ}adda] > [dadda]$ 'grandma' (Nor 1;2.15). Representations of these prosodic word structures produced at Stage I are given in (5.8).

Similar to English, German, Spanish, Catalan and some other languages (Demuth, 1995; Demuth & Fee, 1995; Lleo, 2006; Prieto, 2006), there is a strong preference of trochaic stress patterns (SW) in child Arabic. These patterns appear very early in children's productions of full bisyllabic SW target-like forms or truncated forms of trisyllabic patterns (see examples given below in (6.46 a & b).

(6.46) Examples of trochaic patterns matching adult targets and truncated forms

a. CV:/CV → CV:/CV			
/si:du/	[ti:du]	'grandpa'	(Mar 1;2)
/hiba/	[hiba]	a girl's name	(Nor 1;2.15)
/mo:ja/	[bu:ja]	'water'	(Moh'd 1;2.25)
/dʒadda/	[dadda]	'grandma'	(Nor 1;2.15)
<hr/>			
b. CVC/CV:/CV → CV:/CV			
/ha'bi:bi/	[bi:bi]	'darling'	(Moh'd 1;2.25)
/tuffa:ha/	[wa:ha]	'apple'	(Nor 1;2)
/bal'lo:na/	[no:na]	'balloon'	(Mar 1;2)
<hr/>			

Lleo (2006) and Prieto (2006) provided evidence for the presence of maximality constraints early in child Spanish and child Catalan and they reported that they are partly determined by the frequent metrical structures in these languages. This study analysis yielded similar results for the presence of maximality constraints so early in child Hijazi Arabic (see examples given in (6.46)).

6.5.2 Stage II

This stage is called the ‘systemic stage’ according to Locke’s model (1983). It is marked by the absence of babbled forms and by changes in the phonetic characteristics of the child’s system and in the nature of the lexicon. In addition, more child-adult differences are realized. The ‘whole word’ approach begins to vanish and a marked change in the child’s phonological system starts (Locke, 1983; Stoel-Gammon & Dunn, 1985). For instance, the child produces more types of speech sounds and uses forms of words that are relatively rule-governed. The phonetic system now moves more and more in the direction of the particular ambient language by acquiring more sounds outside the babbling repertoire and loss of sounds outside the adult structure (Vihman & Boysson-Bradies, 1994, Vihman, 1996). Locke (1983: 98) states that “where phonology is concerned, it appears that the first genuine stage may well await the first 50 words, and may not be discerned until 18 months or more.”

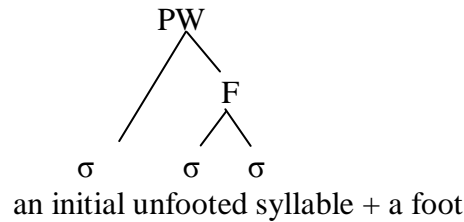
The data analysis has shown that this stage (i.e. 1;4-1;6) is a very productive stage of phonemic phonological development and it is considered a transitional period from simple structures (minimal forms) with open syllables (CVC, CV:C, CV/CV, CVC/CV) at the early stage (1;0-1;3) to more complex disyllabic structures with various templates and closed syllables (CV/CVC, CV:/CVC, CV/CV:C, CVC/CVC) at a later stage between 1;4 - 1;6. Increase of final codas marks children’s productions at this stage. Medial codas continue to appear as place assimilated codas to the following onset or caused by consonant compensatory lengthening (CL) as shown in the examples given in (6.47). The duration of this assimilatory process lasts till the age of 1;9 or even 2;0.

(6.47) Examples of CL from age group (2) word productions

/kalba/	[kabba]	‘doggie’	(Mays 1;5)
/warda/	[wadda]	‘rose’	(Lin 1;6.12)
/dʒazma/	[damma]	‘shoes’	(Nor 1;6)

As to word size and prosodic structure, the bimoraic foot is still the word size maximum in these Hijazi Arabic children’s early word productions at this stage. They continue showing an appeal to the minimality constraint ($W_{min} = F = [\mu\mu]$) and they show an awareness of maximality constraints ($W_{max} = F = [\sigma\sigma]$). The children’s productions at this stage exhibit an increasing ability to handle more complex prosodic structures over time. In addition to the representations given in (5.8) for monomoraic and bimoraic forms, the words produced by age group (2) subjects exhibit more representations of more complex prosodic structures (see Figure (6.48), those with more than a single foot.

(6.48) Prosodic words composed of more than a single foot:



At the age of 1;6, most of the subjects began producing trisyllabic words consisting of an initial weak unfooted syllable and a trochaic foot (WSW) and examples from the data exhibiting this prosodic structure are given in (6.49).

(6.49) Examples of trisyllabic forms showing identity with adult’s targets

/ħa'la:wa/	[ʔa'la:wa]	‘candy’	(Mar 1;5)
/luba:na/	[luba:na]	chewing gum’	(Nor 1;6)
/zi'ba:la/	[si'ba:la]	‘garbage’	(Nor 1;6)
/ʕa'ru:sa/	[ʔa'lu:sa]	‘doll’	(Rem 1;5.17)
/samaka/	[ʔamaka]	‘fish’	(Nor 1;6 & Lin 1;6.12)

The trochaic stress patterns (SW) are still the most preferred in these children’s production of full bisyllabic SW target-like forms (see examples in (6.50) or truncated forms of trisyllabic patterns (see examples given below in (6.51)).

(6.50) Examples of disyllabic SW target-like forms

/ ^l mo:ja/	[^l buwa]	‘water’	(Mays 1;5)
/ ^l ku:ra/	[^l tula]	‘ball’	(Mays 1;5)
/ ^l si:du/	[^l ti:du]	‘grandpa’	(Mays 1;5)
/ ^l ʃo:ka/	[^l ko:ka]	‘fork’	(Nor 1;6)

(6.51) Examples of disyllabic SW forms resulting from truncations of trisyllabic targets: CV/CV:/CV > CV:/CV (WSW > SW)

/saj ^j ja:ra/	[^j ja:la]	‘car’	(Naw 1;4 7 Naw 1;5)
/ʕazi:za/	[^j zi:za]	‘Aziza (a name)’	(Naw 1;4)
/ħu ^l fa:da/	[^l fa:da]	‘diaper’	(Mays 1;5)
/ba ^l ta:ti:ʃ/	[^l ta:ti:ʃ]	‘potato’	(Mar 1;5)
/ħa ^l la:wa/	[^l la:wa]	‘candy’	(Mays 1;5)

The above examples and those given in (6.21) and (6.25) provide further evidence for the trochaic template and support the claim that there is a ‘trochaic bias’ in early word productions (Allen & Hawkins, 1978; Vihman, 1998; Vihman, 1980; Adam & Bat-El, 2007). There is bias toward a particular foot type (SW) as claimed by Allen & Hawkins who state that “the natural metrics form of children’s word is trochaic.”(p.176). This claim has received support from Allen & Hawkins’ child English data where children show preference for trochaic forms (e.g. *banana* [^lnænə], not *[bə^lnæn], potato [^lteto], not *[pə^ltet]). They have a tendency to omit pretonic but not post-tonic unstressed syllables. This claim has also been confirmed by crosslinguistic evidence from data collected from 11 children acquiring six languages (English, German, Czech, Estonian, Slovenian, and Spanish (Vihman,1980) and from child Hebrew data collected from one Hebrew-speaking child (Adam & Bat-El, 2007). The child Arabic data provide another evidence suggesting that the trochaic foot bias is universal rather being attributed to language specific effects. Despite the fact that in Arabic iambic patterns (WS) are more frequent than trochaic patterns (SW)²⁰, the subjects have been found to produce more trochaic patterns, indicating the crucial role of stress in this respect.

²⁰ In fact, there is no study giving the percentage of the frequency of occurrence of iambic and trochaic patterns in Hijazi Arabic, but I relied on Wehr’s study (1971) that provides a classification by Cv-pattern of all the canonical noun stems of Arabic, which provides the percentage of the following patterns: CvCvvC ‘waziir’ (21%) and CvvCvC ‘kaatib’ (12%). Also McCarthy &

Similar to Lleo's Spanish data (2006), the child Arabic data have shown that the unfooted syllables in trisyllabic words are acquired relatively early i.e. by the age of 1;6, whereas Catalan data in Prieto's (2006) have shown that Catalan children exhibit the same phonological development of word structure but a bit later (i.e. at the age of 1;10) than Spanish and Arabic-speaking children. Both Lleo (2006) and Prieto (2006) reported that Spanish and Catalan children show preference for trochaic stress patterns (SW) in their production of full bisyllabic SW target-like forms or truncated forms of trisyllabic patterns (see also section 2.2.3 and 2.2.4.2).

At the second stage (i.e. between 16-18 months), Hijazi Arabic-speaking children show an asymmetry between the production of bisyllabic SW words, which are not truncated (e.g., [si:du] > [ti:du]) 'grandpa,' and [mo:ja] > [bo:ja] 'water'), and bisyllabic WS words with final stress, which are usually truncated as (W)S (e.g. [fusta:] > [ta:n] 'dress', [dʒawwa:l] > [wa:l] 'mobile phone') (see more examples in (6.52)).

(6.52) Truncations of disyllabic WS forms: WS > S

/xa'la:s/	[la:s]	'finished'	(Naw 1;4)
/la'zi:z/	[di:d]	'delicious'	(Mays 1;5)
/fus'ta:n/	[ta:n]	'dress'	(Nor 1;6)
/dab'ba:b/	[ba:b]	'bike'	(Mays 1;5)
/lai'mu:n/	[mu:n]	'lemon'	(Mar 1;5 & Nor 1;6)

We can say that during Stage II of early word acquisition, these children display a maximality effect to a moraic trochee. Stress and syllable position play a great role in determining the word shapes at this stage (see section 6.4.4 for the role of these factors).

6.5.3 Stage III

The data analysis has demonstrated that there is a great similarity between Stage II and III, but there is an increase in word productions because the 'vocabulary spurt' usually starts at the age between 1;8 and 2;0 and sometimes a bit

Prince (1990) provide statistical investigations revealing that CvCvVC nouns are considerably more common (97%) and diverse than CvVC nouns .

earlier. Various word shapes are still produced and more multisyllabic forms (trisyllabic words in particular and very few quadrisyllabic forms) occurred despite the fact that most of them are still subjects to truncations and other processes (see Tables 5.8-5.11).

The bimoraic foot is still the word maximum size in the children's outputs and disyllabic forms constitute the majority of the subjects' early word productions. Still the preference for trochaic stress patterns (SW) is obvious in the subjects' outputs. The production of words consisting of more than a single foot continues and some words with two feet began to emerge (see (5.24) for the representations of these structures). In addition to SW forms, the subjects have started producing iambs (WS), more trisyllabic WSW forms with an initial unfooted syllable, and some SWW forms more successfully though some disyllabic and trisyllabic adult targets are still truncated (see examples given in section 5.3.5). This stage is marked by the gradual acquisition of initial unstressed syllables in WS and WSW words. In spite of this, there is still a strong tendency among children to delete the weak/unstressed syllable in disyllabic and trisyllabic WSW words guided by the stress and syllable position. This is an indication that these children began representing weak/unstressed syllables at Stage III.

Truncating trisyllabic targets continues throughout this stage in spite of the fact that these subjects began producing some in a target-like manner. Most of WSW forms are truncated to conform to a bisyllabic trochee (WSW > SW) or to iambic forms (WWS > WS) as illustrated in the following examples.

(6.53) Truncations of trisyllabic words during Stage III (19-21 months)

a. (WSW > SW)

/lu'ba:na/	['ba:na]	'gum'	(Fais 1;7)
/ha'ma:ma/	['ma:ma]	'pigeon'	(Shah 1;8)
/bid'ʒa:ma/	['ʒa:ma]	'pyjama'	(Maw 1;8 & Tal 1;9)

b. (WWS > WS)

/bantalo:n/	[ʔa'lo:n]	'trousers'	(Maw 1;8)
/burtuga:n/	[bu'ka:n]	'orange'	(Nor 1;9)
/tilifo:n/	[ti'fo:n]	'telephone'	(Nor 1;9)

Although there were very few attempts to produce multisyllabic prosodic shapes consisting of two feet (i.e. quadrisyllabic forms), many attempts failed and

these forms were also truncated to conform to the subjects' bisyllabic outputs (see examples given below in (6.54).

(6.54) Truncations of quadrisyllabic target forms (WWSW > SW)

/ʃukaˈla:ta/	[ka:ta]	‘chocolate’	(Fais 1;7)
/balaˈko:na/	[ko:na]	‘balcony’	(Maw 1;8)

Thus, during this late period, the subjects continue showing an appeal to minimality constraints and keep on displaying maximality effects to a bisyllabic foot, be it trochaic or iambic. It seems that if the constraints of bimoraic and bisyllabic maximum on word size are active, we would expect children to exhibit direct evidence of this during development. Therefore, in Stage II and III, it is expected to find high rates of pretonic syllable truncation in both WS and WSW forms. All stages of word production involve truncations and the initial unstressed syllable was more accessible to truncation and in particular in WS and WSW patterns during stage II and III. Lleo (2006) and Prieto (2006) have reported that the stage involving truncation of the initial syllable in WS and WSW patterns is relatively short-lived. Therefore, it is expected that children will progressively produce the pretonic syllables over time and produce more longer target-like forms at later stages. It is also expected that Stage VI (between 1;9 and 2;0), which is not tackled in this study, will represent the end state where children produce more multisyllabic target-like forms consisting of more than a single foot and some with two feet (WSW, WWS, SWW, WWSW, WSWW) with less truncation patterns. Because targets with four or more syllables are relatively infrequent in the input compared to mono-, di-, and trisyllabic targets, few examples of multisyllabic forms (quadrisyllabic) were attested in some of age group (3) subjects' data. Most of the multisyllabic target words produced at stage III (1;7-1;9) were subject to truncation. These few productions and the truncated forms (see the examples given in 6.50 - 6.54) help us predict the behaviour of such types of words in child Arabic at later stages. Overall, there is no clear evidence that quadrisyllabic targets behave differently. Like trisyllabic forms, they will be subject to truncation first, and the child will produce trochaic forms as shown in the examples given in (6.54); and then the length of production will expand gradually. It is predicted that the rightmost disyllabic foot from the adult target is prosodically circumscribed, and

the segmental material of this foot is selected and mapped onto a trochaic template (SW). Then the child's template expands to include a third syllable by circumscribing an additional syllable from the left edge of the adult word, resulting in trisyllabic forms. Illustrative examples from the semi-longitudinal samples collected from Nor and Mar are the following:

(6.55) /makaro:na/ [ko:na] → [mako:na] → [makalo:na] 'macaroni'
 /ʃuka'la:ta/ [ka:ta] → [sukəlɪt] → [səkala:ta] 'chocolate'

After realising the existence of a weak syllable at the left edge, the child starts realising two feet (maybe with equal stress) and his/her word template expands to include two feet, and thus all four syllables of the adult target word can be incorporated into the child's template. However, some of these long forms are expected to remain subject to truncation and realised as disyllables with stress on the initial syllables for some time during the fourth quarter of the second year and maybe during the the third year as well. It should be noted here that investigating the behaviour of longer targets might be more difficult since the more syllables a target contains, the more non-prosodic factors come into play, and the other point to be considered is that the child is still in the process of learning more about the stress system of his/her language.

The above stages captured in terms of Prosodic Hierarchy indicate that the development of these children's early word shapes is, in fact, not a random process, but a principled one despite individual variation that characterizes children's speech in any of these stages. For example, some children might be able to handle more complex word structures earlier than others.

To conclude, the analysis of child Arabic data does not fully support Fikkert's view and Demuth's identification of the initial stage of prosodic word development. It lends support to the idea that early PWs are limited by minimality and maximality constraints at different stages. Although few subminimal forms occurred at Stage I (between 12 –15 months), the subjects' productins are mainly constrained by minimality constraints and the word size maximum is a bimoraic foot. At Stage II and III (i.e. between 16-18 months and 19 -21 months), Arabic PWs are maximally a moraic trochee. They are limited by maximality constraints;

the majority of words are maximally a bisyllabic foot, but there is a gradual appearance of words consisting of more than a single foot i.e. words with an unfooted syllable and a foot and words with two feet. Similar findings were reported by Lleo, (2006) and Prieto (2006) who found out that at Stage II Spanish and Catalan children's words are maximally a bisyllabic foot. Catalan children did not exhibit minimality restrictions on their outputs, and this may indicate that at the initial stage of word development, children are specially tuned to the language-particular features of the input. Prieto (2006) points out that the Catalan data, together with the French results analyzed by Demuth (2003) and Demuth and Johnson (2003), seem to provide support in favor of the idea that minimality constraints are probably not active in quantity-insensitive languages which also have subminimal inputs like French or Catalan. In general, the presence of a minimality constraint in child language has generally been based on the acquisition of quantity-sensitive target languages such as English that respect minimality. The subminimality constraint seems to be inactive at the very early stage of word production in Arabic and the lack of subminimal forms in Hijazi Arabic and some other Romance languages can be related to the insufficient exposure to CV word types in the input received by children. In other words, there is no prosodic model provided for children for the production of subminimal words.

6.6 Individual variation

6.6.1 Variability of children's forms

An observed property of child speech is the great amount of variability found in children's productions of the same target form and within each child's repertoire (Ferguson & Farewell, 1975; Ingram, 1989; Demuth, 1995). There is an amount of variability of children's forms in cases where their productions reflect distinct child outputs for the same lexical target, which in turn reflect their preference for either certain segments (e.g. labials or dentals) and/or phonological rules such as fronting, gliding, metathesis, and consonant or vowel harmony. Some examples from the data of such varied productions of the same lexical target form at different stages are given below:

- (6.56) **a.** /samaka/ ‘fish’
 [ka] (Shah 1;7)
 [ʔaka] (Maw 1;8)
 [ʔamaka] (Nor 1;6)
 [kamaka] (Moh’d 1;8)
 [sapata] (Trq 1;8)
 [tamata] (Yas, 1;9)
 [samaka] (Tal 1;9)
- b.** /tilifo:n/ ‘telephone’
 [fo:n] (Nor 1;6)
 [ʔo:n] (Mays 1;5)
 [no:n] (Trq 1;8)
 [ʔafo:n] ~ [fo:n] (Naw 1;9)
 [tifo:n] (Yas 1;9)
 [ʔafalo:n] (Tal 1;9)
 [tafalo:n] ~ [fo:n] (Mar 1;9)
- c.** /ʃukala:ta/ ‘chocolate’
 [ta:ta] (Yas 1;9)
 [ka:ta] (Fais 1;7)
 [ʔukəlɪt] (Nor 1;6)
 [tukəla:ta] (Nor 1;9)
 [sukəla:ta] (Mar 1;9)
 [sija:ta] (Naw 1;9)
- d.** /husa:n/ ‘horse’
 [ʔana:n] ~ [ʔana:s] (Mays 1;5)
 [ʔasa:n] (Mar 1;5; Naw 1;9)
 [ta:n] (Moh’d 1;8 & Trq 1;9)
 [husa:n] (Nor 1;9 & Yas 1;9)
 [hasa:n] (Tal 1;9)

Another noticeable feature of child speech is the type of variability found within each child’s repertoire. There are surface variability cases that result from lack of phonological contrast at the initial stages. For instance, a child may produce a long target vowel length with varying degrees of duration because there is no contrastive vowel length in the developing system yet.

- (6.57) /ʔalo/ [ʔa:] ~ [ʔa] ‘Hello’ (Dem 1;1)
 /ha:da/ [ʔa:da] ~ [ʔada] ‘this’ (Dem1;1)
 /mi:n/ [mi:] ~ [mi] ‘who’ (Nor 1;2)
 /tuffa:ħa/ [pa] ~ [pa:] ‘apple’ (Nor 1;2.15)
 /ʔa:ti/ [ti:] ~ [ti] ‘give me’ (All AG(1) subjects)

There are also cases where some productions reflect phonological contrasts. These productions are altering forms or structurally distinct child outputs for the same underlying form. For example, a child might produce [wa:ha] and [fa:ha] for the target /tuffa:ħa/ ‘apple’ and both surface forms are considered ‘grammatical’ in the child’s system. More examples from the data are the following:

(6.58) /ku:ra/	[buwa] ~ [kuwa]	‘ball’	(Mar 1;2)
/ballo:na/	[buwa] ~ [no:na]	‘balloon’	(Mar 1;2)
/sajja:ra/	[ja:la] ~ [ta:la]	‘car’	(Naw 1;4)
/ħala:wa/	[la:wa] ~ [wa:wa]	‘candy’	(Mays 1;5)
/ʃo:ka/	[ko:ka] ~ [ʔo:ka]	‘fork’	(Mays 1;5)
/tilifo:n/	[ʔafo:n] ~ [fo:n]	‘telephone’	(Naw 1;9)
/lajmu:n/	[li:mu:n] ~ [mu:n]	‘lemon’	(Mar 1;5; Nor 1;9)

Linguistically speaking, this case is considered very challenging because there is more than one grammatical output produced by the child.

6.6.2 Individual Variation in employing phonological rules

Though some phonological rules are common in child phonology, others may be specific to individual variation due to the child’s preferences or range of their use. For example, fronting, gliding, and C-harmony or V-harmony are more frequent in the children’s repertoire at the initial stage. Children vary in employing such processes for some continue using them even in advanced stages (i.e. at the age of 1;9 and 2;0 or even after). For instance, rules such as fronting and C-harmony often occur at the very early stages and begin to cease gradually as the child acquires more sounds. The data analysis has shown that in some cases, these processes last for a longer period. For example, one of age group (3) subjects (Yas 1;9) still employs a fronting strategy where she continues substituting [t] for velars [k, x] and some fricatives [s, ʃ] as shown in the following examples:

(6.59) Examples of fronting from Yas (1;9) data

/sakki:na/	[tatti:na]	‘knife’	/xa:la/	[ta:la]	‘aunt’
/ʃo:ka/	[to:ta]	‘fork’	/ʃurra:b/	[tulla:b]	‘socks’
/si:du/	[ti:du]	‘grandpa’	/sahin/	[tahin]	‘plate’
/bakla/	[batla]	‘buckle’	/ka:sa/	[ta:sa]	‘glass’
/ʃanta/	[tanta]	‘bag’	/katku:t/	[tattu:t]	‘chick’

Such examples indicate the child's late acquisition of some sounds [k, s, ʃ] which should have been acquired by the age of 1;9. Such cases indicate that rules might play a negligible role in some children's phonological development.

There are also general patterns in the repair strategies employed by children. For instance, deletion of vowels in diphthongs is almost compensated by CL i.e. lengthening of the adjacent vowel, and deletion of medial coda in closed syllables often triggers consonant lengthening as well. Despite this, children may adopt different strategies and even for a single child, different strategies are possible. For example, use of V-epenthesis to produce words with CV/CV structure (CVC > CV/CV) and to break final consonant clusters (CVCC > CVC/CV) has been found in Nor's repertoire so early. Nor (1;6), using V-epenthesis, has produced some words of CVC structure as CV/CV (e.g. /ʃams/ > [samsi] 'sun') and has broken final CC in two English words, *milk* and *hold* (e.g. *milk* > [milki], and *hold* > [holdi]). It should be noted here that this subject has a tendency of adding the possessive morpheme {-i} 'my' to most of her nouns and the first or second person, feminine morpheme {-i} 'you' to the verbs. Furthermore, there is individual variation observed in the case of coda deletion in CV:C structure at the initial stage where the final consonant is produced sometimes or deleted and the vowel length of the target is retained. Examples of such variability in some children's productions of CV:C targets (e.g. [mi:n] ~ [mi:] 'Who?'; [nu:n] ~ [nu:j] ~ [nu:] 'light' (Moh'd 1;2 & Nor 1;2)) and CV/CV targets (e.g. [ʔa:ti] ~ [ti] ~ [ʔa:] 'give me' (Abdul 1;2)) are attested in the data too.

As to CC production which is often acquired very late (after 1;9), most of the target words with final CC were subject to a reduction process. Very few subjects (Nor, Mar, Tal, & Yas) produced CVCC at the age of 1;8 and 1;9 (see the examples given in (6.60)).

(6.60) Examples of final CC in age group (3) data

/bint/	[bint]	'girl'	(Nor, Yas, Tal & Mar 1;9)
/kalb/	[kalb]	'dog'	(Mar 1;9)
/gird/	[gird]	'monkey'	(Mar 1;9 & Yas 1;9)

In the case of having targets with diphthongs, the subjects' production of diphthongs is marked by rarity or inconsistency in this study child Arabic data. There are some noticeable individual differences among the subjects, Nor, Yas, and Mar, whose repertoires include attempts to produce diphthongs after the age of 1;6 (see the examples in (6.61)).

(6.61) Production of diphthongs in child Arabic

a. /laimu:n/	[laimu:n]	'lemon'	(Mar 1;8)
b. /zaitu:n/	[sainu:t]	'olive'	(Mar 1;8)
c. /zaitu:n/	[si:tu:n]	'olive'	(Nor 1;9)
d. /laimu:n/	[li:mu:n] ~ [mu:n]	'lemon'	(Nor 1;9)
e. /laimu:n/	[la:mu:n] ~ [mu:n]	'lemon'	(Yas 1;9)

Mar is the only child who produced diphthongs in a target-like manner at the age of 1;8 as shown in (6.61a-b), whereas the other subjects' templates disallowed diphthongs and they employed a monophthongization rule through vowel deletion and CL (see (6.61c-d)). The deletion of the second vowel in this case is characteristically concomitant with the lengthening of the first. Despite this difference, the same prosodic result is achieved, and that is limiting the syllable to two moras. Some productions show inconsistency for there are alternating forms between [ai] and [a:] or [i:] sometimes. Yas and Nor (1;9) escape the V-deletion and CL process and employ truncation instead as an avoidance strategy (see 6.61 d-e).

6.6.3 Stages of the prosodic word development: Cases of individual differences

After the early stage, which is mostly characterized by bimoraic minimal words (monosyllabic and disyllabic) consisting of a single binary foot and few monomoraic outputs, the subjects' prosodic word forms expand in two ways sequentially and gradually. First, the subjects produce words which do not fit the 'word = one foot' structure for they contain an extra unfooted syllable (i.e. trisyllabic words) after 1;6. Second, they produce words forms with two feet (i.e. quadrisyllabic) by the age of 1;9 or 2;0. These two stages exhibit productions of prosodic words that are no longer limited to a single foot but extra elements are allowed. In other words, the subjects' template permits not only bimoraic/bisyllabic outputs whether truncated or not, but also allows producing longer words and larger

than a foot (i.e. trisyllabic words). Some children (e.g. Fais 1;7, Shah, 1;8, & Moh'd 1;8) did not exhibit such stages and did not produce multisyllabic words, whereas others (e.g. Nor & Mar) went through these stages earlier than the other subjects. Their data show that they not only restrict their lexical productions to words having certain pattern or templates, but they have also started producing few multisyllabic words i.e. tri- and quadri-syllabic words. Concerning trisyllabic forms, Mar started producing them even earlier i.e. at the age of 1;2 (e.g. [ʔamina] 'Amina (PN)', [matati] 'shoes', [ʔajja:la] 'car' (Mar 1;2)). Until around 1;8, most of the trisyllabic targets are reduced, particularly, to disyllabic structures by the other subjects. Among age group (3) subjects, both subjects are the only ones whose repertoire included quadrisyllabic forms, though a few (e.g. [tukala:ta] 'chocolate', [ʔaddilaha] 'give her', [sala:matik] (Nor 1;9); [makalo:na] 'macaroni,' [ʔaddilaha] 'give her' (Mar 1;5 & 1;9) [sukala:ta] 'chocolate (Mar 1;9). It should be noted here that quadri-syllabic words are actually very rare at this stage of word acquisition. Mar and Nor attempted few multisyllabic target words. Therefore, the number of available targets and child forms is too small to be conclusive in this respect.

In conclusion, we can say that despite the occurrence of general patterns in segmental acquisition (see chapter five), the phonological strategies used, and the developmental stages of prosodic word acquisition, individual variation in the early period of word acquisition is well-observed in the data. Some children may follow different paths to approximate the adult system. Though individual differences may resist any coherent formulation in terms of universal/general phonological principles, but there are general stages of word development and acquisition that are useful in explaining the acquisition process. This also indicates that the development of children's early word shapes is not a random process, but a principled one despite individual variation that characterizes children's speech in any of these stages. As a matter of fact, finding a balance between general patterns and individual differences should be greatly considered in future research; therefore, the patterns of variation need to be examined too.

6.7 The Prosodic Theory: Implications & drawbacks

A great challenge for any theory of language acquisition comes from the necessity of explaining both language and its development. It must be empirically adequate, in such a way that it both accounts for the acquisition data and how it develops from one stage to another. Also, it must have a predictable value and meet the criterion of learnability.

This study supports the Prosodic Theory for being a useful framework for looking at child language data. It has proved to be applicable to child language and this study data analysis shows its empirical usefulness and effectiveness in describing and explaining child language and its developmental stages adequately. Using the prosodic hierarchy has been very useful for describing child Arabic early phonology and acquisition of early words and their prosodic structure. It enables us to look at the gradual accessibility of the prosodic hierarchical structure to the child's system, despite the fact that the model does not explain why not all the prosodic units are accessible in the early stages. The data analysis has pointed to the important role of the prosodic units in word acquisition and in particular that of foot.

The prosodic model also seems to be adequate in giving an account of the developmental patterns found in the subjects' acquisition data and how their early words gradually develop from simple to more complex structures. Not only it accounts for the developmental stages in such a way that the subsequent stage is more complex than the previous one (see all the examples from the data given in chapter five and six), but it also accounts for the transition from one stage to the next though it does not predict the exact age at which the transition takes place. Moreover, capturing the stages of word development in terms of Prosodic Hierarchy indicates that the development of children's early word shapes is not a random process, but a principled one despite individual variation that characterizes children's speech in any of these stages. In this respect, this model advocates a continuous account of the child's system/grammar which is in constant

development till it reaches the adult-like model, but it does not show that there is a considerable amount of overlap between the stages.

As to the predictive value of the theory and considering the learnability aspect i.e. whether it can serve as a theory of language acquisition, one could say that it helps us see the learnability strategies children may follow in acquiring their early words and trace or predict the developmental stages of acquisition and how their structures develop from simple to more complex structures, though the model does not enable us to predict the exact point at which each stage/transition begins. The data analysis has shown how Hijazi-Arabic speaking children's template expands gradually and quite systematically. At the early stages, they closely focus on segmental and syllable structure. Employing a selection strategy, they produce certain 'preferred' segmental (labial and dental + front and back vowel patterns) and prosodic patterns (CVC, CV:/CV, CV/CV, CVC/CV). The children's template consists of bimoraic minimal monosyllabic structures and maximally bisyllabic forms that form a binary left-headed foot. The subjects begin altering adult forms to conform to a certain structure very early. At stage I & II, the child has a quantity-insensitive binary left-headed foot template, which can only accommodate two of three syllables. In some cases, a monosyllabic target is produced by some children as disyllabic when an extra syllable is created by vowel epenthesis (e.g. /ʔabduhra:ma:n/ > [ma:na] (Abdul 1;2)). This may indicate that the child does not copy the foot structure of the adult word, since this extra syllable is not present in the adult target foot. In a transitional step, guided by the stress, they gradually start realising the salient stressed syllables in the target form and they prosodically circumscribe the rightmost foot of the adult target word and maps the segmental content of that foot onto a trochaic foot template, resulting in bimoraic monosyllabic forms (S) by truncating iambic disyllabic targets (WS) and initial-stressed disyllabic feet (SW) by truncating trisyllabic target forms (WSW) (see the examples given in 5.26-5.28). The remainder of the adult target word (i.e. the weak syllable) is not realised because it does not fit into the child's template for it is not prosodically licensed. Truncations of disyllabic targets to monosyllabic (WS > S)

and trisyllabic targets to disyllabic forms with initial stress (WSW > SW) suggest that it is indeed a foot that is picked out and not just the stressed syllable. At another transitional stage, children start realizing weak syllables and expand their template by one prosodic unit (an unfooted syllable) added to the left of the selected foot i.e. word initially. Now the child might start realising/learning the role of stress and the main stress assignment to one part of the foot of his /her template. S/he begins producing iambic disyllabic words with final stress (WS) that resemble adult words in number of syllables and stress patterns (see the examples given in (5.37)) and trisyllabic words with an unfooted syllable and a single foot (WSW) (see the examples in (5.38)). At a later transitional stage, the child expands his template with another foot on the left side, and the result is a word template containing two feet (SWSW). In addition, the prosodic model makes us predict the types of errors that occur during the learning process at different stages and the repair strategies expected to occur whether those related to universal aspects, but due to language particular properties, some errors are not expected.

Finally, I believe that this theoretical prosodic framework/analysis seems to work well for linguistic descriptions of child language; however, when considered from a learnability perspective, it turns out to be somehow flawed, particularly when certain acquisition aspects and errors are related to language particular features /constraints.

CHAPTER SEVEN

Conclusion and Further Recommendation

7.0 Introduction

This research studies the phonological structure of first words in Arabic and their representation. It investigates the structure and development of first words in Hij Ar within the framework of the Prosodic Theory. The fundamental issues raised are: (1) the relationship between child and adult phonology and whether the structure of early words is determined by the same representational prosodic units and principles found in adult language, (2) the developmental stages of word acquisition and the extent to which Arab children's first words follow the same universal path of phonological development reported in the word acquisition literature and the extent to which their language-specific phonology influences their outputs. The discussion of these issues has been accompanied by looking at child-adult differences in syllable and word internal structure and by comparisons held between child Arabic and Germanic languages (child English, child Dutch, and child German), Romance languages (child French, child Spanish, and child Catalan), and Japanese concerning the development of some prosodic aspects.

This research deals with the acquisition of the phonological structure of early words in child Hij Ar Arabic. More specifically, it deals with the acquisition of the prosodic structure below the word level, i.e. the acquisition of syllable structure and other subsyllabic units (i.e. the mora and foot) in the prosodic hierarchy. It investigates the acquisition of syllable internal structure and word internal structure and traces the stages of prosodic word development as well. This shows how these Arabic-speaking children have a gradual full access to the prosodic unit levels in the prosodic hierarchy during the single word period. It also examines the role of stress and word size restrictions in constraining or determining the shapes of early words. Finally, to see if early word patterns are universal or specific to the ambient language, this study draws a number of comparisons with

Germanic languages and some Romance languages in relation to a number of prosodic aspects.

This study is based on cross-sectional and semi-longitudinal spontaneous data collected from twenty two monolingual Hijazi Arabic-speaking children whose ages range from 1;0 to 1;9. The data collected from three age groups divided at three months intervals was analyzed qualitatively and discussed in the light of prosodic theory. By investigating the phonemic inventories of the subjects and using a qualitative analysis to analyze the main characteristics of their early words: their canonical shapes, various templates, syllable and word internal prosodic structure, the prosodic word size restrictions/constraints, and identifying a number of phonological processes employed by them at various stages, I provided an overall picture of the acquisition of first words by Hijazi Arabic-speaking children and traced their developmental stages of word acquisition.

7.1 Conclusion

The conducted analysis has shown that the subjects have a very limited phonemic inventory at the initial stages of word acquisition. The consonantal inventories of the subjects of all age groups (1, 2, & 3) were found to be very limited during the single word period. These include five consonantal classes: stops, nasals, few fricatives, the lateral liquid, and glides. Their phonetic system gradually develops and shows little expansion from 1;6 till 1;9 by including few velar stops and few fricatives. This indicates a gradual process of phonological development that coincides with their limited cognitive and maturational abilities. The subjects have also shown control of the vowel system of Hij Ar with its short and long vowel segments and gradually acquire the mid vowels by the age of 1;9. Regarding the order of acquisition of contrasting consonants, the subjects exhibited the first universal consonantal opposition which is that of nasal and oral stop very early and then later with the acquisition of more consonants (e.g. some fricatives), they have begun producing more consonantal oppositions, that of stop and fricative opposition and stop and liquid opposition. At the initial stage, most of the sounds acquired early (stops and nasals) appeared as onsets, but very few as codas. At a

later stage (i.e. 19 - 21 months), more consonants appeared as coda consonants, but still there is a preference for initial stops and nasals [b, m, n, t, d, k, ʔ] with glides and the lateral sound [l] at onset and medial position in the repertoire of most of the subjects.

The gradual increase of sounds is apparent in the complexity of the subjects' lexical development as manifested in the analysis of the syllable internal structure and the word internal structure of their word production. At the very early stages, children's templates are very simple and could not accommodate all segmental material of the target words. Therefore, the subjects employ some phonological processes such as reduplication, consonant/vowel harmony, substitution, truncation, and some assimilatory processes. Some of these processes that accompany segmental and lexical acquisition are universal and some, such as glottal stop replacement, de-emphasization, and /r/ deviation, are specific to Arabic. These processes enable children to simplify their word structure and select the segmental material that fits into their templates. They played a role in determining the subjects' early word shapes and lead to producing their most common and frequent syllabic word structure, the disyllabic forms.

The data analysis has shown that the coda acquisition process is slow and gradual. Monosyllabic words closed with a coda are attested in the data, demonstrating that codas are acquired early but to a certain extent due to segmental difficulties. Though Hijazi Arabic-speaking children acquire codas early due to frequent CVC and CV:C structure in Arabic, but there are cases where attempts to produce codas fail sometimes and deletion takes place (CVC > CV, CV:C > CV:, CV/CVC > CV/CV), yielding forms constrained by subminimality, minimality, and maximality constraints. Liquids, nasals and those sounds that have not been acquired or mastered yet are often subject to deletion which is determined by the Sonority Hierarchy Principle. Not only final coda appeared early, but there was also early occurrence of medial codas in CVC/CV structures with obstruent and nasal medial geminates. By the age of 1;6, these children gradually produce disyllabic forms with final closed syllables (CV/CVC, CV/CV:C, CVC/CVC, CVC/CV:C).

As to the representational nature of early words, one of the fundamental issues examined in this study is the representational relationship between the child and adult's forms. This thesis supports the PMH which states that templates are defined in terms of the authentic units of prosody: mora (μ), syllable (σ), foot (Ft), and prosodic word (PW). It provides evidence for the existence of the subsyllabic prosodic units (i.e. mora and foot) in early phonology. The data analysis, presented in chapter five and discussed in chapter six, has demonstrated that Hijazi Arabic-speaking children's early phonology has the same organizational constituents that are regulated in terms of PH and FB, and that their templates can be defined in terms of prosodic units and principles. The child Arabic data analyzed here provide evidence that the phonological prosodic structure of these Arabic-speaking subjects' early words is governed by the same representational and organizational units and principles found in adult phonology. The subjects' early phonology includes the prosodic units (i.e. moras and feet) that organize syllables and words at the early period of word production (i.e. between 1;0 and 1;9), and their word productions are constrained by prosodic word constraints as well.

The predictions resulting from the hypothesis that mora, as a prosodic unit, exists in early phonology received support from a number of languages such as English, Dutch, Spanish, and Japanese. The findings of this study provide another support for this claim. Evidence for the existence of moraic structure in early syllables has manifested in two ways. First, patterns of CL lend support to the predictions of moraic conservation. Coda deletion and diphthong reduction trigger lengthening of adjacent segments, whereas loss of onset consonants does not. CL is manifested in two ways: V-lengthening and C-lengthening. In both cases, changes are mediated by the same subsyllabic prosodic unit, the mora. The results also support the assumption that codas are mora bearing segments whereas onsets are not, and therefore, they do not lead to any prosodic adjustments of words through CL. Second, there is a size limit on syllables, which is best understood as a bimoraic upper limit. The argument for moraic phonology in child Arabic phonology is based on the fact that Arabic and its dialects, like many other languages, impose an upper size limit on syllables. The findings support the

bimoraic maximality constraint and the subjects' productions show a preference for bimoraic syllables. The subjects' initial word productions of some target nouns with superheavy syllables (CV:C, CVCC) are bimoraic maximum (CV:C > CV:) by a deletion process eliminating the extrasyllabic consonant or by reduction of the consonant cluster to a singleton (CVCC > CVC) to satisfy bimoraic maximality during the second half of the second year (between 1;5-1;9). Deletion of a consonant segment in these cases depends greatly on the Sonority Hierarchy Principle. The bimoraic maximum on syllable size has also provided an explanation of CL phenomena in which the compensatory processes can be seen as a prosodic adjustment to keep syllable bimoraicity.

Evidence for foot structure, provided in terms of word truncation data, came from two observations: (1) Bimoraic minimality effects attested in child data and (2) Disyllabic maximality effects in the early productions of multisyllabic words. Support for these comes from avoiding truncating some words to monomoraic size, and truncations of words to bimoraic structure or disyllabic size. The disyllabic upper size limit on word production is attested cross-linguistically and it reflects a prosodically defined restriction on word structure. The data analysis has shown a preference for trochaic forms in children's outputs, which might reflect the effect of foot frequency on the children's outputs, and thus reflecting the language-specific foot structure in Arabic.

The observation, that early Arabic words are minimally bimoraic [Ft (σμμ)] and maximally disyllabic [Ft (σμμ)], supports the MWH. The arguments held for foot structure and the findings of this study and previous ones have actually shown that children's early prosodic outputs satisfy PH and FB principles for they consist of a single binary foot and include trochaic disyllabic forms that are initially stressed truncations. Foot binarity has been exhibited either by vowel length [(CV:)Ft]PW or by the presence of a postvocalic coda [(CVC)Ft]PW. Thus, the subjects' early prosodic structures are not only found to conform to the FB principle (i.e. their lexical productions are minimally bimoraic), but they are also constrained by a maximally disyllabic constraint.

The analysis of the subjects' early prosodic word productions has shown that trochaic forms are the preferred PW at the initial stages (i.e. between 1;0 and 1;6). Such preference for trochaic forms might reflect the effect of foot frequency on the children's outputs, and thus reflecting the language-specific foot structure in Arabic. Disyllabic forms constitute the majority of their outputs, and monosyllables (CV, CV:, and CVC) come second in rate. As to the size restrictions, the child Arabic data provide evidence for the presence of minimality and maximality constraints during the single word period where the children's word size maximum is a single binary foot, and their prosodic outputs display bimoraic outputs (S) containing short or long vowels and/or closed with a coda consonant, and show a maximality effect to a bisyllabic foot, be it trochaic (SW) or iambic (WS). The bimoraic foot is the word size maximum in these Hijazi Arabic-speaking children's early word outputs. The subjects have shown an appeal to the minimality constraint ($W_{\min} = F = [\mu\mu]$), and they show an awareness of maximality constraints ($W_{\max} = F = [\sigma\sigma]$). Multisyllabic forms (i.e. trisyllabic and very few quadrisyllabic forms) appear in the utterances of the older subject's (i.e. 1;7 and 1;9). It seems that word minimality constraints are active in Hijazi Arabic-speaking children's early grammar. The subjects not only show awareness of minimality effects, but their word productions exhibit maximality constraints as well. Their prosodic words are restricted to a binary foot, and repair strategies such as CL, truncation, and epenthesis played a role in fulfilling this. This gave rise to unfooted syllable truncation and the truncation of full feet in quadrisyllables. Truncations of initial weak syllables in WSW trisyllabic forms and that of disyllabic iambs (WS) continued during stage II, but they started to decrease by the end of Stage III (i.e. at the age of 1;9). This implies that the maximality constraint against unfooted syllables plays a minor role in Arabic. Very few children produced unfooted syllables early at the age of 1;6. In contrast, prosodic words with two feet (i.e. quadrisyllabic forms) have been truncated for a longer period of time, which implies that the maximality constraint against an additional foot plays a more important role.

Another basic issue in this study is concerned with the course of development of the syllable and word internal structure of early words in child Hijazi Arabic. Investigating these aspects has given a detailed picture of how Hijazi Arabic-speaking children's first words develop till they become more adult-like. It has shown how the developmental process is determined by universal features and language specific ones i.e. determined by frequency of certain patterns in the ambient language. Concerning the stages of prosodic development, the analysis of child Arabic data provides a strong support for Fikkert's view (1994) and Demuth's identification (1995) of the stages of prosodic word development and for the idea that early PWs are constrained by minimality constraints and limited by maximality constraints at different stages. The data analysis has shown that the subjects go through similar stages to those reported in the literature. Although few subminimal forms have occurred at Stage I (between 12-15 months), the productions are mainly constrained by minimality constraints and the word size maximum is a bimoraic foot. At Stage II and III (i.e. between 16-18 months and 19-21 months), the child Arabic prosodic words are maximally a moraic trochee; the majority of words are maximally a bisyllabic foot, but there is a gradual appearance of words consisting of more than a single foot i.e. words with an unfooted syllable and a foot and words with two feet. The initial stage of word development (Stage I) is marked by the subjects' preference for trochaic forms and their words observe a disyllabic word-size maximum. In later periods of development (Stage II and III), early words continue observing a bisyllabic maximum, but they exhibit the appearance of structures exceeding the maximal size of a well-formed binary foot (i.e. trisyllabic words). This indicates another aspect of development and that is the realization or appearance of pretonic syllables, though often truncated for the sake of the disyllabic maximum constraint. The truncation patterns of initial unstressed syllables provided direct evidence in favor of the strong effect of these constraints.

At Stage I (i.e. between 1;0 and 1;3), these Arabic-speaking subjects start their early word productions with bimoraic minimal structures and very few monosyllabic CV forms. Their preferred forms are trochaic disyllabic CV/CV and

CVC/CV (SW) words characterized with open syllables. PH and FB have been fulfilled in the subjects' utterances. The forms are produced with V-lengthening [(CV:)Ft]PW, or with a rhyming coda [(CVC)Ft]PW. There is a preference for bimoraic syllables. The early appearance of coda is noticeable though instances of deleting it have been observed in the data. Stage II (i.e. 1;4-1;6), as the data analysis has shown, is considered a transitional period from Stage I. The subjects began producing more complex structures with various templates and different foot structures (SW and WS, WSW) successfully though some disyllabic and trisyllabic adult targets are still truncated. Between the age of 1;4 and 1;6, the complexity of word structure is apparent in the occurrence of mono-, bi-, and trisyllabic structures, structures with open and closed syllables, structures with two moras and with extrasyllabic consonants (CVCC, CV:C). This indicates children's capability of producing heavy and superheavy syllables at this stage. Though this stage is marked by the gradual acquisition of initial unstressed syllables in WS and WSW words, there is a very strong tendency among children to delete the initial weak/unstressed syllable in disyllabic and trisyllabic (WSW) words. During this stage, the subjects' productions demonstrate sensitivity to word minimality constraint and show an appeal to foot binarity as well. Most of their monosyllabic and disyllabic words obey the minimality constraint that requires a binary foot (i.e. two-mora requirement). The prosodic structures produced are very few monomoraic CV forms, more bimoraic, and disyllabic words showing an awareness of minimality and maximality effects and fulfilling the structural requirements of a prosodic word. In other words, these subjects have gone through a minimal word stage of phonological development where words are minimally one binary foot. At the same stage, their productions have shown maximality effects which are active for producing maximally disyllabic words. Their target-like disyllabic outputs and the truncated forms show that there is a disyllabic maximum on prosodic words during this stage. This stage also witnessed the appearance of structures exceeding the maximal size of a well-formed binary foot, and these were few trisyllabic words that occurred in the outputs of some of the subjects.

At Stage III (1;7-1;9), although the data analysis has shown a great similarity between stage II and III, yet it has demonstrated more phonological development in these subjects' word syllabic structure, coda acquisition, and foot structure. The subjects go beyond the minimal word stage where words are minimally one binary foot, and produce more complex structures showing maximality effects and exceeding the maximal size too. Their word productions still contain monosyllabic, disyllabic and multisyllabic words, but with various templates that have light, heavy, and superheavy syllables. Their words also display bimoraic minimal outputs (S) fulfilling the bimoraicity and minimality constraints and show a maximality effect to a bisyllabic foot, be it trochaic (SW) or iambic (WS). The appearance of multisyllabic outputs with a single foot and an unfooted syllable or with two feet (WSW, WWS, WWSW) show gradual development and more complexity of word structure at this period. Truncations of many multisyllabic targets took place to conform to a bimoraic monosyllabic or bisyllabic outputs. The word size maximum at this stage is mostly disyllabic though some of the subjects' outputs reveal that they have begun to exceed this maximal size limit. The disyllabic words with their various canonical forms (CV/CVC, CVC/CV, CV/CV:C, CVC/CVC, CVC/CV:C) constitute the majority of their productions. Some of the subjects' repertoire show structures exceeding the maximal size of a well-formed binary foot i.e. structures with a single foot and an initial unfooted syllable (i.e. trisyllabic words (CV/CV/CV, CVC/CV:/CV)) and two feet structures (i.e. quadrisyllabic words (CV/CV/CV:/CV)). In addition to realizing the existence of unfooted syllables, there is a disyllabic maximum on prosodic words manifested in the subjects' target-like disyllabic forms, trisyllabic outputs as well as the truncated forms of multisyllabic targets. Despite the fact that these subjects start producing iambs, there is still a preference for trochaic forms. Finally, we conclude that capturing the above stages in terms of Prosodic Hierarchy indicates that the development of children's early word shapes is not a random process, but a principled one despite individual variation that characterizes children's speech in any of these stages.

Recent research has attracted the attention to the impact of the ambient language for languages differ in syllable types, foot structures, and PW structures permitted. Children usually acquire the types of prosodic structures their target language allows and their productions are also influenced by the degree of ‘frequency’ rather than ‘markedness’ of the segment, the syllable or the word in their native language. Recent crosslinguistic research suggests that children’s early words are sensitive to language specific phonologies, showing earlier acquisition of high frequency syllables and prosodic word structures. This indicates that children’s early PWs show more language-specific differences in shape than perceptual, articulatory, and markedness proposals would predict. This leads us to make predictions regarding the timing and course of prosodic word development across languages and suggests that young children are specially tuned to the language-particular features of the input.

Comparisons of the findings with those of previous studies dealing with other child languages such as Germanic languages (child English, child Dutch and child German), Romance languages (child French, child Spanish, and Catalan), and child Japanese greatly help in deciding whether these findings are universal or language specific to Arabic. The hypothesis that the prosodic units of the prosodic hierarchy in adult phonology exists in early phonology received support from a number of languages such as English, Dutch, Spanish, and Japanese as well as Arabic which adds another support for the PMH Hypothesis. Evidence for moraic and foot structure in early child Arabic phonology has been provided in this study, too. There is great similarity between child Arabic and the previously mentioned languages with respect to the stages of prosodic word development and the prosodic word constraints that determine early word structures.

Despite universality of some aspects and phenomena, language-specific phonology still plays a role in shaping early words. For instance, CL as a phenomenon, triggered by loss of codas, has been attested in child English (Stemberger, 1992; Demuth, 1995), child Dutch (Fikkert, 1994), child Spanish (Lleo, 2006), and child Japanese (Ota, 2003). In English, coda deletion causes change of a target short vowel to a long tense vowel, whereas in child Dutch,

deletion of target sonorant codas leads to V-lengthening, and in child Japanese, CL takes place where the target nasal coda (only non-geminate codas) is deleted after a short vowel. The child Arabic data also provides evidence for the existence of such phenomenon in early Arabic phonology. No cases of CL caused by onset deletion have been reported in any study for it does not lead to any prosodic adjustments across child languages because onsets are not mora bearing segments like codas. Another cross-linguistic phenomenon, attested in this study and previous ones, is the sonority pattern, a general observed trend where children tend to reduce syllable-initial and final clusters to singleton consonants and preserve the least sonorous segment in the surface form. Though exceptions to this pattern (e.g the ‘directionality effect’) have also been reported in few researches dealing with the acquisition of consonant clusters, which again reflect different grammar types, but the ‘sonority pattern’ type is still observed in many languages, including Arabic.

Early word productions in child Arabic share certain prosodic features with those of other languages. Similar to English, Dutch, German, Spanish, Catalan and some other languages, there is a strong preference for trochaic stress patterns (SW) in child Arabic. These patterns appear very early in children’s productions of full bisyllabic SW target-like forms or truncated forms of trisyllabic or quadrisyllabic patterns like Spanish, Catalan, and Japanese. As to word size restrictions on prosodic structure, crosslinguistic evidence for the presence of minimality and maximality constraints early in child language has been provided in the previously mentioned child languages including child Arabic. These constraints of bimoraic and bisyllabic maximum on word size are active in Arabic and other languages. The bimoraic foot is the word size maximum in these Hijazi Arabic children’s early word productions at the early stages. Using truncation data, similar arguments and evidence have been provided for bimoraic minimal structure. Truncations of target prosodic multisyllabic forms lead children’s word productions to conform to bimoraic monosyllabic structures or bisyllabic outputs. The minimal word hypothesis introduced by Demuth (1995) has received strong support in the literature, even from some languages such as Japanese where not only truncated forms display this minimality effect, but also augmentation of monomoraic target

forms which are frequent in this language. The minimal word stage also starts early in child Arabic, and this could be attributed to the fact that Arabic is a language characterized by vowel length contrast and the unmarkedness of CVC structure. Being exposed to Arabic which has closed syllables, children can represent coda consonant early, and accordingly, minimal words take the form of CVC structure. This is accompanied by the CV/CV stage which is realized for a period of time as a means for producing minimal words when some coda consonants cannot yet be represented due to segmental markedness in some cases. As a consequence, this could be partly determined by the frequent metrical structures in some of these languages.

Children's productions, in quantity-sensitive languages such as English, Dutch, Spanish, and Arabic, show an appeal to minimality effects and display maximality effects to a moraic trochee. For example, similar to Spanish, few monosyllables (CV) were found in children's productions in the Arabic data. Coda production appeared early in both languages, and there is a preference for CVC over CV forms. Accordingly, it can be claimed that the minimality constraint plays a role for Spanish and Arabic children very early though its effect in the very early stage is not consistent. The subminimality constraint seems not to be active at an early stage of word production in Arabic. The lack of subminimal forms in child Hijazi Arabic and some other Romance languages such as Spanish can be related to the insufficient exposure to CV word types in the input received by children for such forms are of low frequency in these languages. In other words, there is no prosodic model provided for children for the production of subminimal words due to the lack of monomoraic target forms in Arabic. In English, the early attempts to produce CVC target words results in CV subminimal truncations. The lack of apparent CL (CVC > CV:) and good control of vowel quality lead to the conclusion that English-speaking children show little awareness of word-minimality effects. In contrast with other languages, early prosodic words in Catalan and French do not exhibit strong minimality restrictions on outputs. French data (Demuth, 2003; Demuth & Johnson, 2003) and Catalan data (Prieto, 2006) provide support in favor of the idea that minimality constraints might not be active in quantity-insensitive

languages which also have subminimal inputs like French or Catalan. In general, the presence of a minimality constraint in child language has generally been based on the acquisition of target languages that are quantity-sensitive and that respect minimality like English, Dutch, and Spanish. The early appearance of CV subminimal (monomoraic) words can be determined by the language-specific frequency effects and not markedness constraints in children's early grammars. Concerning the maximality constraint, this research findings provide similar findings to those reported by Lleo (2006) and Prieto (2006) who found out that at Stage II (at the age of 1;6) Spanish and Catalan children's words are maximally a bisyllabic foot. This stands against the claim that there is a monosyllabic stage in early word production, which has been confirmed by research on Germanic languages.

The early appearance of prosodic words with an initial unfooted syllable has been of particular interest, suggesting that there are language-specific frequency effects in this respect. The comparison of the Arabic data results with those of English, Dutch, Spanish, and Catalan data also provide evidence that there are crosslinguistic timing differences in the appearance of initial unstressed syllables. These could be explained by children's different exposure to frequent metrical patterns of the ambient language. The child Arabic data analysis has shown that the unfooted syllables appear early in child Arabic. Most of the subjects began producing trisyllabic target words with an initial weak, unfooted syllable and a trochaic foot (WSW) at the age of 1;7 despite the fact that many multisyllabic targets were still subject to truncation till the age of 2;0 and even more. Spanish data from Lleo's study (2006) show that unfooted syllables are acquired early as in child Arabic i.e. around the age of 1;7, whereas Catalan data in Prieto's (2006) show that Catalan children exhibit the same phonological development of word structure but a bit later than Spanish and Arabic-speaking children i.e. at the age of 1;10. The stage involving the truncation process of the initial syllable in WS and WSW patterns is relatively short-lived in some of these languages except Catalan. Catalan-speaking children tend to omit the unstressed syllable in WS forms for a significantly longer time than Spanish and Arabic children even though bisyllabic

WS forms are more frequent in Catalan than in Spanish. This implies that the maximality constraint against unfooted syllables plays a minor role in Arabic and Spanish as well.

As to the predominance of a monosyllabic stage in early word productions, which is a current issue discussed and reported in studies dealing with child English, Dutch, and German (Demuth, 1995, 2001; Demuth & Fee, 1995; Lleó & Demuth, 1999; Lleo, 2006; Prieto, 2006), the results of this study data analysis do not support this claim and question its existence as a universal aspect of child phonology. No strong evidence has been provided for the existence of an early monosyllabic stage in the early word productions. On the contrary, the findings add another crosslinguistic evidence for the prevalence of disyllabic words in early stages of word development as reported and documented in studies dealing with the early prosodic word development of child Spanish, Catalan, and Japanese. This study data analysis has shown that disyllabic forms constitute the majority of all age groups' productions. A number of factors contribute to the high occurrence of disyllabic forms in the data: (1) some phonological processes such as reduplication and syllable truncations that play a great role in this respect, and (2) the high frequency of disyllabic lexical items in the input received. Thus, the findings confirm the claim against the predominance of monosyllabic words at the initial stage reported in the word development of child English, child Dutch, and child German. They again suggest the influence of the relative frequency of syllabic/prosodic structures in the ambient language and reflect the size and the phonetic structure of the words in the input received i.e. the vocabulary used in child-directed speech. In other words, it could be a reflection of the high frequency of disyllabic lexical forms rather than output restrictions. Consequently, language-specific features should be considered for there could be a language-specific bias in the input as suggested by Vihman (1991) and many others, and the differences between children speaking different languages such as Germanic and Romance languages could be accounted for by the relative frequency of prosodic structure in the input language.

The findings of this study and previous studies demonstrate the role of feet in early word production and support the claim that there is a universal trochaic bias, i.e. children are biased towards the trochaic foot [σs σw]Ft, even when iamb structures (WS) are more frequent than (SW) in the input received (Allen & Hawkins, 1980; Demuth & Fee, 1995; Vihman et al, 1998; Adam & Bat-El, 2007). The occurrence of frequent structures such as CVC monosyllabic words and bisyllabic maximum targets in English, Catalan, Arabic, and Hebrew may provide a strong moraic trochee prosodic model which explains why early word productions of young learners of these languages are composed of unmarked trochaic feet and why they tend to omit initial unstressed syllables. As suggested by Prieto (2006), the metrical patterns help in explaining why Catalan children omit the unstressed syllable in WS forms for a significantly longer period of time than Spanish children, even though when bisyllabic WS forms are more frequent in Catalan than in Spanish. In such cases, children become more sensitive to the availability of common foot structures in the language than to PW shapes. Here we can conclude, from such cross-linguistic comparisons, that young children are specially tuned to the relative frequency of metrical structures in the ambient language and that their distribution is critical for predicting early linguistic structures.

7.2 Recommendations for future research

This research contributes to the monolingual phonological acquisition literature by examining child Arabic data and providing an analysis of the phonological structure and representation of Hijazi Arabic-speaking children's early words within the framework of the prosodic theory. It describes the representational nature of early words and establishes the relationship between child Arabic phonology and adult phonology through providing evidence for subsyllabic prosodic constituents: moraic structure and foot structure in early phonology. It provides a thorough analysis of the syllable internal structure and the word internal structure of these early words. The findings not only show evidence for prosodic effects on the acquisition of simultaneously acquired words, but also raise questions about when and how children become sensitive to prosodic

constituency and word-minimality and maximality effects, and why children's productions vary in exhibiting these effects, and thus pointing towards the influence of language-specific properties.

Few generalizations about word acquisition and development in child Arabic can be made from this study because of its small sample and small number of its subjects. Ideally the larger the size is, the more representative the findings will be in statistical terms. Therefore, longitudinal and/or cross-sectional studies with large samples or sufficient number of subjects are needed to provide more representative findings, to capture generalizations, and to establish a typical developmental pattern that minimizes individual differences in the rate and patterns of development.

The analysis of subsyllabic prosodic structure of early words has shown that future work must focus more on the role of mora, foot, stress, syllable position and templatic effects on word acquisition. More concern should be devoted to the development of prosodic structures with unfooted syllables and structures with two feet, and the phonological processes that accompany their acquisition. In general, further research should be conducted to continue investigating the phonological prosodic structure of words acquired by Hijazi Arabic-speaking children who are older than the subjects of this study (i.e. above the age of 1;9 till 3;0). In other words, the prosodic aspects of children's word productions beyond the single word period must be investigated.

The predictions of the prosodic structure development dealt with in this research can also be tested against a wider variety of Arabic dialects and other languages that share similar features with Arabic or differ in some prosodic aspects such as minimality effects, for instance. Among these predictions are those concerned with the existence of moraic and foot structure early in child Arabic, the emergence and development of medial and final codas, and the order of development of obstruent and sonorant geminates.

There are many relevant issues that could not be fully addressed in this study, and therefore recommended for future research. One important question requires further investigation is the exact division of labor between universal

representational principles and language-specific input in early phonology. For example, CL as universal phenomenon observed in some languages and if this could be always related to the mora-timing of the language, which provides unmistakable phonetic cues for skeletal prosodic positions. The extent to which the observed augmentation of monomoraic targets attested in some languages such as Japanese and the disyllabic upper limit could be linked to the relative frequency/infrequency of monomoraic or multisyllabic words in early child directed speech is another issue. More evidence is needed to be collected to convincingly show that these phenomena reflect the inherent properties of prosodic organization in human language rather than being artifacts of the surface input pattern. Nevertheless, it should be noted that the manifestations of these properties can vary from one child language to another, reflecting language-specific properties of the input.

One of the issues that have not been addressed thoroughly in this research is the influence of the ambient language i.e. the input structure influence on the timing and pattern of development. Lack of research investigating child directed speech in Hijazi Arabic is noticeable. To my knowledge, there is only one study available investigating some of the syntactic, discourse and pragmatic linguistic features of child directed speech in Hijazi Arabic (Basaffar, 2002). Therefore, there is a need for the existence of longitudinal acquisition corpora, many of which include extensive samples of early child-directed speech to make it possible to more effectively examine the nature of the language input young children hear, and to assess the possible impact this has on Arabic-speaking children's early word productions.

Further investigation should be directed toward the frequency and markedness constraints which often co-occur, facilitating the early acquisition of high frequent, unmarked structures (e.g. core syllables, trochaic feet) to answer questions regarding the course of acquisition and the effect of the "unmarked" structure or the most frequent structure on phonological development. Testing some of the frequency-based productions is required to provide a theoretical framework for further investigation of children's developing phonologies. For this purpose,

studies concerned with the frequency of syllable types/structures and prosodic foot structures in adult Arabic grammar are required and should be encouraged.

The acquisition of stress is another issue that should be considered in future research to shed more light on truncations and the vital role of stress in this important aspect of early word acquisition. Only by looking at a large sample of cross-sectional data, and in particular by looking at developmental data, we hope to gain more insight into the actual acquisition of stress and other prosodic aspects such as the acquisition of syllable structure and related issues: the acquisition of coda, consonant clustering, and diphthongs. The data collection did not provide enough examples to look thoroughly at the development of syllabic structures with initial and final consonant clusters or diphthongs. Therefore, the acquisition of consonant clusters, and diphthongs should be considered more in future research.

The results also call for further research on the similarities and differences in the acquisition of syllable internal structure and the developmental word patterns between Arabic-speaking children and those children from other related language backgrounds such as Semitic languages like Hebrew, for instance. The findings also suggest the need for an acoustic analysis to test the production of vowels, the productions of vowels in compensatory lengthening forms, and the production of a glottal stop as a substitute for other consonants in various word positions at the early stages of acquisition. The latter is important to argue for/against the existence of onsetless words in early child Arabic.

On the whole, these monolingual Hijazi Arabic-speaking subjects have produced word patterns that are similar to the ones normally described in the literature, but an acoustic analysis of some phonetic features of Hijazi Arabic sounds in certain positions could be the subject of further investigation in the future. There is a need for up-to-date phonological studies of these prosodic aspects and word development in other Arabic dialects too. Besides, variability, as one of the most obvious characteristics of children's speech, needs to be taken into consideration when interpreting children's production. And because the variability of children's productions complicate the task of determining the representations behind the surface forms, more rigorous methods must be designed to differentiate

phonetic variation which reflects variable grammatical outputs, from those which are essentially extra-grammatical.

In general, the area of phonological acquisition in Arabic in general and word acquisition in particular should receive more attention. Further research is needed to give a more comprehensive account of normal and disordered phonology in Arabic, to test some of the theories (e.g. the continuity model and the maturation model, the prosodic model), to analyze the phonological structure and prosodic features of babbling and the child's first words, and to investigate linguistic phenomena such as the vocabulary spurt phenomenon, etc. More contributions should be added to the field of phonological acquisition by researching Arabic phonological acquisition in bilingual contexts for the sake of comparison with monolingual phonological acquisition to see differences in many respects such as prosodic word development, and the acquisition of prosody, for instance. Another aspect that should be taken into consideration is investigating the sociolinguistic competence in bilinguals to show how their speech undergoes parental, societal, and language mode influence, and how they may deploy acquired features to suit certain communicative contexts. In addition, the question of early representations and how they develop into the adult like underlying forms is still open for further investigation. Handling it within the framework of Optimality Theory might provide more insights about this issue. Studying the course of development of prosodic structure in Arabic within the framework of Optimality Theory, a constraint-based model where the ranking and faithfulness constraints are considered is another promising area for future investigation.

APPENDICES

Note: All appendices are put on a CD attached to the back cover of the thesis.

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