SPEECH SOUND ACQUISITION AND PHONOLOGICAL ERROR PATTERNS IN CHILD SPEAKERS OF SYRIAN ARABIC: A NORMATIVE STUDY

By

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ABSTRACT

The lack of norms for speech sound acquisition and phonological error patterns in the Syrian variety of Arabic is one of the challenging aspects of diagnosing and treating speech disorders in speakers of this language. Although there are normative data which speech language therapists could use to assess the phonological skills of Syrian children, these are based on data standardized on children speaking other varieties of Arabic, such as Jordanian. This may lead to incorrect diagnosis and inappropriate treatment. In order to address this problem, a detailed study of Syrian Arabic was carried out for this thesis.

This study was carried out to provide reliable normative data for speech sound acquisition and phonological error patterns in Syrian children between the ages of 2:6 and 6:5. One hundred and sixty typically developing Syrian children were recruited from Damascus to participate in this cross-sectional study. The results indicate that acquisition of the vowels in Syrian Arabic was almost complete by the age of 3. However, some errors persisted at this age and these mainly related to the production of diphthongs. The two diphthongs which were studied did not appear in the children's speech samples until the age of 5:0-5:5, but they did not reach the acquisition criterion.

For the consonants, the results suggest that there is a gradual development in their

correct production: correct production started at 71.3% at the age of 2:6-3:0 and increased with age to 94.3% in children aged 6:0-6:5. All the consonants in Syrian Arabic were acquired by age 6:5, except for the affricate /ʒ/. The order of consonant acquisition in terms of sound class was: median approximants > nasals > plosives > the lateral approximant /l/ > all fricatives

except/ʒ/ > the trill. The findings also showed that the order of speech sound acquisition in Syrian children is very similar to that in children from other language backgrounds.

The results for consonant acquisition also indicated that 11 consonants are acquired between the ages of 2:6-4:0. These early-acquired consonants are / b, f, j, m, n, l, t, d, h, ʔ, w, h /. They include plosives, nasals, the lateral and a few fricatives. One of these fricatives has an anterior place of articulation while three are produced in the posterior portion of the oral cavity, i.e. /h, ʔ, ʕ/. Seven consonants were acquired between the ages of 4:0 and 5:0. These were /x, s, z , ʕ, tˤ, dˤ, k/. Most of which are fricatives and emphatics. The late-acquired consonants are /ʃ, r, sˤ, ɣ/ which are acquired between the ages of 5:0 and 6:5.

There were clear differences in the percentage of correctly produced consonants in different word positions. In general, word-final consonants were produced correctly slightly more often than those in initial and medial positions. This was true for all age

groups. This difference was significant between initial and final position, and between medial and final positions; however, no significant difference was found between initial and medial positions.

As far as the phonological error patterns (all phonological error patterns whatever their percentage big or small) are concerned this study identified a total of 11 phonological error patterns in Syrian children. These errors were: r-deviation, fronting, stridency deletion, de-emphasis, weak syllable deletion, stopping, backing, glottalization, devoicing and assimilation. There was also one dialectal error pattern called epenthesis, in which a vowel is inserted between consonants in order to simplify their pronunciation. Epenthesis is singled out from phonological error patterns that while it is considered a phonological error pattern in some languages, in Syria it is a dialectal error appears in normal speech and as such not consider phonological error pattern.

Using a developmental criterion to define the phonological error patterns used by Syrian children, the study revealed that there are 9 typical phonological errors. These errors are: r-deviation, fronting, stridency deletion, de-emphasis, weak syllable deletion, consonant deletion, backing, glottalization, and devoicing. The results of this study showed that Syrian children no longer produce developmental errors by the age of 5:5.

CHAPTER 1: AIMS OF THE STUDY

1.1 INTRODUCTION

Since the second half of the 19th century, there has been substantial progress in research regarding the age of speech sound acquisition and the occurrence of phonological error patterns in children. Although most of this research has focused on English, a number of other languages have been investigated more thoroughly in recent years. The reason why speech sound acquisition and error patterns in children have attracted such interest is that they both provide essential insights in the phonological development of children. As a result, both factors are crucial in assessing the adequacy of articulation skills.

Normative data for the age and order of speech sound acquisition in typically developing children can often be vital in determining whether speech and language[1]

[1] [1] In this dissertation, we have consistently used the term 'speech sound' instead of 'phoneme' or 'phone'. In the literature, some authors use the term 'phoneme' rather loosely to refer to the physical units of speech (where the term 'phone' would have been more appropriate). In other instances, the term 'phoneme' is used more conservatively to refer to the abstract linguistic units of speech. In this dissertation, the focus is sometimes more on the physical aspects of speech sounds (i.e. concrete units), while in other instances the focus is more on the function of a speech sound in the linguistic system (i.e. abstact units). In order to avoid terminological confusion, we have preferred to use the more neutral term 'speech sound', which allows for a more neutral interpretation of the unit as either a more abstract or more concrete unit. Also for the sake of consistency, all the transcriptions have been placed between slant brackets and square brackets have been avoided.

therapy intervention is necessary. Furthermore, it is useful for the identification of treatment goals. In addition, the number and type of speech errors that may occur are essential factors in measuring children's articulation skills. Consequently, normative data for these aspects of phonological acquisition provide standards against which to evaluate the speech status of individual children.

Historically, there have been two approaches to investigating speech sound acquisition in typically developing children. On the one hand, some studies have focused on the age at which specific speech sounds are mastered. This approach analyses speech development as a sequence of anticipated ages by which speech sounds have to be acquired (Culbertson & Tanner 2001). This tradition is exemplified by the studies of Templin (1957) on English and Amayreh (1994) on Arabic. On the other hand, there is the phonological approach which mainly focuses on children's acquisition of the phonological rules of a language. In this approach researchers have focused on both the development of a speech sound inventory and the rules governing the combination of sounds in syllables. This phonological approach emerged in the 1950s when a significant shift in the investigation of child phonology occurred, i.e., it moved away from the analysis of speech sound errors in terms of omissions, distortions and substitutions towards the analysis of phonological error patterns (Ingram 1973). According to Roberts, Burchinal & Footo (1990), this emphasis on the phonological aspects of speech sound acquisition has

provided a more detailed description of the systematic patterns used by children than the alternative approach which focused on individual speech sound errors. Researchers have also used this phonological focus to study the patterns of sound production in children with multiple articulation errors and discovered specific patterns of sound errors in these children; this suggests that mentalistic rules govern the surface level of sound production (Weiner 1981). Research in both traditions has contributed significantly to the current understanding of developmental phonology.

As mentioned previously, the last fifty years has seen an increase in the number of investigations of the ages at which children acquire speech sounds. The central theme of most of these studies has been that there are universal principles underlying the speech sound inventories of all spoken languages. These universal principles give rise to systematic developmental patterns in all languages, which have been accounted for by principles such as ease of articulation. For example, nasals, approximants and plosives tend to be acquired earlier than liquids, fricatives, and affricates (Edwards & Shriberg 1983).

The universal order of speech sound acquisition in different languages has also been interpreted in terms of “markedness”. This concept has been defined in many ways since it was first proposed by Trubetzkoy (1930, 1939) and Jakobson (1941, 1968).

Trubetzkoy argued that several oppositions (relations between pairs of speech sounds) in speech sound inventories could explain the standard order of speech sound acquisition. One type of opposition is a privative opposition in which one of the members of the opposition bears a "mark" while the other lacks it. For example, /d/ is mark-bearing for voice, while /t/ is mark-less (i.e., voiceless). Although the concept of 'markedness' appeared in Trubetzkoy's work as a specification for a phonological distinction, Jakobson (1941, 1968) observed that the speech sounds in children's first words are unmarked and that these unmarked sounds have a high frequency of occurrence in languages. He also proposed that most unmarked sounds are acquired first, while marked sounds only develop later. According to Jakobson, the order of speech sound acquisition reflects a universal pattern across languages, with nasals, anterior consonants and plosives acquired earlier than posterior consonants and fricatives.

Dinnsen (1992) adopted the same interpretation of the term 'markedness' as Jakobson in order to explain the structure of speech sound inventories across languages. In his discussion of speech sound acquisition Dinnsen suggested five levels of speech sound acquisition in which a child moves from the least complex level (unmarked) to the most complex level by acquiring additional contrasts each time. For example, advancement from level A to level B occurs by adding a voicing contrast to A (that is, a child first acquires /t/ and then acquires /d/ by adding a

voicing contrast).

Yoneyama, Beckman & Edwards (2003) proposed that “contrasts which involve unmarked sounds are the ones that occur in all or many languages, whereas marked sounds occur more rarely” (Yoneyama, Beckman & Edwards 2003: 7).

Other researchers have defined markedness as rarity in input frequency. For example, Greenberg (1966) first used frequency as the basis for defining markedness, and Baayen , Burani & Sehreuder (1997) took frequency into account in defining the marked member of a pair, describing a marked form as “the form which occurs more frequently” (Baayen, Burani, & Sehreuder. 1997: 14).

Another way in which markedness has been defined is in terms of ease of articulation, so that the unmarked member is assumed to be easier to pronounce than the marked member. Anderson and Lightfoot (2002) define markedness according to “the tendency for phonetic terms to be pronounced in a simple, natural way, as determined in part by the nature of speech articulation, acoustics, and audition, and in part perhaps by more abstract cognitive factors” (Anderson & Lightfoot 2002: 101). So early acquired speech sounds are those that are easy to articulate and easy to perceive. Like Anderson & Lightfoot, Locke (1983) proposed that the ease of production and perception play an important role in speech sound acquisition; specifically, he claimed that the earliest acquired speech sounds will be

the easiest to produce and the most salient to perceive.

Although some studies of speech sound acquisition have relied on universal theory in interpreting their results, these have also faced strong criticism. For example, Jakobson claimed a universal order of speech sound acquisition across different languages, but Ingram (1999) reported different patterns of acquisition in five children with different language backgrounds, i.e., English, Quiché (language spoken in Guatemala), Turkish and Dutch. He showed that the consonant inventories at 20-27 months are not the same in these different languages, which goes directly against Jakobson's claim.

Another assumption of universal patterns of acquisition that can be criticized is the idea that there is a clear demarcation between the consonants and vowels which children produce in their babbling stage and those that occur in their first words. Vihman, Macken, Miller, Simmons & Miller (1985), for example, showed that most children do not suddenly stop babbling and that they use the sounds which appear in babbling also during the next stage of acquisition.

Some results from studies of phonological error patterns provide evidence against a universal order of phonological acquisition. One example comes from Beckman, Yoneyama & Edwards (2003), who studied substitution patterns and reported that these differ from the error patterns most commonly reported for English. Further,

Beckman, Yoneyama et al. (2003) found that 2-5 year old Japanese children made more than twice as many backing errors for /t/ than fronting errors for /k/. This differs from the errors made by English children who were found to make three times more fronting errors for /k/ than backing errors for/t/ (Isermann 2001).

While many researchers have used the notion of markedness to interpret the universal patterns of speech sound acquisition, others have used the idea of "functional load "to explain differences in the order of speech sound acquisition across languages. Functional load refers to the potential of a particular feature in creating phonological contrasts in a language. For example, Ingram (1988) attributed differences in the age of acquisition of the consonant /v/ in English, Estonian and Bulgarian to the differences in its functional load in these languages. In English children, /v/ is a late-acquired sound because it has a low frequency of occurrence in common words while the frequency of occurrence for /v/ is high in the early vocabularies of Swedish, Estonian and Bulgarian children, and consequently is acquired earlier in these languages than in English.

However, there are also studies which have provided evidence that the functional load of consonants may not fully explain the differences in the order of consonant acquisition in a specific language or across languages. For example, /ŋ/ has a lower functional load than /n/ in Putonghua (modern Standard Chinese), but Zhu (2002)

reported that /ŋ/ was acquired before /n/. Also, Pye, Ingram & List (1987) found that although /w/ was acquired at the same age in Quiché and English, /w/ was the second most frequent consonant used by Quiché children and only the seventh most frequent sound in English children. Such results do not support the idea that functional load can fully explain the difference in the order of speech sound acquisition. Furthermore, it can be argued that there is no adequate method of calculating functional load and that sole focus on functional load does not allow other phonological aspects such as vowels and syllable structure to be considered (Zhu & Dodd 2000).

The second major research theme in many of the speech sound acquisition studies concerns language specificity of acquisition patterns in languages. In this line of research, observed variations in the order and age of speech sound acquisition are accounted for by differences in phonological salience, which is defined as a language–specific and syllable-based concept (Zhu & Dodd 2006).

Acquisition theories that are based on phonological salience assume that the order and rate of phonological acquisition are determined by three factors. The first is that a component can be compulsory or optional in the syllable structure. For example, Zhu & Dodd (2006) suggested that a compulsory component is more noticeable (salient) than an optional one. Therefore, a compulsory component will

be acquired earlier. In Modern Standard Chinese, tone is a compulsory component for each syllable: a change in syllable tone creates a change in lexical meaning. Zhu (2002) investigated the acquisition patterns in typically developing Chinese children and found that of the four possible syllable components in the language the first acquired was tone. This was followed by the syllable-final consonants and vowels, and syllable-initial consonants.

The second factor underpinning acquisition theories that are based on phonological salience has to do with the ability of a component to add to or to differentiate the lexical meaning of a syllable. Specifically, a component which contains more distinguishing lexical information is more noticeable than one which has less and will consequently be acquired earlier. For example, it is generally held that Chinese tone and speech sound sequences convey the lexical information of a word. However, Zhu (2002) concluded in her study that tone has a higher salience for each syllable than the speech sounds since a change of tone leads to a change in lexical meaning. The prediction, then, is that tone should be acquired earlier than correct speech sound sequencing.

The third and final consideration in acquisition theories based on phonological salience is the number of allowed choices within a component in the syllable structure. For example, So & Dodd (1995) attributed the fact that Cantonese

children acquired their speech sounds inventory more quickly than English children to the different salience ranking of the same syllable components in the two languages. Specifically, while the Cantonese inventory consists of 17 consonants and two consonant clusters, the English inventory has 24 consonants and 49 clusters.

In order to summarize the main research themes, it was seen that (1) markedness has been used to explain universal patterns of phonological acquisition. This is the first major focus of research in the field. (2) Not everyone agrees that acquisition proceeds in the same manner across languages. This is the second major focus of research in the field and it takes phonological salience and frequency of occurrence as its starting point.

The present study will adopt two basic assumptions, which incorporate aspects of both the universal and language-specific themes in acquisition research. In the first instance, it will be assumed that there is a universal pattern of speech sound acquisition in different languages and that Syrian children follow a course similar to that of children acquiring other languages. In the second instance, it is assumed that the Syrian variety of Arabic has a unique and specific phonological structure. There are emphatic consonants, which are unique to the Syrian variety like in all Arabic varieties. The languages which have emphatic consonants are 0.22% of all languages in UPSID.

(Newman, UGAT ALDADA without date: 72)(Which might lead to differences in the rate

and order of speech sound acquisition between Syrian children and those acquiring other languages. Therefore, this study will rely on the idea of frequency of occurrence and phonological salience to explain these different patterns. It is important to note that this second assumption is not incompatible with the first assumption since there are coordinate positions that can be taken between the two. More specifically, this means that although there are some phonological characteristics specific to Syrian Arabic which may lead to differences in speech sound acquisition and phonological error patterns, the results of the present study could still provide some support for universal theories of phonological acquisition.

1.2 RESEARCH AIMS

Normative data about speech sound acquisition are essential for supporting speech and language therapy in general and in Syria in particular. Speech and language therapy is a new field in Syria and there is very little information available on typical acquisition. As such, speech and language therapists (SLTs) face the challenge of providing a sufficient and appropriate service to the speech-disordered population. In order to do so, Syrian speech and language therapists either use data which have been normalized on other Arabic varieties (e.g. Jordanian) or they rely solely on their specific experience to diagnose and treat speech-disordered children. Therefore, information about the typical progression of speech sound acquisition

in Syrian Arabic is urgently required as such data provide a scientific basis for SLT work.

Speech sound acquisition and phonological error patterns were chosen as the focus of this study since establishing norms in these two areas will enable SLTs to more accurately identify articulatory or phonological disorders. ++This normative information also provides a guide for appropriate referral to treatment services, and it will enable SLTs to formulate realistic objectives and appropriate intervention. Knowledge of the ages at which speech sounds are acquired and the types of phonological error patterns which typically occur at different ages is essential in order to make a correct diagnosis.

Furthermore, the findings obtained in this study will also increase the knowledge base regarding the order and age of speech sound acquisition in the Syrian variety of Arabic. As the Syrian variety is one of the Arabic varieties which has not been formally investigated to date, the findings from this study will contribute significantly to a more thorough description of Syrian Arabic.

This study will also yield valuable information about whether speech sound acquisition is similar across languages and thus will provide those working in universal theory with important evidence to validate their theoretical claims.

To summarize, this study aims to achieve the following goals: (1) to determine the age and order of speech sound acquisition in Syrian children, (2) to identify the phonological error patterns produced by Syrian children and (3) to compare differences in speech sound acquisition and phonological error patterns between Syrian children and children from other language backgrounds.

1.3 RATIONALE

This study investigates the phonological acquisition of speech in Syrian Arabic. More specifically, the ages of speech sound acquisition and the phonological error patterns in Syrian children will be studied. A number of previous studies have been conducted to determine the ages of speech sound acquisition in children. However, most of these studies have focused on English with few studies addressing acquisition in other languages. Specifically, the few studies that have been carried out on Arabic have focused on specific Arabic varieties while neglecting others. For example, Amayreh (1994) conducted a study on Jordanian, while Ammar & Morsi (2006) looked at Egyptian. The focus in this study is the Syrian variety of Arabic and it is the very first study to yield data regarding the phonological development in Syrian children with Arabic as a mother tongue.

As Dyson & Amayreh (2000) have argued, there is a need to expand our knowledge

of the acquisition of Arabic phonology by carrying out studies into many different varieties. The cumulative result of such studies will allow researchers to determine the general rules and patterns in Arabic phonology. Moreover, the results obtained from this study will also provide new data which may help to validate existing theories of phonological acquisition. According to Zhu (2002), good theories of phonological acquisition require evidence from studies in a wide range of different languages. This study aims to reveal the language–specific patterns of the Syrian variety of Arabic.

Another rationale for the present study is that it will fill a theoretical need, because there are substantial discrepancies between the results reported in previous studies of Arabic acquisition. For example Saleh, Shoeib, Hegazi & Ali (2007) studied the acquisition of Egyptian consonants and found that speech sounds in word-final position were produced more correctly than in other word positions. Ammar & Morsi (2006), however, found that the final position was the most difficult one. The present study will thus aim to provide additional evidence to validate the results of previous studies.

One practical benefit of the present study is that it will provide speech language therapists with an articulation test which has been designed after a thorough examination of other tests from different languages and which, for the first time,

considers the characteristics of Syrian Arabic.

As explained above, this study will investigate the ages of speech sound acquisition and phonological error patterns in Syrian children because speech sounds and error patterns are essential aspects of phonological development and very important in the successful treatment of speech impairment. There are different views regarding speech development and treatment in children. In a traditional approach, the main concern is the age at which speech sounds are acquired and speech development is viewed as a sequence of generally predictable ages at which speech sounds are mastered (Culbertson & Tanner 2001: 15). This approach is the most popular in the field (Garn-Nunn 1986; Culbertson & Tanner 2001) and it examines the phonemic and phonetic aspects of children's speech so that clinicians can compare children's speech to charts or tables which describe the chronological appearance of each speech sound in the speech of a normative sample of children. As such, this approach is most useful for children who only have a few speech sounds or who need oral sensory-motor stimulation. However, this approach is not appropriate for children with multiple articulation errors and the therapy depending upon it may result in slow and limited progress (Garn-Nunn 1986).

Another popular approach to the study of speech development is the phonological approach which places strong emphasis on the linguistic rules governing syllable

formation. This approach does not only address the development of speech sound inventories, but also the rules which govern the permissible sound combinations in a syllable. Any child has to give up immature strategies or processes to develop an adult phonology. Children persisting in using immature phonological combinations are described as having erroneous phonological processes or error patterns.

Lastly, there is a marked interest in phonological processes or error patterns. Studying these errors at different stages of development enables a fundamental insight into the phonology of the ambient language (Smit 1993). In addition, studies of typical errors in children not only enable the description of the normal progress of phonological acquisition, but also help to identify delayed and disordered phonology in children.

CHAPTER 2: SPEECH SOUND ACQUISITION IN PERSPECTIVE

This chapter will present an overview of the studies that have been conducted on speech acquisition in children as a means of examining the relevant developmental literature in order to demonstrate how the results from previous studies have helped to shape the present study. In previous phonological acquisition studies two main issues have been investigated: the timing of speech sound acquisition and the phonological errors which are common in children. While the traditional focus has been on investigating the timing of speech sound acquisition, some studies have focused on the phonological errors in children's speech while other studies have investigated both issues. The following section will first present a review of timing studies, before going on to a review of phonological investigations. Finally, a review of studies which have targeted both issues will be presented. Studies on English are presented first, followed by studies on other languages.

2.1 THE STUDY OF SPEECH SOUND ACQUISITION IN ENGLISH

2.1.1 TIMING STUDIES

Templin (1957) was one of the first to investigate speech sound acquisition. He studied speech sound articulation in 480 children (240 male; 240 female) between the ages of 3:0 and 8:0 years. He investigated 69 consonants, 90 consonant clusters

and 17 vowels. The consonants were investigated in word-initial, medial and final position. Children aged between 3 to 5 years who were unable to read were given pictures illustrating the target words and they either produced these words spontaneously or repeated them after the examiner. Children between the ages of 6 and 8 years either read the test words from a list or repeated them after the examiner. Sounds were considered acquired when they were articulated correctly 75% of the time in each word position. Templin's findings are summarized in Table 2.1:

Table 2.1: The ages of speech sound acquisition in English according to Templin (1957)

Age	**Speech Sounds**
3	m, n, h, p, n, j, f, w
3:6	J
4:0	k, d, b, g, r
4:6	s, ʃ, tʃ
6:0	t, l, θ , v
7:0	ð , ʒ, dʒ, z
8:0	h, w

The order of consonant acquisition was: nasals > plosives > fricatives > affricates > approximants. The results also revealed that consonants in initial and medial positions were pronounced correctly more often than in final position and that voiceless consonants were generally pronounced correctly more often than voiced ones. This finding, however, did not apply to the plosives. Templin also found that there is a clear relationship between age and omission errors: these decrease with age, while no such relationship was found for other errors.

With regard to articulation errors, Templin found that the type of sound and its position in the syllable affects the frequency and type of error. For example, the number of pronunciation errors involving fricatives was 25 times higher than in nasals. As for articulation errors involving vowels, Templin found the same level of accuracy in the production of vowels and diphthongs in 3-year-olds as in 7-year-olds.

Templin's work is one of the landmarks in the study of speech sound acquisition and most other studies compare their results to his. However, one of the weaknesses of his study is that it uses single words to elicit speech sounds and as a result his findings may not be representative for conversational speech.

The second landmark study that needs to be mentioned in this section is that of Smit, Hand, Freilinger, Bernthal & Bird (1990) who collected speech samples from

997 children (514 male, 483 female) between the ages of 3:0 and 9:0. They investigated English speech sounds in word-initial and final positions, with the following restrictions: (1) /ʒ/ was not tested, (2) /ð, h, w, j/ were tested only in initial position, and (3) only 27 of the most common initial consonant clusters were studied. The children had to spontaneously respond to photographs and name them. If a child could not respond, the examiner would say the word for the child to repeat. The authors set the age of acquisition of a sound as the point at which 90% of the children in an age group produced it correctly in all positions; they used the 75% criterion to compare their results with other studies.

Smit et al. (1990) found that the age of acquisition for most consonants is very similar to the norms found by Templin (1957) and that the age of acquisition of consonant clusters was very similar too. These results were not influenced by demographic variables such as socio-economic status (SES). Although the girls scored better than the boys, the differences were not statistically significant.

The importance of this study is that the sample included children who had articulation disorders and who were receiving treatment as a result. Therefore, it can be argued that these findings may be more representative of society as a whole. A clear weakness of the study, however, is that the results of both groups are not reported separately so that it is not clear to what extent articulation

disorders may have been a contaminating factor.

The third study investigating the timing of acquisition is Prather, Hendrick & Kern (1975), who tested 147 children aged between the ages of 2:0 and 4:0. There were an equal number of males and females in each age group. Production data were obtained for all consonants in word-initial and final position, and for vowels in a single context. Each child was required to give single-word responses to pictures. If a child was unable to identify a picture, cues were offered, and if a child did not respond, the examiner used a forced-choice question to elicit the word (e.g. Is that a fish or a dog?). The examiner would then state the correct choice (e.g. fish) to the child. If no response was given, the item was omitted.

The acquisition criterion used in Prather et al. was defined as the age at which 75% of the children correctly pronounced the consonants. The authors combined the two positions tested (i.e. initial and final) and considered an average of 75% for both positions as the developmental age of the acquisition of a sound.

It is striking that Prather et al. (1975) report age levels for correct sound production which are consistently lower than in previous studies. In addition, reversals of some sounds were noted, particularly for /s, r, l/. This means that /s/ is produced correctly by 75% of the participants at a particular age and is no longer produced

correctly by 75% of the children at a later age.

The most important contribution of Prather et al. (1975) is that 4-month intervals were used to study speech development and this clearly has the potential for greater accuracy in determining speech sound acquisition than the 6-month interval adopted in most other speech sound acquisition studies.

The main criticism of Prather et al. (1975) is that the early ages of acquisition may not reflect true norms. This may be due to the use of a more relaxed acquisition criterion: whereas Templin (1957) used 75% of the children who produced each sound correctly in three word positions, Prather et al (1975) used an average of 75% in only two word positions.

2.1.2 PHONOLOGICAL ERROR STUDIES

Research into phonological error patterns in children's speech has historically attempted to describe the types and frequencies of phonological error patterns such as fronting, backing, stopping, gliding, weak syllable deletion, etc. Several studies have determined the age at which normal children no longer produce these errors in their speech and some studies have investigated the type and frequency of phonological error patterns in language-disordered children. Because one of the objectives of this study is to determine the phonological error patterns in the acquisition of Syrian Arabic, it is relevant to provide some general information

about the production of phonological errors in English.

All children make pronunciation errors when learning to talk like adults. These errors occur as part of phonological developmental processes which generally disappear in normally developing children by the age of 5 (Bowen 1998; Grunwell 1997). However, in children with speech or phonological disorders, these errors do not disappear spontaneously and may require intervention.

Phonological development processes are identified on the basis of error patterns and these concern errors involving more than one sound. Data obtained from error patterns in normally developing children provide age cut-offs for some phonological processes and this helps clinicians to determine whether an error pattern is typical or unusual (Hayenes & Pindzole 2008). These measures help clinicians to compare common developmental and non-developmental patterns which have been reported for disordered speech (Dodd 2005). Furthermore, error pattern data help to differentiate the diagnosis of various phonological disorders. Clinicians can distinguish between children with articulation disorders and those with delayed development based on the number of errors they make (McCormack and Dodd, 1998).

Bernthal & Bankson (1998) and Grunwell (1981) classified error patterns into two main types: syllable error patterns and substitution error patterns. Syllable error

patterns are defined as those pertaining to simplifications in the structure of syllables and words. These processes can be divided into the following specific categories: final consonant deletion, weak syllable deletion, reduplication, consonant cluster reduction, assimilation, epenthesis, metathesis and coalescence. Substitution error patterns are defined as those pertaining to simplifications in the systems of contrastive phones or systemic simplification. Such errors include fronting, stopping, gliding, affrication, deaffrication, vocalization, voicing, and backing (Dodd 2005; Bernthal & Bankson 1998; Grunwell 1985). These phonological processes are illustrated in table 2.2:

Table 2.2: Summary chart for phonological processes.

Phonological error	Definition	Example
Consonant deletion	Omitting a consonant in initial or final position	boot→ [bu]
Syllable deletion	Omitting one syllable of a multisyllable word	telephone→[tɛfo n]
Stridency deletion Strident consonants: /f,v,s,z,ʤ,ʃ,tʃ/	Omitting strident or replacing strident with non-strident	bus→[bʌ]
Stopping	Production of a fricative or affricate as a homorganic plosive*	see→[ti]

Fronting	Production of a back consonant as a front consonant with consonant made at or in front of the alveolar ridge	key→[ti]
Backing	Replacing mid and front consonants with back consonants	bus→[bʌk]
Alveolarization	Replacing consonants made with the lips or teeth with consonants made at the alveolar ridge	thump →[tʌm]
Labialization	Replacing consonants made with tongue tip with consonants made with the lips	sad →[fæd]
Affrication	Replacing a fricative consonant with an affricate consonant	show→[tʃo]
Deaffrication	Replacing an affricate consonant with a fricative consonant	cheese → [siz]
Voicing change	Replacing a voiced consonant with a voiceless consonant, or replacing a voiceless consonant with a voiced consonant	thief →[dif]
Gliding	Replacing a liquid sound with a glide	love→[jʌv]
Cluster reduction	Omitting one or more consonants in a consonant cluster	spoon→[pun]

Another study investigating phonological error patterns in English was conducted by Roberts, Burchinal & Footo, (1990), who tested 145 English children between the ages of 2:6 and 8. The researchers used the Goldman-Fristoe test (1969) to collect speech samples on an annual basis with children recruited at birth between 1972

and 1985. These samples were then analyzed for the occurrence of phonological error patterns. Roberts et al. (1990) computed the percentage of occurrence of each phonological process by dividing the actual frequency of a particular process by the total number of potential occurrences. The criterion for determining the occurrence of a process was an incidence of at least 20%. The results revealed a clear decrease in both common and uncommon error patterns produced by children between 2:6 and 4. Some common phonological processes such as the deletion of final consonants, syllable deletion, stopping, the deletion of medial consonants, gliding, fronting and de-affrication, appear to remain constant with a slight drop after the age of 4. This was not the case for uncommon phonological processes, such as reduplication, assimilation, deletion of initial consonants, addition of consonants, metathesis, backing, apicalization, and labialization; these were produced only infrequently by children between the ages of 2:5 and 8.

In this study, common processes such as the deletion of final consonants, syllable deletion, stopping and the deletion of medial consonants had an incidence lower than 25% before the age of 2:6. Gliding, fronting and deaffrication had disappeared between the ages of 2 and 3, and cluster reduction between the ages of 3 and 4. Another assessment was the age at which a process occurred in less than 10% of the sample. According to this criterion, stopping disappears between 2:6 and 3, fronting and deaffrication between 3 and 3:6, gliding between 4 and 5, and cluster

reduction between 6 and 7 years.

The main conclusion of this study was that that typically developing children display uncommon phonological developmental processes, although not as frequently as phonologically disordered children.

Three years after Roberts et al. (1990), Smit (1993) provided a more extensive analysis of typical and atypical consonant errors produced by 1049 English children aged between 2 and 9. Speech data were elicited as single-word responses to a photograph. Errors were divided into the following categories: errors with an incidence between 30-50%, errors with an incidence between 15 and 30%, errors with an incidence between 5 and 15%, and occasional errors which were produced by most groups at a frequency between 1-4%, or by a few groups at less than 3%. Rare errors were classified as those occurring with a frequency of less than 3%.

The results showed that the most common error involving nasals was de-nasalization and substitution, while for glides the most frequent error was deletion. Errors occurring in plosives were consonant voicing, fronting and deletion of final consonants, while errors involving liquids were gliding and vocalization. The most prominent error patterns for initial /r/ were the substitution of /r/ by /w/ and the substitution of de-rhotacized variants. The nasal and plosive errors are part of developmental processes, whereas labialized and labialized de-rhotacized variants

for [ɹ] may not be developmental. The errors observed for fricatives and affricates were stopping and substitution of one target fricative with another, while other common errors observed were de-palatalization for palatals and de-affrication for affricates.

Smit (1993) also found that there were restrictions on the phonological processes affecting the acquisition of a range of consonants or word-positions. She described these as reflecting three trends. The first trend is the limitation on the scope of phonological processes. Prevocalic voicing was limited to plosives. Stopping was more prominent than other errors for /f, v, z, ʤ, θ, ð/ at the youngest ages. Final consonant deletion applied 5-15% of the time for /p, b, d, f, v, s, z, ʃ, ð/. Fronting of velar stops to alveolar, and deaffrication applied to /tʃ/ not /ʤ/.

The second trend is that phonological errors which were not classified as phonological processes included errors which occurred more than 5% of the time in at least one age group. These were epenthesis (addition of a consonant) for final / ŋ / in all age groups, devoicing of initial voiced consonants, distortions of /r, ɚ/and the substitution of /f/ for /θ/. Finally, there were atypical errors such as the use of /d/ for initial /g/.

As previously noted, Smit (1993) provides important information based on quite a large sample (1049 children) about phonological error distribution in consonant

sounds. It presents data about the most prominent error types and the phonological errors which appear to be restricted to specific consonants or word positions. It also classifies error types as typical or atypical. The weakness of this study, however, is that it examined phonological error patterns in consonant singletons and does not provide data on syllable-level errors or consonant clusters. Another important consideration is that children who were receiving intervention for articulation were included in this study.

2.1.3 PHONOLOGICAL AND TIMING STUDIES

Studies in this category examine both the age and order of speech sound acquisition as well as phonological error patterns. The first of such studies was carried out by Lowe (1989) who investigated 1320 children (636 males, 674 females) between the ages of 3:0 and 8:11 for all consonants in syllable-initial and final positions. In addition, various phonological processes were examined. In order to elicit speech, Lowe (1989) used a delayed imitation task in which a child had to repeat sentences after the examiner. The examiner first produced a model sentence and then showed a picture visualizing the sentence while the child was asked to imitate the examiner's model. The criterion of speech sound acquisition in this study was 90% correct in either of the two word positions.

Although Lowe used a non-spontaneous technique (i.e. delayed imitation) to elicit

speech in his study, the ages of acquisition were similar to studies using spontaneous single-word elicitation. The sounds acquired first were /m, n, p, b, d, k, w, h/ in word-initial position and /m, p, t, d, k, g/ in word-final position. The last sounds to be acquired were/r, ð, s, z/. All speech sounds and clusters had been mastered before the age of 7: 5. These results are similar to those in Templin (1957) and Prather et al. (1975) in that nasals and plosives are acquired early, while fricatives are acquired late. However, there were some differences in the acquisition age of certain speech sounds compared to these two previous studies. For example, while the children in Templin (1957) acquired /s/ at the age of 4, the acquisition age in Prather et al. (1975) was 6:6. The reason for this difference may have to do with the acquisition criterion used in this study which is considerably stricter than in the two previous studies. This point is supported by the fact that Smit (1986), like Lowe, employed a quite strict acquisition criterion and the results of these two studies are quite similar in the ages and order of acquisition (i.e. 19 English speech sounds are acquired at the same age).

With regard to developmental phonological processes, Lowe found that there was a gradual suppression of all processes with increasing age and phonological errors decreased with age as well. For example, in the 3:0-3:5 group, there were 12 different types of phonological errors. This number decreases to 10 between the ages of 4;6 and 5. Almost all phonological processes had disappeared by the age of

6:6, except for labialization.

The Lowe study is important because it is one of the first to provide information about norms of phonological processes. It also identified the occurrence of phonological errors in the different age groups and the age of suppression of these errors. One weakness of this study is that the results do not provide norms for some speech sounds in word-final position, even though it was an explicit objective of this study to determine the ages of speech sound acquisition in both initial and final positions.

Another important study of both timing of acquisition and phonological processes is Dodd, Holm, Zhu & Crosbie (2003), who examined the phonological development of 684 English children (326 male, 358 female) between 3:0 and 6:1. In addition, they tested 32 children aged 2:0 - 2:11 in order to identify the developmental patterns used by these very young children. All consonants were investigated in initial and final position except for /ð/ and all vowels were included. The study furthermore examined phonological error patterns in these children, who had to spontaneously respond to pictures or repeat words after the examiner. A sound was considered to be acquired if it was correctly produced or imitated by 90% of the children in a particular age group.

The findings were that the production of speech sounds becomes more accurate

and stable over time: older children produced more accurate speech and made fewer phonological errors. The order of speech sound acquisition was also entirely consistent with previous studies. The first sounds acquired were /m, n, p, b, w/, while /θ, ð, ɹ/ were acquired last. The study also identified a statistically significant difference in correct consonant production between the groups of children aged 3:0-3:11, 4:0-5:5, and 5:6-6:11. The results also revealed numerical differences in vowel production between the youngest groups (3:0-3:11 and 4:0-5:5) and the two older groups (4:5-5:5 and 5:6-6:11), although these were not statistically significant.

Regarding the phonological errors, 90% of the children aged 6 and over had error-free speech. No gender differences were observed until the age of 5:6. In the oldest age group girls did better than boys on all the phonological accuracy measures. There were no significant effects of socio-economic background on any of the phonological accuracy measures in any age group.

The importance of Dodd et al. (2003) is that it used a more accurate criterion to determine error patterns in children's speech, i.e. that the error pattern should occur at least 5 times in a child's speech to be considered as a real error pattern. One weakness of this study, though, is that it used intervals of 1 year between the different age groups. A smaller time interval of, for example, 6 months could have provided a more fine-grained picture.

2.2 STUDIES OF PHONOLOGICAL ACQUISITION IN OTHER LANGUAGES

2.2.1 XHOSA

Xhosa is one of the official languages of South Africa. It is spoken by about 7.9 million people. An interesting feature of this language is that it has clicks, which are sounds produced on a lingual airstream mechanism.

Mowrer & Burger (1990) studied the speech of 70 Xhosa children aged between 2:6-6:0. They examined the age and order of acquisition of all Xhosa speech sounds in intervocalic position. In addition, they also studied the different phonological error patterns produced by these children. The results were then compared with those of 20 English-speaking children who had also been included in the study. Children were tested individually in a picture-naming task. If a child failed to name the picture, the examiner provided the name of the object and the child was asked to imitate the examiner's production. A sound was considered to be acquired if 80% of the children produced the sound correctly in word-medial position.

The results indicated that most speech sounds were acquired by Xhosa children at an earlier age than English children: Xhosa children mastered 80% of Xhosa speech sounds before the age of 3, while English-speaking children had only mastered 48%. Plosives and nasals, though, had been acquired by both groups of subjects before the age of 3, with the exception of /t/ and /d/.

Turning to those findings particular to Xhosa it was found that clicks were acquired early by Xhosa speakers: /!/ was acquired between 2:6-3:0 and /|/ between 3:6 and 4. It is interesting that this finding is contrary to the findings of other studies that have investigated clicks, and that it does not support Jakobson and Waugh's (1979) claim that uncommon consonants in the world's languages are among the last to be acquired. Consonants which are acquired late by Xhosa children are the same as those that are acquired (relatively) late by English speakers: i.e. /s, ʃ, z, r, tʃ/. An additional finding was that Xhosa and English speaking children made the same number of errors on the same speech sounds, and that most misarticulated speech sounds were similar in both languages. This provides some support for the existence of universal tendencies in phonological acquisition.

One weakness of the Mowrer and Burger (1990) study, however, is that each speech sound was only assessed once, which yields a quite limited measure of speech sound acquisition.

2.2.2 ZULU

Zulu is another official language of South Africa with about 10 million speakers. This language has a relatively large number of consonants and 3 clicks.

Naidoo (2003) assessed speech sound acquisition and syllable development in 80

Zulu children aged between 3:0 and 6:2, using toys and pictures to elicit 100 samples of conversational speech from each child. A sound was considered acquired when 5 out of 6 children (83.33%) produced it correctly in an age group.

The results show that there was a clear progression between the ages of 3 and 6:2 in speech sound and syllable development. In addition, nasals, plosives, approximants and fricatives were found to have developed earlier than affricates, clicks and pre-nasalised sounds.

The main weakness of the Naidoo study is that the criteria for speech sound acquisition were not clearly stated (5/6 subjects produced sound correctly). It would have been better if researchers had used the number of times a sound is produced correctly by each child. Another weakness of the Naidoo study is that some speech sounds were acquired by younger children and then seem to disappear from the inventory of older children. Naidoo considers this to be a consequence of her use of a spontaneous speech sample which meant that there may have been insufficient opportunity for some speech sounds to occur in children's speech samples.

2.2.3 GERMAN

Fox (2000) sampled 177 German children between the ages of 1:6-5:11, with an equal number of males and females in each age group. All the German speech

sounds were tested in all possible word positions. Moreover, most word-initial consonant clusters and some medial and final clusters were tested as well. 99 pictures were used to elicit spontaneous single-word responses from children in the age groups above 1:6 and connected speech for the 1:6 and under age group. Two acquisition criteria were applied. The first criterion considered a phone to be acquired when 75% of children produced this phone at least twice in any word position, whether correct or not, and it was considered to have been mastered when 90% of the children within one age group were able to produce it correctly at least twice throughout the sample. The second criterion considered a speech sound to be acquired when 75% of the children within one age group produced it correctly at least two out of three times in each word position.

The results showed that vowel production was unproblematic even at an early stage in the acquisition of German. Furthermore, the speech sound inventory of German children had been fully acquired by the age of 4:5-4:11. Children at 3 years of age had already started to produce consonant clusters (e.g. /st, fr/). Finally, it was observed that the most frequently occurring phonological errors produced by German children were similar to those produced in other languages.

2.2.4 MODERN STANDARD CHINESE

Modern Standard Chinese is the official language of China and Taiwan. Zhu (2002)

analysed the phonological development of 134 Chinese children aged 1:6-4:6. Besides the vowels, all tones and speech sounds in each legitimate word position were investigated. Children were assessed individually by means of a picture naming task. If a child failed to name the target picture, the examiner would present semantic or contextual prompts. If a child failed to produce the target word, he or she would be asked to imitate the examiner. Spontaneous speech samples were elicited by means of five scene pictures which the children were asked to describe. A speech sound was considered stable when 90% of children in an age group produced the sound correctly on at least two occasions.

The results revealed that 75% of the children had acquired the 21 syllable-initial consonants from Modern Standard Chinese by the age of 3:6. Among the first sounds to be mastered were nasals, alveolar stops, alveolo-palatal fricatives and affricates, the velar stop and velar fricative. The speech sounds acquired last were alveolar affricates and alveolar approximants. The most frequent error pattern was syllable-initial consonant deletion in the youngest group, followed by backing (which rarely occurs in other languages), fricative velarization, fronting and stopping. The order of acquisition was tone > syllable final consonants > vowels > syllable-initial consonants.

2.3 IMPLICATIONS FOR FUTURE STUDIES OF PHONOLOGICAL ACQUISITION

Two important issues arise from these previous studies on both English and other languages which have consequences for the validity of the results of future acquisition studies. These issues have to do with task-related considerations and the criteria for successful acquisition.

2.3.1 TASK-RELATED CONSIDERATIONS

Some speech therapists believe that speech samples obtained in single-word elicitation tasks do not provide enough information to enable correct speech intervention. In single word tasks, a child has one opportunity to produce a given sound. This “all-or-nothing” method does not allow the possibility of determining whether a child can correctly produce the sound in other words too. Thus, this mode of elicitation may not provide an accurate picture of a child’s real ability.

Faircloth & Faircloth (1970) support this view and argued in their study that single-word elicitation may present a biased sample of children’s speech sound production. Bauman-Waenlger (2000) also put forward this argument, pointing out that the correct production of a sound in a one-word response does not necessarily mean that the child is able to produce the sound correctly in natural speech

conditions.

Smit (1986) compared several studies which had used single words to elicit speech sounds (Templin 1957; Prather et al 1975) with studies which had used conversational speech instead (Olmsted 1971; Irwin & Wong 1983). She concluded that acquisition studies based on spontaneous speech samples have the potential to provide more accurate information, and argued that data obtained in conversational speech "have not been reported in forms that allow clinicians to use them in a normative way" (Smit 1986: 184)

Morrison & Shriberg (1992) also compared findings derived from conversation with findings in single words. They analysed speech samples of 61 children with speech delay and compared the results from the Photo Articulation Test (Pendercast, Dickey, Selamr & Soder 1969) with those from conversational speech. They found significant differences in the data collected by the two modes of elicitation at all linguistic levels (i.e. overall accuracy, phonological processes, individual speech sounds, error types, word position). They also found a relationship between the developmental occurrence of speech sounds and their accuracy, depending on the method of elicitation used: "Established sounds were often produced more accurately in conversational speech, whereas emerging sounds were often produced more accurately in response to articulation test stimuli" (Morrison &

Shriberg 1992: 267).

Wolk & Meisler (1998) also made a systematic comparison between conversational and single-word elicitation. In this study, the performance of 13 phonologically impaired children was assessed by means of a conversational speech task and a 162 picture naming task. The two methods generally produced similar sound error patterns. However, the picture-naming task yielded more phonological errors. Wolk & Meisler (1998) argued that both methods of speech elicitation are useful clinical tools for assessment.

An important general question that remains to be answered here is whether there are differences in the type of errors produced depending on the type of speech elicitation method. In their attempt to investigate this question Healy & Madison (1987) used two different methods to study the frequency and type of articulation errors produced by 120 articulation disordered children. They compared single word production and connected speech samples and found that articulation errors were significantly more frequent in connected speech samples than in single word utterances.

Another study which tried to answer this question is Johnson, Winney & Pederson (1980) who elicited single-word and connected speech samples from 35 articulation-disordered children. The results showed significant differences in the

number and type of errors, as well as in the prevalent error patterns. The authors also reported that there were more errors in connected speech than in isolated single word responses. The findings also indicate that connected speech sampling provides a higher number of omissions than substitution errors, whereas in single word sampling the number of substitution errors was higher.

Many studies have been interested in investigating the most effective mode of sampling, i.e. either single-word or connected speech, to determine the number and nature of speech sounds in children's productions. Masterson, Laxon, Garnegie, Wright & Horslen (2005) also compared the production abilities of 20 children by administering a single-word and a connected speech task. Like Wolk & Meisler (1998), their findings suggested that a single-word task was not only an effective way to assess children's sound system, but it was also substantially faster than collecting and analyzing connected speech.

One further important question is whether or not an imitation task yields the same results as spontaneous production. In spontaneous production, the examiner asks a child a question or shows a picture, and then asks the child to name it so that the examiner does not interfere with the child's response. In an imitation task, the examiner presents a certain model of speech and asks a child to repeat it. Kay, Lesser & Coltheart (1992) presented a model of speech production which will be

reviewed here as it is based on both spontaneous production data and imitation data and illustrates the differences between the two methods. Kay et al. (1992) assumed that 7 major processing stages were involved in the production of imitated utterances. These stages are as follows: (1) an auditory phonological analysis, (2) a phonological input buffer, (3) a phonological input lexicon, (4) a semantic system, (5) a phonological output lexicon, (6) a phonological output buffer and (7) the production of speech. However, there are fewer processes involved in spontaneous speech which begins with seeing a picture. The five processes in this case are (1) a visual object recognition system, (2) a semantic system, (3) a phonological output lexicon, (4) a phonological output buffer, and (5) the production of speech. Notably, only three of these five processes are shared with the imitation task, so there is a significant difference in the way in which speakers select a certain representation to be converted to the appropriate word in spontaneous speech as compared to merely repeating the word. Since more processes are involved in recognizing the model of the examiner and repeating spoken utterances in the imitation task, differences that are found between the two methods of data collection could possibly be explained in terms of differences in the degree of mental processing involved.

Some studies found no significant differences between imitated and spontaneous production (Dubois & Bernthal 1978; Templin 1947; Siegel, Winitz & Conkey 1963).

However, Kresheck & Socolfsky (1972) examined the influence of the two methods in assessing the articulation of 45 four-year-old children and did find a significant difference between the two methods in terms of the children's total articulation scores. Particularly, better articulation scores were obtained by 40 out of 45 children in the imitation method of stimulus presentation, whereas none of the children had better articulation scores in spontaneous speech.

Johanson & Somers (1978) also examined the two testing modes. Their participants were children in reception classes of two American infant schools. They found a significant difference between the two methods in that consonants were more accurately produced in imitated productions than in spontaneous speech. They concluded that the elicitation of speech by imitation should be avoided if at all possible, since it may present an inaccurate picture of a child's true abilities. Like Johanson and Somers, we favour the use of spontaneous production since we believe it is likely to produce a more realistic picture of children's speech, whereas the imitated response may elicit models that may not exist in children's natural speech.

2.3.2 THE CRITERION OF ACQUISITION

A second issue that was raised in our earlier review of the phonological acquisition

literature relates to the specific criteria used for speech sound acquisition. There seems to be a general preference for a 75% criterion of correct production, where the term “correct production” means that children’s production is identical to that of adults. Yet, even when adopting this criterion, there still remain significant methodological differences between studies. For example, while Templin (1957) and Prather et al. (1975) both use the 75% acquisition criterion, the two studies differ as to the number of word positions that are taken into account. While Templin (1957) required a sound to be produced correctly 75% of the time in three word positions, Prather et al. (1975) only applied the 75% criterion to production in two word positions. Smit (1986) adjusted the data obtained from Prather et al and she compared these with the two position norm reported in Templin (1957). The results gave very similar results in the age of speech sound acquisition, despite these methodological differences.

Another difference between the Templin and Prather studies is that Prather’s 75% criterion was “the average of the percentages in two positions” (Prather et al. 1975: 184) while the Templin’s 75% criterion was the percentage of children who produced each sound correctly 75% of the time in each word position. According to Smit (1986) the combination of these two factors should result in earlier ages of acquisition in the Prather study than in the Templin study and yet there are some examples in which the Templin acquisition norms show younger ages of acquisition

than those reported by Prather even though his criterion was stricter.

Some researchers, like Ingram, Christesen, Veach & Webster (1980) reject the 75% criterion as too strict. In their own study, they adopted a 70% criterion instead. Sander (1972) took a different approach and defined two measures: (1) customary age (51% correct production in two word positions) and (2) age of mastery (90% correct production in three word positions). Amayreh (1994) uses a third measure in addition to the two proposed by Sander : (1) age of customary production, in which at least 50% of the children in an age group produce a sound correctly in at least two positions; (2) age of acquisition, in which at least 75% of children in an age group produce the sound correctly in all positions, and (3) age of mastery, in which at least 90% of the children in an age group produce a sound correctly in all positions.

Smit et al. (1990), So & Dodd (1995) and Dodd at al. (2003) adopted a 90% acquisition criterion on the basis that the prevalence of phonological delay in disordered children is reported to be about 10% of the normal population. However, further examination of the study by Zhu (2002) shows that disordered children had already been eliminated from the study before the results supporting the 90% criterion were analysed. As such, the sample does not contain phonologically delayed children and the justification for adopting the 90% criterion

does not seem valid. Indeed, Culbertson & Tanner (2001) queried why 5 to 10% of developmentally delayed children had already been eliminated from the authors' sample. Nevertheless, it can be assumed that many studies do not systematically eliminate phonologically delayed children and so that the 90% criterion seems most sensible.

2.3.3 CONCLUSIONS

Although there are quite a number of differences between these studies in terms of methodology and criteria, there are several trends that can be detected. In the first instance, there is a gradual development of speech sound acquisition across languages. Secondly, all studies which have examined the age of vowel acquisition have shown that vowels are mastered earlier than consonants. Thirdly, it has been documented that consonant acquisition tends to follow a similar course in different languages, which suggests that speech sound acquisition takes place along universal principles. Especially, the manner of articulation provides some clear evidence of such universal patterns. In many languages, nasals and plosives are mastered before fricatives, and fricatives before affricates. This has been confirmed in studies on English (Templin 1957, Prather et al. 1975, Dodd et al. 2003) and is also attested in several other languages, including Zulu (Naidoo 2003), Cantonese (So & Dodd 1995),

Xhosa (Mowrer & Burger 1990), German (Fox 2000), Putonghua (Zhu 2002) and Jordanian (Amayreh 1994). This finding can be explained by the fact that some speech sounds tend to occur more universally than others. Specifically, plosives occur in all the languages of the world, while 96.45% have nasals (UCLA Phonological Segment Inventory Database (UPSID). 96.23% have approximants: all these sounds are acquired relatively early by children across languages. The percentage of fricatives and affricates in the languages of the world is 93.13% and 66.52 %.(UCLA Phonological Segment Inventory Database (UPSID)) , respectively, and these sounds are typically acquired late. The percentage of fricatives raises problems for the earlier claim that fricatives are nearly as common as nasals, but nevertheless fricatives are acquired later than nasals. Locke (1983) and Stokes & Surendran (2005) suggested that articulatory complexity has to be taken into account to explain why some speech sounds tend to be acquired relatively late although they tend to occur more universally than others.

Some researchers make a further connection between the frequency of sounds in the world's languages and the naturalness of sounds (Vihman 1993), as the speech sounds which are rare in languages could be regarded as "unnatural" and therefore tend to develop later.

In addition to the universal tendencies which have been observed in previous

studies, language-specific influences have also been noticed. Each study has reported particular patterns, both in the order and in the age of speech sound acquisition, as well as in the error patterns. For example, the speech sound /v/ shows considerable variation in acquisition rate amongst learners of different languages. It appears to be acquired earlier in German, Turkish and Xhosa than in English. Another example is the acquisition age of /ʃ/, which for Turkish children was found to be 1:11 (Topbas & Yavas 2006), while for English children it emerged at the age of 5:11 (Dodd et al. 2003). Some researchers have attributed these differences in acquisition rate to differences in the phonology of the various languages. Ingram (1989), for example, pointed out that a sound will be pronounced correctly earlier in a language in which it occurs more frequently and in which it has a greater functional load. Although the idea of functional load refers to the relative importance of each speech sound within a specific phonological system (Zhu 2002: 15), it has been widely argued that functional load is difficult to calculate across languages.

Phonological error patterns also provide evidence for the universality of acquisition as a great deal of similarity has been observed across languages. For example, Fox (2000), and Mowrer & Burger (1990) demonstrated that most error patterns in English also occur in German and Xhosa. Such errors include fronting, stopping, cluster reduction, weak-syllable deletion and final consonant deletion. Yet,

differences in error patterns across languages also provide evidence of the inherent variability of phonological acquisition across languages. One example is that Amayreh (1994) found that most of the errors in the speech of Jordanian children acquiring Arabic related to emphatic consonants, which reflects a language-specific issue. Another example comes from Mowrer & Burger (1991), who reported that Xhosa children made fewer errors on plosives and fricatives than English-speaking children. A third example comes from Zhu (2002), who indicated that there is a difference in the error patterns produced by children speaking Modern Standard Chinese and children speaking other languages. Specifically, syllable-initial consonant deletion and backing are the second most frequent error patterns in Chinese children, yet they are considered atypical error patterns in English children.

Considerable variation in speech sound acquisition between different languages has been reported in the literature, but differences between studies which have investigated the same language have also been noted. For example, there is disagreement about the age of speech sound acquisition in studies which have examined English children. Templin (1957), for example, found that the speech sound /r/ was mastered around the age of 4, while Smit et al. (1990) reported that this speech sound was not acquired until the age of 8:0. Yet another example of differing results from studies of the same language comes from Saleh et al. (2007), who reported that Egyptian children produced the highest number of speech

sounds correctly in final position, which runs counter to the findings reported in Ammar & Morsi (2006) and Amayreh (1994) for speakers of Arabic. Other data from Saleh et al. (2007) revealed that the consonants /ʕ, h , ʃ, r/ are part of Egyptian phonemic inventory before age 2:6 while Omar(1973) indicated that these sounds were not acquired by Egyptian children until age 4:6.

2.4 ARTICULATION TESTS

Most studies of children's speech development are based on articulation tests. Some studies used a test which had previously been designed, while others designed their own diagnostic instrument. Before proceeding, it will be useful to clarify the difference between an articulation test and phonological assessment. In a phonological assessment, the speech and language therapist attempts to evaluate the phonological system (i.e. the rules of the sound system of a language including the combination of these sounds into intelligible speech) and the purpose of phonological testing is to determine and categorize error patterns which enable an understanding of the client's phonological system. In an articulation test, the SLT assesses the production of consonants and vowels. An articulation test can be a phonological test depending on the manner in which the researcher analyses the results. For example, if he/she looks at speech sound classes and attempts to find

out the phonological error patterns that apply to them, then the test will be phonological.

In the present study, it was necessary to design an original articulation test because there are no articulation tests for Syrian Arabic. Developing a standard articulation test as an instrument for this study was a precise matter and several principles had to be considered. In order to design an appropriate and effective test, 4 tests on English and 2 tests on Arabic were reviewed with respect to their content and psychometric characteristics. The discussion below will focus on the 4 English tests, while the two Arabic tests are described in the following chapter. In the discussion, only tests were included which test articulation, phonology or both and which are intended for children aged from 2 or 3 onwards. The English tests that were studied in detail are the Diagnostic Evaluation of Articulation and Phonology (DEAP) (2002), the Arizona Articulation Proficiency Scale (1963-2000), the Goldman-Fristoe Articulation Test (1969 1986) and the Assessment Link between Phonology & Articulation (ALPHA) (1989).

2.4.1 THE DIAGNOSTIC EVALUATION OF ARTICULATION ANDPHONOLOGY (DEAP)

The diagnostic evaluation of articulation and phonology was developed by Dodd, Zhu, Crosbie, Holm & Ozanne (2002). This test aims to differentiate between

disorders of articulation (functional and organic), delayed phonological development, and consistent and inconsistent phonological disorders in children between 3:0 and 6:11. The test consists of five sections. The first section is a diagnostic screening in which children name ten pictures twice to determine whether or not any aspect of the speech system needs further investigation. The pictures are designed to elicit all consonants, a few consonant clusters and a range of vowels.

The second section is an articulation assessment which uses 30 pictures to elicit all the English consonants and vowels in single-syllable CVC words. This assessment aims to determine whether a child is able to produce a sound in the context of a single syllable.

The third section consists of a phonology assessment in which children name 50 pictures to elicit all the consonants in word-initial and final positions, as well as all the vowels and diphthongs. Fourteen items are used to elicit the same single words in connected speech. This connected speech sample thus allows the researcher to identify children whose speech in single words is different from connected speech. The purpose of the assessment is to determine the use of articulation error patterns.

The fourth section is an assessment of inconsistency based on 25 pictures. Children

name the pictures three times, with each trial being separated by another activity. Inconsistency is considered to be evidence of atypical speech development as typically developing children produce the same word consistently on different occasions.

The fifth section is an oro-motor assessment consisting of a diadochokinetic task which tests children's ability to produce a repeated sequence of the sounds /p, t, k/. This task was included to evaluate children's oro-motor function, with the results rated according to sequencing ability, intelligibility and fluency, and isolated and sequenced movements.

The norms for DEAP are based on the assessment of 684 British English children who were assumed to be a true reflection of the whole population, because children with speech difficulties were not excluded from the standardised sample. The sample was approximately balanced for gender: 52.3% of the participants were female and 47.7 % were male.

To examine the reliability of DEAP, 8.1% of the children (mean age 5:3) were tested twice. Inter-rater reliability was also conducted on the results from 10% of the children (mean age 5:3), which were transcribed and analysed by two independent examiners. The correlation between the ratings was high.

The DEAP test has high content validity because the items sample all syllable-initial and final consonants in English, all but one vowel, clusters and a range of syllable structures. Concurrent validity was established by correlating this test with another phonological test that had previously been validated, i.e. the Edinburgh Articulation Test, which had been applied to 7.3% of the UK sample used in DEAP (with a mean age of 4:9). The resulting correlation coefficient between the two tests was high and significant ($r=0.95$, $p<0.001$), which indicates that the results from the two tests are significantly correlated and that the concurrent validity of the DEAP is high.

The main advantage of DEAP is that it consists of a comprehensive battery of five assessments. As such, it helps clinicians to make a differential diagnosis of speech disorders in children. Another important advantage is that it is a time- and cost-effective clinical tool: the diagnostic screening allows clinicians to choose the most appropriate subsections to administer.

2.4.2 THE ARIZONA ARTICULATION PROFICIENCY SCALE

This proficiency scale was developed by Fudala in 1963 with many subsequent modifications and additional versions. The scale aims to provide an objective measure of articulation proficiency in children between the ages of 1.5-18. It consists of three sections: a sample of spontaneous speech, a brief assessment of

children's overall language skills and an assessment of verbal cognitive skills. The test covers 24 consonants in initial and final positions, several /s/, /l/, and /r/ clusters, and 20 vowels and diphthongs. Children are required to name 42 picture cards. Scores are provided in percentile ranks and/or standardized scores. The children are asked to name pictures or to read the words from a single card, which is often preferred by adolescents.

A sample of more than 5,500 children and teenagers in the US participated to normalize the test. The sample represented the US population in terms of ethnicity, region and parental education, with an equal number of boys and girls. The test lists the ages at which 90% of all children have acquired individual sounds.

To validate the test, it was administered to 45 children aged 6-12, whose articulation ranged from normal to severely defective. For each child, one minute of spontaneous speech was recorded. Two 10 second samples of spontaneous speech were then presented to 10 judges to determine the defectiveness ratings of the children. These ratings were correlated with the Arizona test scores for the same children. The results indicated a high correlation (0.92), which suggests that the Arizona articulation proficiency scale is a valid measure of articulatory proficiency.

An important feature of this test is that it gives weighted values for speech sounds

based on their frequency of occurrence. It does not give equal value to each speech sound as it places more weight on the erroneous production of sounds which occur more frequently and less weight on less frequently occurring sounds. It also provides a quick measure of articulation proficiency (less than 3 minutes) because all target sounds are tested by means of just 42 pictures.

2.4.3 ASSESSMENT LINK BETWEEN PHONOLOGY & ARTICULATION

This test is a delayed sentence imitation test which was developed in the USA by Lowe (1989) to provide a link between traditional articulation testing and phonological assessment in children from the age of three onwards. The test enables children's phonetic inventory and the deviant use of phonological processes to be assessed. It examines all English consonants in initial and final syllable positions but it does not study the vowels. In addition, the test evaluates 15 phonological processes: consonant deletion, syllable deletion, stridency deletion, stopping, fronting, backing, alveolarization, labialization, affrication, deaffrication, voicing change, gliding, vocalization, cluster reduction and cluster substitution. The test consists of 50 words which are embedded in 50 short sentences. For each sentence there is a corresponding picture. The examiner presents the stimulus picture with the model and asks the child to repeat it.

The test was administered to a random sample of 1,310 children aged between 3:0 and 8:11. The norm sample was not restricted to any specific economic, intellectual or ethnic category.

The significance of this test is that it is one of the few tools which address the need to develop an assessment which links traditional articulation testing with phonological assessment. Although the author (Lowe 1989) indicated that all English consonants are assessed in the test, the results do not present norms for all sounds in final position.

To determine the reliability of this test 233 children were randomly selected and tested twice. Their performance was compared between the two tests. The results showed evidence of high test–retest reliability for speech sounds and for phonological processes.

In terms of the validity of this test, there is some evidence of construct validity, i.e. whether there is a real difference between normal speakers and articulation disordered groups. The percentage of errors in each group on each speech sound was compared using t-tests. The results indicated that there were significant differences between normal and articulation disordered groups on 49 of 53 speech sounds for pre-schoolers, and that there were also significant differences between

normal and disordered school-aged children on 43 of 53 speech sounds.

Further evidence for construct validity comes from assessing the changes in phonological process with age. Comparing the performance of normal and articulation disordered groups on phonological processes revealed significant differences between normal and disordered children for all phonological processes, with disordered children making more errors in all comparisons.

2.4.4 THE GOLDMAN-FRISTOE TEST OF ARTICULATION

This test was developed in the USA by Goldman & Fristoe (1969). The purpose of the test is to assess an individual's articulation of consonant sounds in English. It contains three sections which each look at different levels of complexity:

(1) Sounds in test words in which the examiner uses pictures to elicit the articulation of the 23 single consonants and clusters with /s/, /l/and /ɹ/

(2) Sounds in test sentences which assess spontaneous sound production in connected speech. Target speech sounds are sampled within the context of simple

sentences.

(3) A stimulabilty test measures the examinee's ability to correctly produce a previously misarticulated sound when asked to repeat the word or sentence modelled by the examiner.

Familiar words, simple sentences and short funny stories are used in three sections. The norm sample was a national sample consisting of 2,350 children aged from 2:0-21:0 who were selected to match US census data on gender, race/ethnicity, region, and socio-economic status.

Age-based standard scores include separate normative information for females and males, because the findings indicated differences in the normative data between boys and girls so the authors provided separate norms for each group.

The test uses pictures to elicit speech sounds in single words. In addition, the Goldman-Fristoe test assesses spontaneous sound production in connected speech, by retelling a short story based on pictures.

While testing sounds in single words assesses the sound at word level, testing sound production in connected speech assesses the sound within the context of connected sentences, and this requires more coordination than single word production. These two assessments enable an examiner to form a clear view of

children's articulation ability. This is the main advantage of this test and this may provide a more complete picture of children's articulation ability.

The Goldman-Fristoe test examines several sounds at the same time within the same stimulus word. Thus, by evaluating more than one sound at a time, a time saving of 29% is achieved. Whitehead & Mullen (1975) compared the time of administering the Goldman-Fristoe and the Arizona Articulation proficiency scale test. The results indicated that, even though the Goldman-Fristoe test contained 11 fewer pictures than the Arizona test, for both normal and articulation defective children the Arizona test required less time to complete than the Goldman-Fristoe test. This was attributed to the fact that children were unable to identify the correct stimulus so that they often uttered several possible words, which took substantially longer.

To further clarify the results of their previous study, Mullen & Whitehead (1977) investigated the possible differences in the correct initial identification of stimulus pictures between the Goldman-Fristoe test and the Arizona. The subjects were 20 normal and 20 articulation-defective children. Each child was administered the sections of the Goldman-Fristoe and the Arizona tests which evaluate consonants and consonant clusters. Each child's initial identification of the stimulus picture was recorded. The results indicated that the Goldman-Fristoe test elicited significantly

fewer correct initial stimulus picture identifications than the Arizona test. The authors attributed this finding to the fact that the designers of the Goldman-Fristoe test had attempted to reduce the number of test words by targeting several speech sounds in a single word.

To examine the reliability of the Goldman-Fristoe test, the authors assessed the test-retest reliability. 37 articulatory defective children aged between 4-8 years were tested twice by the same examiner with a one week interval between the test and retest. The findings were made with reference to the presence or absence of errors in the production of each speech sound. The mean agreement for sounds in the words subtest was 94%, while the mean agreement for sounds in a sentence was 86%.

The items used in this test ensure its content validity, as the sounds in the words subtest were designed to sample all English consonants except one. A sample of speech sounds which were most likely to be misarticulated was included in the sounds in sentences subtest. The results of the test-retest reliability of the two subtests were used in the comparison. For the presence or absence of error the agreement was 86%, while the agreement on the type of speech sound production was 72%. Thus, the two subtests are measuring different aspects of articulation development.

2.4.5 PRESENTATIONAL ASPECTS OF THE TEST

One important question is whether the pictures selected for an articulation test may influence the elicited response. A study by Shanks, Sharp & Jackson (1970) examined the effectiveness of stimulus pictures in articulation tests to elicit responses. The Arizona Articulation Proficiency Scale, the Templin-Darley Tests of Articulation, the Look and Say Test, and the Photo Articulation Test were each presented in random order to 96 first-grade children. The Photo Articulation Test elicited the highest number of spontaneous responses and also proved highly time efficient. The authors reported that the type of pictures in the Photo Articulation Test was responsible for these results. They found that colourful photographic pictures yield more responses, and therefore the authors recommend to test the efficiency of pictures used for articulation testing in eliciting correct responses before deciding which test to use.

Madison, Kolbeck & Walker (1982) compared the number of correct responses in three tests of articulation: the Photo Articulation Test (PAT), the Templin-Darley Test of Articulation and the Goldman-Fristoe Test of Articulation. These tests were administered to 64 English speaking elementary school children aged between 5:8 and 9:7. Significant differences between the tests and between the age groups were found.

The Goldman-Fristoe and Templin-Darley tests had higher mean errors in responses across age groups with a percentage of 13% and 15% respectively. The error percentage was 4% in the PAT. The authors also found that the younger children had a significantly lower percentage of correct identification than older children in both the Goldman-Fristoe and Templin-Darley, while there was a consistent correct identification by all children (older and younger) responding to the PAT. After analysis of the results the authors indicate that "vocabulary rather than visual imagery is the important variable in picture ambiguity" (Madison, Kolbeck, & Walker 1982: 110).

Another question that needs to be addressed is whether the ease of stimulus picture identification affects the degree of spontaneity with which children perform on an articulation test.

Eveleigh & War-Leeper (1983) compared three articulation tests (Photo Articulation Test, Fisher-Logemann Test of Articulation Competence(Fisher and Logemann,1971) Templin-Darley Test of Articulation (Templin and Darley, 1969) regarding the ease of stimulus picture identification and the time required to administer the test. The results revealed that the screening version of the Photo Articulation Test elicited a higher number of initial picture identifications. These findings are consistent with those of Shanks et al. (1970) who concluded that real

photographs lead to better results in initial identification.

Another important consideration that should be taken into account when designing an articulation test is the selection of the test vocabulary. Most of the articulation test developers have chosen familiar and common words as test items. For example, the DEAP test, the Arizona proficiency scales, and the Goldman-Fristoe articulation test include words which are known to, and frequently used by, young children. Other tests selected words from frequency lists containing common words which are often used in conversational speech. For example, in the Templin–Darley tests of Articulation words were chosen that would be familiar to young children and that can easily be represented by pictures. These words were obtained from the first-grade level of the Risland Basic vocabulary list. In the Photo Articulation Test the items were chosen from the first 4000 words of the Thorndike word list (Thorndike and Lorge, 1944), the bond developmental reading series and from words occurring in 1% or more of the 500 telephone conversations in a Bell telephone study.

The findings of some studies have shown the effectiveness of the test vocabulary on obtaining correct responses. For example, Madison, Kolbeck & Walker (1982) examined the effectiveness of stimuli used to elicit responses in three articulation tests (Goldman-Fristoe test of articulation, the Photo Articulation Test and Templin-

Darly test of articulation). They suggested that the vocabulary selection and the visual presentation are the main causes of stimulus ambiguity in picture articulation tests and it was concluded that the failure in eliciting expected results in an articulation test is basically due to vocabulary selection. Abou-Elsaad, Baz & El Banna (2009) found similar results when they selected the words for the Mansoura Arabic Articulation Test (MAAT). They chose the MAAT pictures and administered them to children. Subsequently, they changed the pictures which received the lowest number of correct responses and administered the test with new pictures. The results indicated that there were no significant changes in children's accuracy of responses for pictures that had been replaced, so they concluded that "vocabulary rather than visual ambiguity is the important variable in picture ambiguity" (Abou-Elsaad, Baz & El Banna 2009: 280).

2.4.6 METHODS OF SCORING AN ARTICULATION TEST

Articulation test items are scored as correct or incorrect, with an item being considered as correct if the articulation conforms to an adult norm. If the speech sound is not correct, usually the type of error is reported. Hutcheson (1968) concluded that the results obtained by this method are subjective and that they do not consider the developmental process of a child because in "this method no

distinction is made between a child whose speech patterns are very immature and one whose patterns approach more nearly to the adult model" (Hutcheson, 1968: 38).

Many different types of scores are used in standardized tests. The first type is a raw score or the number of items that were correct (Paul 1995; Haynes & Pindzola 2008). Raw scores are not meaningful by themselves; they should be converted into a meaningful number to allow comparison with a normative sample. Therefore, raw scores can be converted to a percentile rank, which reflects a percentage of subjects or scores that fall at or below a particular raw score.

The second type of score is the mean, which is obtained by adding up the scores of all participants and dividing the result by the number of people who took the test. This is a measure of central tendency, i.e. the extent to which a score deviates from the middle of the distribution. The Goldman-Fristoe, the ALPHA, and the Arizona test all use raw scores, the mean and the standard deviation, which represents the average difference of scores from the mean score.

For the Goldman–Fristoe test 26% of the total number of possible marks is given to consonants in medial position. Some researchers have criticized this scoring system as they doubt the importance of using a medial category (Ogburn, Borton, Presley, Holmes, McGraw & Borton 2008; Bauman- Waengler 2000): the consonant is used

either at the onset or coda of a syllable. In the Arizona test, more than 30 % of the total scores focus on vowels. The total consonant score is 55.5 points, while the total vowel score is 45.5 points out of 100. This way of scoring may lead to an underestimation of articulation problems in children as most studies of the development of vowels concluded that children acquire all vowels by the age of 3 (Templin 1957; Irwin & Wong 1983) and vowel errors tend to occur less frequently. This method could, according to Ogburn et al. (2008) "alter the overall standard score as it inflates the value of vowel production" (Ogburn et al. 2008:6).

Another way to convert raw scores to more interpretable data is to convert them to a standard score. The score then has the same mean and standard deviation (Paul 1995).

The Diagnostic Evaluation of Articulation and Phonology (2002) uses standard scores and percentiles as quantitative measures. It also uses percent consonants correct, percent vowel correct and percent speech sounds correct. This presents a more accurate picture, as it provides the examiner with a separate measurement for all vowels and consonants and helps to determine the severity of a client's speech disorders by counting the unproduced consonants without the effect of vowel values.

Few studies have tried to determine the differences between the standardized

scores of the different articulation tests to investigate whether these scores affect decision making. Schissel & James (1979) investigated the differences between the standardized score of the Deep Test of Articulation (DTA) (McDonald 1964) and the Arizona Articulation Proficiency Scale (Fudala 1963). Children's performance for individual speech sounds and global test performance was evaluated. The results indicated that there were significant differences between the two tests. They also showed that there were accuracy differences for 8.2% of the speech sounds tested in approximately 83% of participants. Such scoring processes could affect clinicians' decisions. For example, it was found that the Deep Test of Articulation identified 3 children in need of treatment, while the Arizona test was unable to identify these children. It was concluded that the scoring process of the Arizona test may be deficient for two reasons: the number of trails from the Arizona is too low and this gives children either 0% or 100% correct production (especially with consonant speech sounds known to be frequently in error), and the Arizona does not take into account the frequency of misarticulated consonants compared to vowels.

Ogburn, Borton, Presley, Holmes, McGraw Borton (2008) found that their results supported those of Schissel & James, in that there are significant differences between the Arizona Articulation Proficiency scale-3 and the Goldman-Fristoe Test of Articulation-2. Moreover, they found that these differences could affect treatment decisions. The difference was 6.4 points between the mean standard

scores, with the Arizona being more sensitive to error than Goldman-Fristoe. Mathias (2010) reviewed the content and psychometric characteristics of 9 speech sound production tests: i.e. Structured Photographic Articulation, Diagnostic Evaluation of Articulation and Phonology (DEAP), Arizona Articulation Proficiency Scale (Arizona 3), Goldman–Fristoe Test of Articulation (GFTA-2), Hodson Assessment Of Phonological Patterns (HAPP-3), Khan-Lewis Phonological Analysis (KLPA-2), Assessment Link Between Phonology and Articulation (ALPHA-R), Clinical Assessment of Articulation and Phonology (CAAP) and Children 's Speech Intelligibility Measures (CSIM). The investigation was based on 11 criteria which McCauley and Swisher (1984) consider essential for standardized norm-references tests. These criteria included: the description of normative sample, sample size, content validity, mean and standard validity, concurrent validity, predictive validity, test-retest reliability, inter-examiner reliability, description of test procedure, description of examiner qualifications and construct validity. The criteria that were met by almost all tests are: the description of the test procedure, the description of examiner qualifications, normative data (means and standard deviation) and evidence of validity (content and construct). The results also indicated that test-retest and inter-examiner reliability were not adequately reported by any of the 9 tests. However, as mentioned earlier in this study, the Diagnostic Evaluation of Articulation and Phonology (DEAP) (2002), the Goldman–Fristoe Test of Articulation

(1969) as well as the Assessment Link between Phonology and Articulation (1986) all demonstrate test–retest reliability. The DEAP (2002) also tested inter–rater reliability. According to McCauley & Swisher (1984) there is a set of characteristics that should be available for each criterion in each test in order to determine whether or not a test meets this criterion. The findings of Mathias (2010) indicate that the Arizona and DEAP meet the highest number of these criteria (6 criteria) while the Goldman-Fristoe test meets only 4.

Summary of the most important criteria for previous diagnostic tests which should be taken into account before designing an articulation test:

- Determine clearly the test objectives.
- Determine the test subjects related to this point and choose test items to be suitable to subject's age, mental and language development.
- Subject selection should be appropriate to the target group being tested. This means to choose a sample that has characteristics similar to that of society.
- Select methods of speech sample elicitation, which is appropriate to the test

objectives.

- Determine the test contents (all speech sounds, vowels, clusters, phonological error patterns)
- Determine the criteria to consider whether the subject has normal development or has a disorder.
- Choose the test materials (words, pictures) suitable for subjects.

The aforementioned criterion was used as a guide to design and build the test for this study.

2.5 SUMMARY

This chapter discussed the growing interest in cross-language studies of speech sound acquisition over the last fifteen years. It also reviewed the reasons for studying speech sound acquisition and phonological error patterns in languages as these aspects are vital in the diagnosis and treatment of speech and language disorders in children. They also provide essential insights into the phonological development of children. This chapter has reviewed studies which investigated speech sound acquisition in English. First three timing studies were reviewed in which the main interest was to determine the age and order of speech sound

acquisition in children. These studies are those of Templin (1957), Smit et al (1990) and Prather et al (1975). Then two phonological error studies were discussed: Roberts, Burchinal & Footo (1990), and Smit (1993). In addition, two phonological and timing studies which examined the age and order of speech sound acquisition as well as phonological error patterns were discussed. Speech sound acquisition in other languages was also discussed on the basis of studies of Xhosa (Mowrer & Burger 1990), Zulu (Naidoo 2003), German (Fox 2000), and Modern Standard Chinese (Zhu 2002). From these studies two important issues arose which have important consequences for the validity of the results i.e. task-related factors and the criterion of acquisition. Phonological error patterns in other languages were also reviewed.

One important aim of this study was to design an articulation test to be used as a tool to assess speech sound acquisition in Syrian children as there are currently no such tests in Syrian Arabic. Four tests in English were reviewed with respect to their content and psychometric features. The most important principles and criteria which should be taken into account when designing articulation tests were discussed.

CHAPTER 3: THE PHONETICS AND PHONOLOGY OF ARABIC

3.1 INTRODUCTION

Arabic is a Semitic language that belongs to the Afro-Asiatic language family (Fatihi 2001). Recent estimates put the total number of native speakers of Arabic at about 250 million (Holes 2004). Classical or Standard Arabic is the official language in around 22 Middle Eastern and African countries. It is used in official and literary contexts, and it is spoken on radio, television and in schools.

The distribution of Arabic in the Arab world and in the Muslim communities around the world involves pluricentricity and linguistic diversity. Pluricentric languages are those that have several centres each with their own specific norms depending on the national variety (Clyne 1992). Pluricentricity joins people on the basis of language, but also separates them because of the development of national variables that identify subgroups of speakers (Clyne 1992). Abd–el-Jawad (1992) divided the Arabic-speaking world into different levels of pluricentricity, and he distinguished three geographical areas with similar features, i.e. Al-Maghreb Al-Arabia (Morocco, Algeria and Tunisia), the Levant area (Palestine, Syria, Lebanon and Jordan) and the East-Arabia area (the eastern part of Saudi Arabia and the Gulf states).

According to Abd-el-Jawad, the second level of pluricentricity includes the independent political entities that each Arabic country may form as an independent linguistic centre with its own distinct variety. Arabic is often described as a "coalitive" language which consists of a mixture of varieties (Abd-el-Jawad 1992). Each Arabic country has its own variety which differs from others. These varieties are spoken varieties and are learnt by all native speakers as a mother tongue before they begin formal education.

According to Holes (2004), Arabic can be divided into two main varieties: the Maghrib (North African) varieties and those of the Middle East. The Middle Eastern varieties are in turn further subdivided into and sedentary varieties, whose speakers include Jerusalemites, southern and central Syrians, Egyptians and the Lebanese. These varieties have shed many classic forms and features that are still found in several conservative Bedouin varieties. On the other hand, there are the much more conservative Bedouin varieties, such as those spoken in southern Iraq, the Syrian Desert, Jordan, Central and Eastern Saudi Arabia, and the Gulf States.

All these varieties differ from each other in terms of certain grammatical, morphological and phonological features.

Because this study focuses on the Syrian variety as spoken in Damascus and Homs and Hama, and there are significant differences in Arabic varieties, for example the

'Maghrib' varieties differ totally from the Syrian variety in terms of all language aspects such as phonology, morphology, syntax and Semitic. Consequently, depending on standardized tests and data obtained from one variety and applying results to others make from treatment decisions based on these data not correct. It is useful to point out some of the characteristics which distinguish the Syrian variety from other Arabic varieties.

At the morphological level, some varieties of Arabic use the negative word /ma/ before the verb as well as the suffix /ʃ/ to make a verb negative. This does not occur in Syrian Arabic which only uses the negative marker /ma/ before the verb, e.g. Palestinian /ma ʔakalta ʃ/ > Syrian Arabic /ma ʔakalt/ "I have not eaten".

At the syntactic and semantic level, most Arabic varieties omit the case and mood markers which in Standard Arabic appear at the end of every word (i.e. the final vowel at the end of a word): Standard Arabic /na:ma/ > Syrian Arabic /na:m/ "get sleep".

Besides morphological and syntactic differences, there are also substantial differences in the lexicon. For example, each variety uses a different word to express the possessive: the Egyptians use /bita ʕ/, Syrians use /taba ʕ/, and in the Gulf /hagj/ is used: e.g. Standard Arabic /ʔassajjaratu li:/ > Syrian Arabic /ʔissajjara

tabaʕj/ > Egyptian /ʔissajjara bata ʕj/ > Gulf /ʔissajjara hagj/ “the car is mine”.

3.2 PHONETICS AND PHONOLOGY OF SYRIAN STANDARD ARABIC

As this study aims to determine the age of speech sound acquisition and phonological error patterns in Syrian children, it is useful to identify some of the phonetic/phonological characteristics of the Syrian variety in comparison to Standard Arabic and some of the other Arabic varieties

Syrian Arabic consists of various regional varieties and a distinction can be made between Shami variety (Syrian -Arabic variety) which is (spoken in Damascus, Homs and Hama), North Syrian Arabic (spoken in the region of Aleppo), the Allied Dialects which are spoken in the coastal mountains, the variety spoken in the Jabal Al-Arab Mountains and the eastern dialect which is spoken in Al Hasaka and Deir ez-zor, and southern variety which is spoken in Haoran. It is important to note that these are dialects and not accents: these varieties not only differ in terms of their pronunciation (phonology, including prosody) but also in terms of their grammar and vocabulary. This study focuses on the Syrian variety of Arabic as spoken in Damascus and Homs and Hama (Shami variety). The variety in these three cities share several phonological features so we can consider them as one variety (Syrian variety (SYA) or ‘Shami variety’. Therefore whenever SYA appears in the current study it refers to Shami variety. We refer to figure 3.1 for a general overview of the

different regions in Syria.

One of the difficulties which faced Syrian Arabic learners is diglossia. The Arabist William Marcais used the term diglossie in 1930 to describe the linguistic situation in Arabic –speaking countries. The term "diglossia" was introduced to English in 1959 by Charles Ferguson who defined diglossia as a "relatively stable language situation in which, in addition to the primary dialects of the language, there is a very divergent, highly codified (often grammatically more complex) superposed variety—the vehicle of a large and respected body of written literature either of an earlier period or in another speech community—that is learned largely by means if formal education and used for most written and formal spoken purposes but is not used by any sector of the community for ordinary conversation." In Syrian Arabic, the written language referred to as Modern Standard Arabic (MSA) is in fact formal literary Arabic, is the formal literary Arabic. It is used in education, administration, literature, journalism, and so forth. In contrast a spoken Syrian variety is used in everyday informal transactions. Differences between both varieties are widely exhibited in syntax, morphology, phonetics, and semantics.

The student alike must face the fact that there is more to be learned than one variety. This means Syrian variety learners will have to learn double sets of

vocabulary items and syntactic and morphological rules and sounds, as well as a whole set of skills involved in selection of the appropriate variety for a given context. For example, although SYA do not have the consonants / θ/, /ð/, / ðˤ/, Syrian children and learners acquire these consonants after they enter school.

FIGURE 3.1 MAP OF SYRIA

3.2.1 THE CONSONANTS

The consonant inventory of Syrian Arabic (SYA) consists of 25 distinct consonant sounds which are listed in table 3.1.

Table 3.1: Consonant inventory of Syrian Arabic

	Bilabial	Labio-Dental	Dent-al	Alveolar-dental	Post-alveolar	Vel-ar	Uvul-ar	Pharyng-eal	Glot-tal
Plosive	p b			t d tˤ dˤ		K g	q		ʔ
Nasal	m			n					
Trill			r						
Fricative		F v		s z sˤ zˤ	ʃ ʒ		x ɣ	ħ ʕ	h
Affricate					(dʒ)				
Approximant	w				j				
Lateral-approximant				l					

dʒ :it was put between brackets as it is allophone to / ʒ/

Syrian Arabic (SYA) as spoken in Damascus and its suburbs and Homs and Hama (Shami variety), consists of 29 consonants as shown in table 3.1 based on Ambros (1977); Versteeg (2006) Ferguson (1961).

SYA has 8 plosives which can be subdivided into a voiceless series, a voiced series and a series with pharyngealisation. There are plosives at a labial, dental-alveolar, velar, uvular and glottal place of articulation. SYA has 2 nasals at a bilabial and alveolar place of articulation. Furthermore, the language has a voiced alveolar trill /r/ and 14 fricatives at 7 places of articulation; labio-dental, dental, alveolar, post alveolar, uvular, pharyngeal and glottal. Finally, SYA has one affricate /dʒ/ which appears in borrowed words as in the word / dʒ i:nz/ ”jeans/, it also appears in some Damascus suburbs, 2 central approximants /j/ and /w/ and one lateral, approximant /l/.

Three of these 29 consonants are borrowed from other languages. These loan consonants are /g, v, p/, /g/ as in the loan word /ʔangiltra/ “England” and in the word /siga:ra/ “cigarette”.

The second borrowed consonant is /v/ as in the word /vidyo/ “video”. The last borrowed consonant is /p/ as in the word /ʔroppa/ “Europe” or/ ʃampoo/”shampoo”.

According to Ambros, Syrians used the non aspirated [p] as allophone variant of consonant /b / this occurs especially when voiceless consonant precedes it such as in the word /sabt/ becomes /sapt/ “saterday” Ambros (1977).

Cantineau (1956) does not agree to consider all forms of /p, g, v/ Syrian speech sounds. He does not think that these consonants are a core part of the consonantal system of Syrian Arabic. Cantineau argued that there are not any minimal pairs where they can differentiate these consonants from other SYA consonants. In addition to non existing minimal pairs to these consonants; all of these loan consonants are replaced sometime by other SYA consonants as in the words:

/pəli:s/ → / bəli:s/

/talvazyo:n/→/talfazyo:n/

/Siga:ra/→/sika:ra/.

The most obvious difference between Syrian Arabic (SYA) and Standard Arabic (STA) is that while Standard Arabic and some Arabic varieties have the fricatives /θ/, /ð/, / ðˁ/ these are not part of the Syrian Arabic sound system. Besides these differences in the sound inventory of both varieties of Arabic, a number of notable structural differences can be found within Syria and in comparison to other varieties of Arabic.

In the first instance, the voiced uvular stop /q/ is replaced by the voiceless glottal stop /ʔ/ in Damascus Homs and Hama, and /g/ in north eastern areas. It must be noted that there are some words where Syrians in all areas use the stop /q/: e.g. /qurʔan / “Muslim Holy Book” and /qarja/ “village”. However, in SYA Ambros (1977) considered /q/ as a loan consonant which is a borrowed consonant from Standard Arabic (STA). Secondly, the voiceless dental fricative /θ/ is replaced by either /t/ (e.g. STA /θo:m/ > SYA /to:m/ “garlic”) or /s/ (e.g. STA /θa:naja/ > SYA/ sa:naja/ “a second”). These substitutions occur throughout Syria except in the north-eastern and southern areas where /θ/ does not change. The voiced dental fricative /ð/ is replaced either by /d/ (e.g. STA /ðanab/ > SYA /danab/ “tail”) or by /z/ (e.g. STA /ʔi ðaʕa/ > SYA /ʔi zaʕa/ “radio”). The pharyngealized dental fricative /ðˁ/ is replaced by the dental plosive /dˁ/ (e.g. STA /ðˁahar/ > SYA/dˁahar/ “back”).

The three consonants θ/, /ð/, / ðˁ/ are represented by /z, s, zˁ/. One of the obvious differences between Syrian Arabic (SYA) and Standard Arabic (STA) is that the emphatic consonant /ðˁ/ in STA is replaced by another emphatic consonant /zˁ/ in SYA so the emphatic feature does not omit. For example, /ðˁana/ “he believed/ in STA is articulated in SYA /zˁana/.

however /zˁ/ in some cases is replaced by /d/ as in the words /daʔ/”he tasted”, or in the word /dayaʔni/”he annoyed me”.

Pharyngealization or emphasis is a significant feature in SYA. The four pharyngealized consonants of SYA are /sˤ, zˤ, dˤ, tˤ/ and these are produced with a secondary articulation in which the root of the tongue constricts the pharynx (Mitchell 1990). The emphatic feature is clearly phonemic as illustrated by the following minimal pairs: [te:n] “fig” vs [tˤe:n] “mud”,[sabba] “he cursed” vs [sˤɑ bba] “he poured”, [da:r] “house “ vs [dˤa:r] “harmful”. The occurrence of pharyngealisation in languages of the world is extremely rare and this is clearly a unique feature of SYA and of Arabic in general. Amayreh (1994) also considers /q/ as an emphatic consonant. Amayreh (1994) and Newman (2002) also identified /l/ as a pharyngealized sound.

In addition to /tˤ, dˤ, sˤ, zˤ/ there are other pharyngealized consonants which are /l, m, n, r, b/ Versteeg (2007); Ambros (1977). Ambros called these consonants secondary emphatics or velarized consonants. (Ambros, 1977:13)

Ferguson (1961) considered all from /bˤ, mˤ, nˤ, rˤ/ emphatic consonants and he presented minimal pairs to prove that they are not allophonic to /b, m, n, r/. For example, Ferguson (1961) distinguished between /baba/ “her door” and /bˤabˤa/ “my dad”. However, Cantineau argued that there is an important factor which distinguishes between these minimal pairs which is not due to emphatic feature for consonant /b/. Cantineau concluded that there is a suffix of the third person

feminine singular like bab(h)a “her door”. Cantineau also argues that using proper names in minimal pairs is generally avoided in phonological discussion (Cantineau, 1956: 117). Consequently Cantineau (1956) concluded that these speech sounds /bˤ, mˤ, nˤ, rˤ/ are not different consonants from /b, m, n, r/ in that they do not have distinctive function and he concluded that each consonant of these secondary emphatic is” a combinatory or optional variant of a speech sound” (Cantineau (1956:117). On the contrary, Ambros argued that these secondary speech sounds appear to be non phonemic consonants as they generally correlated with occurrence of primary pharyngealzed consonants and with back vowel in the same word as in the words /mabsˤu:tˤ/ ”happy” usually realized as /mˤabsˤu:tˤ/.

Another interesting feature of Arabic is known as gemination, which means that a consonant is pronounced with a longer duration. For example, the consonant /j/ is geminated in the word /sajjara/ “car”. In Arabic, as in some other languages, there are rules which determine consonant duration and vowel length in the syllable structure. Long consonants in a stressed syllable are preceded by short vowels, while long vowels must be followed by short consonants: e.g. SYA /ʕallam/ “to teach”, SYA /ʕa:lam/ “scientist”.

Many studies have been carried out to determine the temporal difference between singleton and geminate consonants and their adjacent vowels (e.g. Ghalib 1984; Al-

Tamimi 2004; Hassan 2002; Hassan 2003). The results have provided acoustic, myodynamic, and aerodynamic evidence that vowels preceding geminates are shortened by the geminate. It has also been found that the duration has a noticeable role in distinguishing singleton and geminate consonants. These studies were interested not only in Standard Arabic but also in many of the Arabic varieties and they emphasized durational cues to gemination (e.g. Al-Tamimi (2004) studied the Jordanian variety; Hassan 2003 studied Iraqi; Khattab (2007b) studied the Lebanese variety).

3.2.2 THE VOWELS IN SYRIAN ARABIC

The vowel system in SYA contains 11 monophthongs: 5 short /i, u, a, e, o / and six long /i: , u: , a:, ɑ:, o:, e:/, (Ambros (1977); Ferguson (1961), Versteeg (2006)). Cantineau (1956) counted only three long vowels in Syrian Arabic which are /a:, i:, u:/ and he considered e: and o: are “realizations of the groups of speech sounds ay and aw” (Cantineau, 1956 : 118)

While long vowels can occur in all possible word positions, short vowels duplicate in word final position and turn into long vowels. According to Ambros, the most distinguishing feature that differentiates the Syrian variety from other Arabic varieties is the vowel lengthening of the final syllable before a pause so there is no

short vowel in final position (Ambros 1977:2). However, disagreeing with these scholars Ferguson presents some examples to clarify that there are short vowels in final position in Syrian Arabic. For example /ɣada/ “lunch” VS /ɣ ada:/ “His lunch”, a word with a pronominal suffix of the third person. Another example is in the word /dʿarabu/” they strike” Vs /dʿarabu:/ “they strike him”. Cantineau discusses Fergusons opinion that the vowel /a/ in word / ɣ ada:/ is short using Fleisch (1947) interpretation, who concluded that “in the words without a suffix the final vowel is unstressed and medium (not short) while in words with pronominal suffix of the third person the final vowel is stressed and long.” (Cantineau, 1956: 120). Thus there is not only short and long vowel; there is also a medium long vowel. Cantineau (1956) in his turns concluded that there are not only three degrees of vowel lengths rather there are at least five degrees: very short, short, medium, long, and very long vowels.

Ambros (1977) presents another important feature of SYA vowels in that only three short vowels /a, e, o/ occur in penultimate position (before a word–final consonant) so /u/ becomes /o/ and /i/ becomes /e/. He also discussed a further neutralization occurrence in all other positions so /e/ and /o /are represented by A shwa- vowel / ə/. Consequently, Ambros (1977) did not consider /ə/ possessing independent phonemic status (Ambros, 1977:17).

There are also two rising diphthongs /ai/ and /au/: e.g. SYA /bai:t/ “house”, SYA /jaum/ “day”. When the vowel /a/ is followed by the semivowel /j/ or the vowel /i:/ in Standard Arabic /ai/ is replaced by /e:/ : e.g. STA /ʕai:n/ > SYA /ʕe:n/ “eye”. When the vowel /a/ is followed by /w/ or /u/ in Standard Arabic, SYA has /o:/: e.g. STA /nawm/ > SYA /no:m/ “sleep”. The vowels of Syrian Arabic are illustrated in figure 3.2:

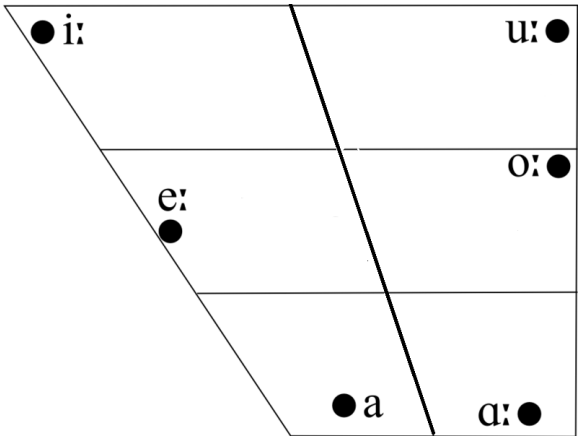

FIGURE 3.2 LONG VOWELS IN SYRIAN AND SYRO-LEVANTINE DIALECTS.

One of the most notable differences between Syrian and Standard Arabic is that the long vowels in SYA are shortened in continuous speech: e.g. STA /fi: l ma: dˁ i:/ > SYA /fi l ma dˁ i:/ “In the past”. All long vowels are shortened when they are followed by two consonants: e.g. STA /dʒa:mʕun/ > SYA /dʒamʕ/ “mosque”.

Some researchers have investigated the vowel systems in Arabic, but most of these

have focused on the Qur'anic version of Arabic (e.g. Iqbal, Awais, Masud & Shamail 2008). A small number of studies have been carried out on specific Arabic varieties. Previously, Newman and Verhoeven (2002) conducted an acoustic investigation of Arabic vowels in connected speech in Qur'anic recitation style and in the Egyptian Arabic variety (Cairene). The results indicated that the vowels in Cairene connected speech are lower and more front than the Qur'an recitation vowels. They also found that there is no significant acoustic difference between the short and long vowels in the Qur'anic recitation style, while the short vowels in the Cairene variety are more central than their long counterparts (Newman & Verhoeven 2002).

Alghamdi (1998) carried out a cross-dialect study to investigate the phonetic differences in Arabic vowels when spoken by speakers from different Arabic dialects, including the Saudi, Sudanese and Egyptian varieties. He found that vowel duration was very similar in the varieties investigated. He also found that the duration of the long vowels was twice that of their short counterparts. Also the short vowels are more centralized in the three varieties, which agree well with the findings in Newman and Verhoeven (2002). The distinct differences were in the short vowels across all varieties.

3.2.3 SYLLABLE STRUCTURE

The syllable structure of Syrian Arabic is characterized by the presence of an onset, whereby each syllable begins with a consonant. The syllable in Standard Arabic cannot start with a vowel (Fatihi 2001:115). Syrian Arabic syllable structures can be classified into 5 distinct categories:

- Open syllable with a short vowel, which starts with a consonant and has a shortvowel as a nucleus /CV/: e.g. /ka. ta. ba/ “he writed”.

- Open syllable with a long vowel, which has an onset and a long vowel as a nucleus:/CV:/ e.g. the first syllable in the word /ka:.tib/ “writer”.

- Closed syllable consisting of a consonant and a short vowel as a nucleus and a consonant as a coda /CVC/: e.g. /min/ “who”.

- Closed long syllable consisting of an onset, a long vowel nucleus and a coda /CV:C /: e.g. /qa:l/ “he said”.

- Final syllable consisting of a consonant, a short vowel and two consonants as a coda /CVCC/: e.g. /bInt/ “girl”.

Examples of syllable patterns in the SYA are given below:

CV	tˤaba	football
CVC	dubb	bear
CV:	ma:dˤi	past
CV:C	ra: h	he went
CVCC	ʔumm	mother
CCVC	smaʕ tu	I heard him
CCVCC	smarr	became brown

SYA also has consonant clusters which are exemplified by the following examples:

SYA	/ ʃrabt /	/CCVCC/	(ENG:" I drank")
SYA	/tneen /	/CCV:C /	(Eng: "two")
SYA	/ smaʕ tu /	/CCVCC/	(Eng: "I heard him")
SYA	/Kteer/	/CCV:C/	(Eng: "too much")

SYA /metlj/ /CVCCC/ (Eng: “like me”)

It is worth noting that the final /CC/ clusters are not obligatory in all contexts in SYA. Syrians often use epenthesis to separate the two consonants in a cluster: e.g. STA /ʒisr/ > SYA / ʒisir/ “bridge”. The epenthetic feature does not only appear in SYA but is found in all sedentary varieties (Lebanese, Palestinian and Jordanian). Some studies have investigated the differences between epenthetic vowels and lexical vowels in the same context. For example, Gouskova & Hall (2009) studied Lebanese and found a clear phonetic distinction between epenthetic and lexical vowels: epenthetic vowels are more back and shorter than lexical vowels in the same contexts. Gouskova also found that there are some differences between the participants: while some speakers did differentiate between epenthetic and lexical vowels others did not. In another study, Gouskova and Hall (no date) carried out an acoustic investigation of the duration, formants and intensity of epenthetic and lexical vowels in the Palestinian variety. The results revealed that the Palestinian variety did not show any significant differences in vowel quality, intensity, or duration between epenthetic and lexical vowels.

In addition to phonetic, phonological, and lexical differences the syllable structure (as well as other prosodic elements such as intonation and rhythm) may distinguish Arabic varieties. Hamdi, Ghazali & Barkat (2005) investigated the frequency of

different syllables types in Moroccan, Tunisian, and Lebanese. The results indicated that there are significant differences in the type and frequency of syllables between these varieties, and that syllabic patterns may form a good basis for characterizing the different Arabic varieties. They also found also that CV and CVC account for 55% of all syllables in Moroccan, 65% in Tunisian, and 76% in Lebanese. As such, these two types can be regarded on the most dominant syllable types.

3.3 TESTING ARABIC PRONUNCIATION

In order to design an articulation test as a tool to collect the speech samples in the current study, the articulation tests which were designed for other Arabic varieties will be discussed in detail. These tests are the Amayreh articulation test (1994), and the Mansoura Articulation Test (2009).

3.3.1 AMAYREH ARTICULATION TEST

This test was developed in the USA and was administered in Jordan. The aim of the test was to collect normative data for the acquisition of the Arabic consonants. It assesses all Arabic consonants by means of 58 pictures targeting 28 consonants in 3 word positions (28 initial, 28 medial and 23 final). 21 words targeted more than one consonant at a time. Sets of three line-drawn pictures were used to elicit the target

sounds. The test was administered to 180 monolingual Jordanian children aged between 2:0 and 6:4. Ten percent of the children were selected randomly and retested to examine the reliability of the test. The test-retest reliability (r = 0.832) was very good.

For content validity, the author ensured that all the sounds in Arabic were included in the test. There is good evidence that pronunciation accuracy increases with age and this confirms construct validity.

This test is the first articulation test in Arabic and has been extensively used in clinics and by researchers. However, since its establishment in 1994 no further standardization of the test has been undertaken.

3.3.2 MANSOURA ARTICULATION TEST

This articulation test was published in Egypt by Abou-Elsaad, Baz & El-Banna in 2009. The aim of this test is to provide a criterion for comparing speech sounds of both normal and phonologically disordered Arabic-speaking children. It assesses all possible consonant positions (initial, middle and final) and all vowels of Colloquial Egyptian Arabic (CEA). The test consists of two sections: the first investigates the 25 CEA consonants. The test does not include /θ/ and /q/ as these are always replaced in CEA by /t/ and /ʔ/. The second section examines the 8 long and short vowels. The

authors used several criteria to select test words which are culturally appropriate, familiar to young children and unambiguous.

To normalize the test, it was administered to 100 typically developing Egyptian Arabic children (52 males and 48 females) aged 42 to 70 months. The children were selected randomly from a kindergarten in Mansoura city. The study excluded children with delayed language development, impairment hearing, visual difficulties, learning disabilities and children with oro-facial disorders.

To determine the validity of this test, 3 judges were asked to review the test with respect to the chosen age group, the suitably of the words to the tested consonants and vowel positions, the appropriateness of the pictures, the suitability of adding basic vowel words to the test and allowing children to pronounce the word after the examiner in cases of difficult words. There was a significant correlation between the three judges on all items in the questionnaire ($r=0.91$, $P=0.00$) and this is suggestive of the test's validity.

The test-retest method was used to examine the test's reliability with the same children being retested five weeks later by the same examiner. The reliability coefficient for correct consonant production was 0.75 and 0.66 for picture identification. The reliability coefficient for picture identification and correct word

utterance was found to be higher in females than in males.

3.4 SPEECH SOUND ACQUISITION IN ARABIC STUDIES

There are few studies on speech acquisition in different varieties of Arabic. The studies that do exist have focused on two varieties only, i.e. Egyptian and Jordanian. In this section we will concentrate on four such studies: two studies by Amayreh, one on speech sound acquisition (1994) and one which aimed to describe phonological errors in Jordanian children (Dyson & Amayreh 2000), one study by Ammar and Morsi (2006) and one from Saleh, Shoeib, Hegazi and Ali (2007) both on the Egyptian variety. It is important to mention here to the first study which targeted speech sound acquisition in Egyptian variety which was carried by Omar (1973) but it was not included in this review as there is not clear criteria for consonant acquisition. And the number of children who shared in this study was not big enough which depend on to make correct comparison with other consonant acquisition studies or until current study results.

Amayreh (1994) administered a 58 item articulation test to 180 Jordanian children. It included single-speech sound consonants in initial, medial and final positions. The children ranged in age from 2:0 to 6:4. Each age group included 10 boys and 10 girls and each child was tested by means of pictures. A child had to name the pictures

spontaneously. If a child could not identify a picture, cues were offered. If the word still could not be elicited spontaneously, the examiner used delayed imitation in which a time interval was inserted between the model and the child's production. Acquisition was defined as the age at which 75% of the subjects correctly produced a consonant in all word positions.

The results revealed that there is a gradual developmental trend for the consonants in Arabic. Three developmental categories were distinguished: (1) early acquired consonants / b,t,d,k, h, m, n, l, w/, (2) intermediate consonants /s, ʃ , ɣ, x, h ,r/ and (3) consonants which are late-acquired / tˤ, dˤ, θ, ð, ðˤ, sˤ, ʔ, ʤ/. In this study, no significant differences were found between girls and boys. The age of acquisition of some consonants was similar to English, with the set of early acquired speech sounds (/b, t, d, k, f, m, n, l/) being almost identical. This also applied to some of the late-acquired speech sounds such as /θ, ð/. Other sounds were acquired earlier in Arabic than in English (e. g. /f, t/) while others were acquired later (e.g. /h, j, ʃ/). Emphatic sounds in Arabic were acquired later than their non-emphatic cognates: none of the emphatic consonants had been acquired by the oldest age group (6:0-6:4). The late acquisition of emphatic consonants was ascribed to their articulatory complexity, in that they require a secondary articulation feature which requires retraction of the root of the tongue. Amayreh (2003:526) argues that this feature is

not yet available in children before the age of 7 or 8 years.

The importance of this study is that it is the first systematic investigation of speech sound acquisition in Standard Arabic. It offered a well-accepted methodology and reported the age of speech sound acquisition in term of initial, medial and final positions. It also introduced three ways of defining speech sound acquisition: (1) the age of customary production (in which at least 50% of the children in an age group produce the sound correctly in at least two word positions), (2) age of acquisition (in which 75% of the children in an age group produce the sound correctly in all positions), and (3) mastery age (in which 90% of subjects in an age group produce the sound correctly in all positions).

A major drawback of this study is that it purported to collect normative data for speech sound acquisition of standard Arabic. However, it is questionable whether the results of this study can be generalized to all Arabic speaking countries.

In his second study, Amayreh joined Dyson (Dyson & Amayreh 2000) to analyse speech samples from 50 Jordanian children aged 2:0-4:4. These speech samples were collected by means of a 58 word picture-naming articulation test, which had been designed to capture children's common errors and sound changes. The criterion which Dyson and Amayreh used to classify errors and sounds changes is that the pattern should occur in at least 5% of possible occurrences within an age

group.

The results indicated that the consonants produced by 43.7% of younger children did not conform to adult pronunciation and 46.6% were produced with a deviation from standard Arabic (i.e. with some change from Educated Spoken Arabic). Modern Standard Arabic is the standard language which is based on Classical Arabic, which is the language of the Qur'an. MSA serves as a lingua franca for speakers who speak different dialects of Arabic. This variant is also often called inter-Arabic or Educated Spoken Arabic (El-Hassan, 1978). It is not learnt as a first language but as a second language in schools and by exposure to radio, television, newspapers and magazines.

The results also revealed that de-emphasis (e.g. $t^{ʕ}$ becomes t, $d^{ʕ}$ becomes d) occurs in 50%, while stridency deletion and lateralization of /r/ occur between 25-50%. The remaining processes occurred between 1% and 24%: these included syllable reduction, final-consonant deletion, consonant sequence reduction, fronting, final devoicing, and initial voicing and stopping. As in the original Amayreh study (1994) there were no significant differences between boys and girls in terms of error patterns or sound changes. However, there was a small effect of the dialects spoken in Jordan on the production of certain consonants.

The third study was carried out by Saleh, Shoeib, Hegazi and Ali (2007) who

investigated speech sound acquisition and phonological error patterns in 30 Egyptian children ranging in age between 12 and 30 months. They used toys and pictures to elicit children's speech, which was either spontaneously produced or elicited during free play with parents. A speech sound was considered to occur frequently when it was used by 5 or more children in a group (N=10 in each group), and a process had to occur twice to qualify as a phonological process.

The results showed that the most common consonants were front consonants /b, t, d/and glottal plosive / ʔ/, nasals /m, n/, glides /j, w/, fricatives /h, s/ and liquids /l/. The highest percentage of speech sounds were correctly realised in final position, which is contradictory to the results reported in Amayreh (1994). Syllable structure errors occurred more frequently than substitution and assimilation errors. Finally, glottal replacement, weak syllable deletion and regressive assimilation were the most common processes.

The strength of this study is that it is the first study in Arabic which targeted children at such an early age (i.e. from 12 months onwards). The weakness of the study is that the authors do not properly formulate the criteria they used to identify specific phonological processes.

The last study to be reviewed in this section is Ammar & Morsi (2006) who investigated speech sound acquisition and phonological error patterns in 36

Egyptian children between the ages of 3:0 and 5:0. Speech samples were elicited by means of pictures or the presentation of objects. A child had to name the picture and would be asked to imitate the examiner's model if he/she failed to name the picture spontaneously. A speech sound was considered to be acquired when it was produced correctly in 90% of the responses, and it was regarded to be customary when it occurred correctly in 50-89% of the responses.

The results of Ammar and Morsi indicated that 14 speech sounds had been acquired by the age of 5 and 13 by the age of 4. These thirteen speech sounds were /w, k, m, h, f, x, n, t, ʃ, l, ʔ, h, j/. The final position was found to be the most difficult of all word positions. For phonological processes, devoicing was the only significant process attested in the data according to the 25% criterion with all processes declining by the age of 5.

Although Amayreh (1994) and Saleh et al. (2007) targeted different Arabic varieties, some findings are similar in both studies. For example, the most commonly occurring consonants in Saleh et al. were /b, t, d, ʔ, m, n, w, j/ and these were also the early acquired sounds in Amayreh (1994). However, Ammar & Morsi (2004) differ from both of these studies in that the earliest sounds to be acquired were /w, k, m, h, f, x,ʔ, t/.

These differences may be attributed to the different criteria used in these studies.

Although Saleh at el. (2007) and Ammar & Morsi (2006) targeted the same language variety in their studies, there was a clear difference in their results. Saleh et al. found that the highest percentage of correct speech sound realisation occurred in the final position, which contradicted Ammar and Morsi who found precisely the opposite. This difference may be explained by the different age groups of the children involved in both studies. That is, it is reasonable to assume that at an early age pronunciation in final position may produce the highest percentage of errors, with such errors decreasing as children become older.

With regard to the phonological error patterns, there are some differences between Ammar & Morsi (2006) and Amayreh (1994). In the Ammar and Morsi study, the most commonly occurring phonological error was devoicing, with an average occurrence of 33% among children aged 3-4. This was, according to the 25% criterion, the only significant process. However, in Amayreh, de-emphasis was the most frequent pattern observed in those aged 2-4:4, which included 50% of the children in this age category. The next most frequent errors in the Amayreh study were stridency deletion and lateralisation.

3.5 CONCLUSIONS

This chapter gave a brief overview of the phonetics and phonology of the variety of

Arabic that is spoken in Syria. This chapter has also reviewed some studies which investigated speech sound acquisition in Arabic. First two studies were reviewed in which the main interest was to determine the age and order of speech sound acquisition in children. These studies are those of Amayreh (1994) who studied speech sound acquisition in Jordanian, children, Saleh, Shoeib, Hegazi and Ali (2007) who investigated speech sound acquisition in Egyptian children. Furthermore, two studies which investigated error patterns were discussed: Ammar & Morsi (2006) have investigated speech sound acquisition and also phonological error patterns in Egyptian children. Dyson & Amayreh 2000) examined phonological error patterns in Jordanian children.

Two previous Arabic articulation tests which designed for other Arabic varieties were reviewed with respect to their content and psychometric features. These tests are the Amayreh articulation test (1994), and the Mansoura Articulation Test (2009).

CHAPTER 4: METHODOLOGY

4.1 OBJECTIVES OF THIS STUDY

Speech and language therapy is an emerging subject in Syria and speech and language therapists face several challenges in their attempts to provide accurate assessment and appropriate intervention to children with speech and language disorders. One of the most important problems which affects the efficiency of speech and language therapy is the lack of data which can facilitate decision making in testing and treating disordered children. So far, there have been no studies of the phonological and articulatory development in Syrian children. This study will be the first step towards providing normative data which are needed to assess and treat Syrian children with speech and language disorders.

Due to the absence of reliable normative data about the phonology of Syrian children, the first aim of this thesis is to provide reliable information about speech sound development in Syrian children between the ages of 2:5-6:5. The following specific objectives are addressed:

To determine the age and order of speech sound acquisition in Syrian children.

To investigate whether there are significant differences in the age

of speech sound acquisition between Syrian girls and boys.

To determine the accuracy of consonants according to different sound classes.

To compare the similarities and differences in the ages and sequence of speech sound acquisition between Syrian children and English children.

To compare the similarities and differences in the ages and sequence of speech sound acquisition between Syrian and other Arabic children.

The second aim of this thesis is to investigate the phonological error patterns in Syrian children. The following are the specific goals:

To determine the percentage of consonants which are produced incorrectly.

To determine the occurrence of error patterns by age.

To investigate the age at which phonological error patterns disappear.

To investigate the similarities and differences between the phonological error patterns in Syrian and English children.

To investigate the similarities and differences between the phonological error

patterns which are reported in Syrian children and in other Arabic varieties.

These research questions feature against a background in which it has been claimed that consonant acquisition tends to follow a similar course in different languages and this suggests that speech sound acquisition develops along universal principles. The dimension of manner of articulation provides some evidence of these universal patterns. For example, in many languages nasals and plosives are acquired before fricatives, and fricatives before affricates. This has been confirmed in studies on English (Templin 1957, Prather et al., 1975, and Dodd et al 2003) and is also attested in several other languages including Zulu (Naidoo 2003), Cantonese (So & Dodd 1995), Xhosa (Mowrer & Burger 1990), German (Fox 2000), Putonghua (Zhu 2002) and Jordanian (Amayreh 1994). This finding can be explained by the fact that some speech sounds tend to occur more universally than others. Plosives occur in 100% of the UPSID languages (Maddieson 1983), while 96.45% have nasals, and 96.23% have approximants, which are acquired early by children across languages. The percentage of fricatives and affricatives is 93.13% and 66.52%, respectively. Some researchers make a connection between the frequency of sounds in the world's languages and the naturalness of sounds (Vihman 1993) as the speech sounds which are rare in languages could be regarded as "unnatural" so that they

develop later. Another example of a universal trend in speech sound acquisition is that many studies report that the consonants /m, n, b, k, j/ are the earliest consonants acquired by children in various languages such as English, German, Zulu, Turkish, modern Chinese, Jordanian, and Egyptian.

The second observation is that there are studies which have reported that there are language-specific patterns in both speech sound acquisition and phonological error patterns. For example, Dyson et al. (2000) found that the most frequently occurring error pattern in Jordanian children concerns emphatic consonants which are realised as non-emphatic. Zhu (2002) indicated that while backing is the second most frequent error pattern by Chinese children, this error pattern is an uncommon and an atypical phonological error pattern in English children. Furthermore, the affricates /ʤ, ʧ/ are among the first acquired consonants in Xhosa children while they are among the last acquired consonants in many languages such as Jordanian, Maltese and Punjabi (Zhu et al. 2006).

4.2 OVERALL APPROACH

In this study, the language of interest is Arabic, i.e. the Syrian variety spoken in Damascus, Homs, Hama (Shami variety). There are presently no normative data on speech sound acquisition in Syrian Arabic. Furthermore, there are no assessment

tools in Syria. Thus, there is a clear need for the development of an articulation test to assess speech sound acquisition in Syrian children so as to provide an instrument to collect speech samples of children recruited for the current study. These speech samples will be analysed to determine the age of speech sound acquisition and the phonological error patterns in Syrian children.

The first step in this study was the design of an articulation test to collect speech data from children. For this purpose, the previous chapters have reviewed 6 articulation and phonological tests to obtain information about the criteria on the basis of which an articulation test can be designed. This newly developed assessment tool was used collect speech samples of 160 Syrian children recruited from 2 nurseries.

The nurseries were selected from Damascus and its suburbs. The first nursery called 'Dar Alfarah' was chosen because it is in Damascus city. The second nursery 'Ahly ayam altufula' located in Deer Qanon village in Damascus suburb. A total of 125 children were chosen from two nurseries; 50 children were from Dar Alfarah nursery and 75 children from Ahla ayam altufula.

35 children were chosen from friends' of families and relatives who lived in Damascus and its suburbs according to subject criteria on page 71-72. The ages of 30 out of 35 children were between 2:5-3:5 years, and 5 children were boys whose

ages were between 3:5-6:5 years

Each interview for each subject lasted between 6-10 minutes depending on the child's age and his/her speech development. The longest interview lasted less than 7 minutes and was for children in age range between 4:5-6:5 years. On average 8 children were examined per day, 6 in nurseries and 2 at home. However, the interviews for the youngest children (2:5-3:5 years) took about 20 minutes, a majority were examined by me and only 9 children were examined by their parents.

These speech data were analysed to determine the age of speech sound acquisition and phonological error patterns in Syrian children.

4.3 ASSESSMENT

The first step in the assessment was the design of an articulation test. This was necessary for several reasons. Firstly, there is no standardized Syrian assessment that can be used to collect speech samples from children. Secondly, there is a clear need to develop such an articulation test for SYA. This will enable SLTs to assess children and to make appropriate intervention decisions. Thirdly, here are very few articulation tests in Arabic generally and they often have shortcomings, some of which have been discussed in chapter 2. Finally, translating a test which has been designed for another language will not provide therapists with an adequate

assessment tool as the phonologies of languages differ. Any test should take into account the specific phonological structure of the language for which it was designed.

The test that was developed for this study is a picture-naming test. This type of test was chosen because it enables the elicitation of all speech sounds of SYA in three word positions. The test consists of 62 pictures, targeting 28 consonants in three word positions (28 initial, 28 medial and 26 final). For example, to assess the plosive /b/ three pictures were used in the test: /ba:s/ (Eng. “bus”), /ta:ba/ (Eng. “ball”), and /ba:b/ Eng. “ door”). The speech sound /ðˁ/ was an exceptional case since this emphatic consonant could not be assessed in word-final position since there are no words in the language which are appropriate for the age of the subjects. Table 4.1 presents an overview of all the sounds targeted in the test and all the words that were used as test items.

Table 4.1: Survey of the sounds targeted in the test.

		Adult form	**Word-*phonetic form***	**Adult form**	**Word-*phonetic Form***	**Adult form**	**Word-*phonetic form***
1	B	باص	Ba: sˤ	طابة	tˤ aba	باب	ba:b
2	T	تفاحة	tufa h a	مفتاح	mefta:h	بنت	bent
3	tˤ	طابة	tˤ aba	بطة	ba t̪ˤ tˤa	بوط	bu: t̪ˤ
4	d	دب	dubb	مخدة	maXadda	يد	jad
5	dˤ	ضو	dˤaw	يضحك	dˤ aħa k	بيض	Bai dˤ
6	k	كاسة	Ka:se	سمكة	samake	شباك	ʃ ubak
7	q	قطار	qiṯˤtˤ a:r	بقرة	baqara	ورق	waraq
8	ʔ	ارنب	ʔarnab	راس	raʔas	لا	laʔ
9	m	مفتاح	mefta: h	ليمون	Lejmu:n	تم	tum
10	n	نايم	najam	عنب	ʕenab	عين	ʕ ai:n
11	F	فيل	fi:l	ليفة	lefa	خروف	xaruf
12	θ	ثلاث	θala:θ	اثنان	ʔaθ na:n	ثلاث	θ ala: θ
13	ð	ذيل	ðajl	اذن	ʔeðun		
14	zˤ	ظهر	zˤahar	بوظة	bu z ˤa		

15	S	سيارة	Sajja:ra	كاسة	Ka:sa	راس	raʔs
16	sˤ	صوص	sˤ u: sˤ	حصان	hisˤsˤ a:n	باص	ba: sˤ
17	z	زيتون	zaitu:n	موزه	mawza	موز	mu:z
18	ʃ	شاي	ʃa:j	فراشة	fara ʃa	ريش	rejʃ
19	X	خروف	x aru:f	مخدة	ma x adda	اخ	ʔa x
20	ɣ	غسيل	ɣassi:l	يغني	ju ɣ ani:	صمغ	sˤemaɣ
21	ħ	حليب	ħ ali:b	تفاحة	tufa ħ a	مفتاح	mefti: ħ
22	dʒ	جبنة	dʒebne	وجه	wedʒ ih	تاج	ta: dʒ
23	?	لا	la?	حليب	ħ ali:b	فيل	fi:l
24	r	راس	ra:s	سيارة	Saja:ra	احمر	ʔa ħ mar
25	ɹ	يضحك	jadˤ ħ ak	ليمون	Lejmo:n	شاي	ʃa:j
26	w	ولد	walad	موزه	mawza	ضو	dˤ aw
27	h	هدية	Hadi:ja	زهرة	zahra	وجه	wa dʒ ih
28	ʕ	عين	ʕain	ساعة	Sa: ʕ a	اصبع	ʔa sˤbaʕ

In addition to the consonants, the test also assesses the long vowels in SYA / a:, u:, i:, o:, e:/ and the two diphthongs /ai:/ and /au:/. The diphthongs were only assessed in 2 words, since all other words containing these diphthongs could not be adequately illustrated by pictures. The test also targets 7 geminate consonants. The geminate consonants were elicited by the words /sajjara/ (Eng. “car”), /ʃubba:k/ (Eng. “a window”), /batˁtˁa/ (Eng. “a duck”)

Ingram (1982) recommended that target speech sound should be tested in stressed syllables. This is because the sounds in stressed syllables are louder, have a higher pitch (Bauman-Waengler 2000), have a longer duration (Mowrer & Burger 1990) and are more likely to be produced correctly (Kent 1981) than the same sounds in unstressed syllables. However, as sounds in stressed syllables are more likely to be produced correctly; this may lead to an underestimation of the number of errors. Therefore, some speech sounds in this test were targeted at least once in an unstressed syllable as well as in a stressed syllable.

4.4 PRINCIPLES AND CRITERIA FOR TEST DESIGN

4.4.1 FAMILIARITY AND IMAGEABILTY

Several criteria were taken into account in the design of the test stimuli. The first criterion had to do with word familiarity and imageability. While studies on languages other than Arabic often have databases specifying the imageability and familiarity of words in the lexicon, such information is not available for Arabic. It was nevertheless desirable to have an idea about precisely this aspect of the test items. Therefore, the word list was assessed by 6 Syrian nursery school teachers and 7 Syrian parents, who were asked whether the target words are familiar to Syrian children between the ages targeted in this study. The assessment panel was given a number of alternative words which could be candidates to serve as test words and they were asked to indicate the familiarity and imageability.

4.4.2 WORD APPEARANCE

The second criterion was the age at which certain words appear in children's vocabularies. Words that appear earlier in children' vocabularies were chosen, on the basis of the longitudinal study of Abdu-Abdu (1991). He reported the appearance of words in his own children on which basis he identified the words used by children until the age of 6

years. Since this study was on Jordanian Arabic, these criteria were only taken into consideration when two words had the same familiarly rank according to the teachers and parents. The word with the earliest appearance was then chosen for inclusion in the test.

4.4.3 PHONETIC COMPLEXITY

The third criterion was that the test should contain words of mixed phonological complexity. The complexity of the stimulus words was examined by means of an index of phonetic compexity developed by Jakielski (1998) who assigns complexity marks to specific sounds and sound categories. Her marking scheme is summarized in Table 4.2.

Table 4.2: IPC scoring scheme (Jakielski 1998)

Factor	**No Score**	**One point each**
1. Consonant by place	Labials, coronals, glottal	Dorsal
2. Consonant by manner	Stops, nasals, glides	Fricatives, affricates, liquids
3. Singleton consonants by place	Reduplicated,e.g:/baba/ (Eng:"dady")	Variegated /samake/(Eng:"a fish")
4. Vowel by class	Monophthongs, diphthongs	Rhotics

5. Word shape	Ends with a vowel	Ends with a consonant
6. Word length (Syllables)	Monosyllables, disyllables	>=3 syllables
7. Contiguous consonants	No Clusters	Consonant Clusters
8. Cluster by place	Homorganic	Heterorganic

In the present study, phonological complexity was calculated according to the following guidelines:

Dorsals, fricatives, affricates, liquids, variegated consonants, and consonant clusters are given 1 mark. Hetero-organic clusters, where the two constants in a cluster do not have the same place of articulation were given one point, while homorganic clusters received no points.

Each word which ends with a consonant or which has three or more syllables was given 1 point.

One of the most important features in the Jakielski system is that the context of the syllable is as important as the number of syllables. Because this system is not

designed for Arabic, however, some Arabic speech sounds which do not occur in English had to be added to the system. For example, Jakielski, (1998) awarded all fricative sounds one point each, but Arabic has 5 fricatives that do not exist in English, i.e. /ʕ /, /ðˤ/, / ħ /, /x/, /ɣ/. So, each of these was also awarded one point. Phonetic complexity was examined for all test words, and the results indicated that there are 5 complexity levels. As indicated in Table 4.3, most words in the current study are relatively easy.

Table 4.3 Phonetic complexity level for tests words in current study

Phonetic complexity level	***Number of words***	***Example***
Phonetic complexity level 1	12	/ba:b/(Eng. “door”)
Phonetic complexity level 2	21	/xad/(Eng. “cheek”)
Phonetic complexity level 3	22	/tufa ħa/(Eng. “an apple”)
Phonetic complexity level 4	3	/ɣassale/(Eng. “washing machine”)
Phonetic complexity level 5	2	/sajja:ra/(Eng. “car”) /sˤ u: sˤ/(Eng. “chick”)

There are 12 words in the test which have a phonetic complexity level of 1. Most of the words on this level are monosyllables (e.g. /ba:b/) or di-syllables (e.g. /kase/). Recall that in the Jakielski system, no marks are given to plosives, nasals and glides, so the word/ba:b/ was only given one mark as it ends with a consonant.

There are 21 words with phonetic complexity level 2. Ten words at this level are monosyllabic and 11 are polysyllabic. Monosyllabic /xadd/ (Eng. “cheek”) was given two points, one for its fricative sound /x/ and the second because it ends with a consonant. Polysyllabic [ʔuðun] (Eng. "an ear”) received 2 points, one for the fricative / ð/ and another because it ends with a consonant. In one example of a tri-syllablic word, /maxadde/ (Eng. “pillow”), one point was given for /x/ and another point because this word consists of three syllables.

There are 22 words with complexity level 3. This level contains several syllabic structures, di- and polysyllabic. One example from this level is polysyllabic /tafaha/(Eng. “an apple”) which receives two points for the fricatives consonant /f, h / and one point for three syllables.

Finally, there are 3 words with phonetic complexity level 4 and 2 words with complexity level 5. The two words in category 5 are /Sajja:ra/. This word attracted

one point for /s/, two points for the geminated consonant /jj/, one point for /r/ and one point for the tri-syllabic structure. This word appears twice in the test, each time assessing a different consonant, i.e. /s/ and /r/. The second word is monosyllabic /sˁ u: sˁ/ (Eng. “chick”) which receives two points for the emphatic consonant /sˁ/ and two points for fricatives and one point for ending with a consonant.

4.4.4 SPEECH SOUND FREQUENCY

Ingram (1976) noted that the unequal frequencies of speech sound occurrence are not always considered by articulation tests (Irwin and Wong 1983). In this study, however, it was attempted to design an articulation test which takes into account speech sound frequency in Syrian Arabic. For this purpose, the results of a pilot study were taken into account which was carried out to determine the frequency occurrence of speech sounds in SYA

This study was carried out in 2003 and its purpose was to determine the frequency of occurrence of Arabic consonants in the speech of 16 Syrian children between the ages of 5:1-5:7 (Owaida, 2003). Sixteen normally developing children (9 girls and 7 boys) were recruited from Syrian schools as participants in the study and these children were carefully selected to meet several inclusion criteria. Specifically, they

were children who were born and had grown up in Syria, had not travelled abroad, had not learnt another language, and who had Syrian parents who spoke the Syrian variety of Arabic. None of the children showed any obvious speech or language disorders during the conversation with the researcher.

Spontaneous speech samples were collected from every child by asking the child some general questions, such as “What did you do yesterday?” or “Tell me a story”. After that, children were shown a few situational pictures and asked to describe these. A high quality cassette recorder and microphone were used to record the speech samples. This provided approximately 15 minutes of speech for every child.

From each speech sample, the first 50 words were selected. Foreign words and words occurring two times or more were excluded. Each target word was transcribed phonetically from the audiotape by the researcher using the IPA notation system. The researcher listened to each word as often as necessary to make a good phonetic transcription. When there was any doubt about a speech sound or word, the researcher sought advice from a Syrian teacher at the school where testing was conducted. The transcribed data consisted of 3,819 consonant speech sounds, drawn from 800 word tokens. For each sound, its frequency of occurrence was calculated. The findings of the pilot study indicated that the nine

most frequently occurring consonants were /l//j/,/m/,/n/,/r/,/t/,/b/,/h/,/w/, and the nine least frequent consonants were /sˤ/, /z/, /x/, /ɣ/, /d̪ ˤ/, /θ/, /ð/,/ðˤ/**.** These findings were implemented in this study by ensuring that /l, j, m, n, r, t, b, h, w/ occurred most frequently in the test materials. There was one exception: the speech sound /b/ has the highest frequency of occurrence in the test materials for the main study and is slightly overrepresented.

4.5 PICTURES

The majority of the words that make up the articulation test in the main study are nouns with a concrete meaning (fruit, animals, parts of body, etc.), which can be easily elicited by pictures. In the present study, the test stimuli consisted of 82 colour pictures. Coloured pictures were preferred on the basis of the results of Bernthal, Grossman and Aerts Goll (1989), who examined the responses of 18 phonologically delayed children to three types of pictured stimuli, i.e. black and white line drawings, coloured line drawings and coloured photographs. The results indicated that kindergarten and first grade children produce more targeted responses by means of coloured drawings or coloured photographs than with black and white line drawings.

While most of the pictures in this test are coloured photographs (62 pictures), 20 pictures are coloured line drawings. The final choice of pictures was determined by presenting three Syrian children aged 3, 4 and 6 with multiple pictures representing the target words. The pictures which correctly elicited the target words most frequently were chosen. Some pictures appeared twice as they were used to assess two speech sounds.

As an additional help to children, the pictures in the study were arranged according to semantic category in order to increase the probability that children would identify the picture spontaneously (Harrington, Lux & Higgins 1984).

4.6 SUMMARY OF PRINCIPLES AND CRITERIA FOR DESIGNING THIS ARTICULATION TEST

The articulation test assessed all Syrian speech sounds in three word positions (initial, medial, final). These speech sounds included 28 consonants, 6 long vowels, two diphthongs and 7 geminated consonants. The test was a picture naming test consisting of 62 colour pictures.The test assessed consonants in both stressed and unstressed syllables.

The following criteria were taken into account when selecting the test stimuli:

Familiarity and imageability: A word list consisting of 154 words was sent to 6 nursery teachers and 7 parents to determine the most familiar words for children aged 2-7 years. The words which had the highest agreement ratings were chosen to serve as test stimuli. The same occurred for imageability.

Words that appear earlier in children's vocabularies were preferred. This preference was based on the findings of a longitudinal study by Abdu-Abdu (1991).

The stimuli had various phonetic complexity levels. Words should not have overly complex phonological structure or an overly simple phonological structure.

The frequency of speech sound occurrence for the test consonants was examined to ensure that the test contained an unequal frequency of speech sound occurrence.

The majority of the test words were nouns with a concrete meaning.

Coloured pictures were chosen according to the results reported by Bernthal, Grossman, and Aertscoll (1989) who found that more targeted responses can be obtained by means of coloured drawings or colour photographs than with black and white line drawings. The pictures were also arranged by semantic category to increase the probability of spontaneous identification. Besides, each one of the

pictures was presented individually on a different sheet so that children can only focus on one at a time.

Some test words targeted more than one consonant in a word in order to save time.

4.7 PARTICIPANTS

The participants were 160 children who were native speakers of Syrian Arabic. These children were recruited from two nurseries in Damascus on the basis of several criteria. The sampled age range was between 2:6 and 6:5. This range was chosen because speech sounds develop most rapidly between 2 and 4 years of age (Hoffman 1986). Most previous studies have indicated that early speech sounds are acquired by the age of three (Wellman et al. 1931; Templin 1957; Smit et al. 1990; Dodd et al.2003), but there is also evidence from previous studies that some speech sounds are acquired before this age (Parther et al. 1975; Sander 1972; Amayreh 1994). Therefore, a lower limit of 2:5 was chosen. A further consideration was that most previous studies investigating error patterns targeted children younger than 3 and found evidence that error pattern extinction begins before this age (Culbertson & Tanner 2001). Children below the age of 2:5 were not included to ensure that the intended responses could be elicited: some studies have shown that children

younger than 2 do not provide adequate responses. For example, in Prather et al (1975) only 3 of the 21 subjects aged 2 were able to respond to all the 44 test stimuli (Smit 1986). Also, the Fox (2000) had to include spontaneous speech samples in the data collected for the lowest age group (1:6-1:11) because these very young children were reluctant to name pictures and had a restricted vocabulary. In the present study, subjects belonged to 8 age groups, with each age group covering a 6 month interval. The lowest age group ranged from 2:6 to 2:11 and the oldest age group ranged from 6:0 to 6:5. In each age group there were 10 boys and 10 girls.

In addition to age criteria, the children were chosen according to the variety criteria. As reported earlier, children were monolingual native speakers of Syrian Arabic, who were born and bred in Syria. Both parents also spoke SYA at home. The most important criterion was that a child should speak SYA, more specifically, the Shami variety. Three Syrian children who were born and brought up in Damascus were excluded because their varieties differ from SYA. These children are: one from Swuida city, one from Deer Alzor and one from Jable. 5 Latakain. Three Homse children were accepted to participate in this study as they were born and brought up in Damascus and they speak SYA (Shami variety).

As reported earlier, children were monolingual native speakers of Syrian Arabic,

who were born and bred in Syria. Both parents also spoke SYA at home. Additionally, children with speech, language, voice, hearing or cognitive difficulties were excluded. The absence of such difficulties was not assessed formally, but was based on reports from parents and teachers.

Because hearing is a critical factor in speech development for self-monitoring, auditory recognition and the auditory discrimination of the distinctive features of speech (Weiss, Gordon, & Lillywhite 1987) the hearing ability of each participant was screened at frequencies (500, 1000, 2000, and 4000 Hz) at a hearing level of 20 dB. For this purpose, an Inter acoustics audiometer was used to screen the children in their nurseries. Children who failed the hearing test were excluded from the study and their parents were informed that there was a need for the child to be referred for further audiometric assessment. In total, three children aged 3:4, 3:8, and 5:5 had to be excluded from the sample on the basis of hearing problems.

Finally, children were only allowed to take part after their parents and the school had given informed consent.

4.8 PROCEDURE

Each child was tested individually by the researcher in their familiar nursery environment. The children were comfortable and the examiner first established a

rapport with the child before testing. In order to elicit speech children were asked to look at the pictures and to name them. If a response could not be elicited spontaneously from the picture, another cue was given to the child to try to elicit the target word. In case a child could not respond, the examiner used delayed imitation; specifically, she gave the name of a target picture and told the child that she was going to ask about the picture again in a short while. Then after targeting 4 other words, the examiner would return to the target picture and ask the child what it was. The children's speech samples were recorded using a digital tape recorder. Twenty percent of the children were tested a second time with a one week interval in order to assess test consistency and test reliability.

In a few instances, there were some problems eliciting speech samples from the youngest children, who sometimes refused to respond and in those cases the children's mothers were asked to administer the test. They received proper instruction and practical assistance on how to do this.

4.9 PHONETIC TRANSCRIPTION

After collection of the data, the speech samples were transcribed phonetically by means of the International Phonetic Alphabet (IPA).Three versions of phonetic transcriptions of all children's' speech samples were used in the current study. The

first version was a live transcription during collection of speech samples from children. However, this version was only used when there was a disagreement between two other transcriptions. The second and third transcriptions were made using a tape recorder for speech sample for all children. The researcher who is a native speaker of Syrian Arabic made all the transcriptions. In addition, another speech expert transcribed the same samples. This expert is a speech and language pathologist who had been working with Syrian children for 5 years and who had a good knowledge of phonetic transcription. The speech samples were transcribed phonetically by means of the International Phonetic Alphabet (IPA) using both letters and diacritics. Since the transcriptions had to be processed by means of computer, SAMPA (Speech Assessment Methods Phonetic Alphabet) was used. This is a machine-readable phonetic alphabet, which maps the IPA symbols onto ASCII characters (Wells, 1997). SAMPA was also used to make a standard version (correct realisation of SYA s) for all tested words, which were included in the articulation test. This standard version and two transcriptions were entered into a JMP-database for statistical analysis and to make comparisons between the standard version and two transcriptions and also to measure the agreement between the two phonetic transcriptions.

CHAPTER 5: AGE OF SPEECH SOUND ACQUISITION

5.1 INTRODUCTION

This study aims to determine the ages of speech sound acquisition of Syrian children between the ages of 2:6 and 6:5. A picture naming test was designed to elicit the speech data. In order to assess speech sound acquisition a 90% criterion was used: a speech sound was considered acquired when 90% of the children within an age group produced the sound correctly in two word positions. This is for either the initial and final position or the medial and final position. The 75% criterion was also used, but only in order to enable comparison with other studies. Two accuracy measures were used to establish the acquisition of speech sounds, i.e. the percentage of consonants correct (PCC) and the percentage of vowels corrects (PVC). In this chapter the age of acquisition of the different speech sounds in Syrian Arabic will be presented. The correctness of speech sounds was determined on the basis of in the Standard variant of Syrian Arabic (Shami variety) which is spoken in Damascus, Homs and Hama. In total, 70,000 speech sound realisations were transcribed. Before presenting the results concerning speech sound acquisition, the validity and reliability of the test, as well as the reliability of the phonetic transcriptions will be examined.

5.2 TEST VALIDITY

Test validity can be expressed as a.o. content validity or construct validity. Content validity refers to the extent to which a test actually measures pronunciation ability. It is derived from a careful examination of the contents of the test. According to Salvia and Ysseldyke (1981) content validity is determined by examining three factors: i.e. the appropriateness of the included items, the completeness of the items and the way in which the items assess the content. Content validity of this test was examined by 33 expert judges who participated in a survey, i.e. 20 Syrian nursery teachers and 13 speech and language therapists. The SLTs were asked to judge whether the test contained all the SYA consonants and vowels, while the nursery teachers participated because of their practical knowledge of phonetics which is taught in nurseries and primary schools.

The questionnaire consisted of 16 items (Cfr. Appendix 4). Each of the three factors which Salvia and Ysseldyke (1991) consider essential for content validity was assessed by 5 items. The agreement between the teachers and SLTs concerning these three factors was also looked at. The results of this survey show that 40% of speech and language therapists considered that a small number of words to be too difficult to pronounce: /xaruf/ (Eng. “sheep”) assesses /x/ in initial position,

/maqasˁsˁ/ (Eng. “scissors”) assesses /q/, /θalʒ/ (Eng. “ice”) assesses /dʒ/ , and /safena/ (Eng. “ship”). These words were replaced by: /xadd/ (Eng. “cheek”), /baqara/ (Eng. “a cow”), /ta: ʒ/ (Eng. “crown”) and /lefa/ (Eng. “sponge”). In addition, 60% of the SLTs indicated that the item /jad/, which assesses initial consonant /j/, is not suitable because /j/ occurs in initial position and therefore this word is pronounced as /ʔajed / in Syrian Arabic. As a result, /jad/ was replaced by /jadˁhak/. Overall, 93.51 % of the teachers and 91.48% of the speech and language therapists agreed that the items included in the test were appropriate.

As far as the completeness of the test is concerned, the survey shows that 95.89% of teachers and 90.98% of SLTs confirmed that the test included all SYA consonants and vowels.

Another way to investigate the validity of a test is by examining its construct validity. This type of validity is measured by looking at the changes in the percentages of correct consonant production with age. These are summarized in table 5.1

Table 5.1. The percentage of correct consonants for each age group.

	2:6-2:11	3:0-3:5	3:6-3:11	4:0-4:5	4:6-4:11	5:0-5:5	5:6-5:11	6:0-6:5
% Correct	71.53	81.33	84.71	85.60	90.94	91.18	94.84	96.31
Standard deviation	2.95	3.79	2.79	1.69	2.04	2.49	1.67	1.53

A one-way ANOVA shows that the changes in the correct production are significantly related to age ($F(7,135) = 111.94$, $p<0.0001$). This indicates that also at this level, the test can be regarded as valid.

5.3 TEST RELIABILITY

A test is reliable if the responses for each sound are consistent. In this test the test-retest reliability was determined for 10% of the children who were randomly selected and retested by the same examiner with a one week interval between both tests. A comparison was made between the test and retest scores in terms of the presence or absence of errors in speech sound production. Test-retest reliability was investigated by means of the Pearson correlation coefficient, which amounted to 0.941 for the consonants and to 0.969 for the vowels. Both were significant at $p < 0.001$. This means that the test-retest reliability was very high.

5.4 TRANSCRIPTION RELIABILITY

Transcriptions of children's speech samples were made by the researcher and another speech expert. Both transcribers worked independently of each other. Intra-rater and interrater reliability were assessed by means of Cohen's Kappa (Cohen 1968). Mean agreement for the consonants was 0.95 and overall inter-rater reliability was 0.99. This shows that agreement between the transcribers was excellent.

5.5 VOWEL PRODUCTION

Vowels are obligatory elements of the Syrian syllable structure and it is expected that Syrian children acquire the Arabic vowels at an early age and that there will be very few errors. It is clear from table 5.2 that Syrian children acquire vowels mainly before the age of 2:6-2:11. The 90% acquisition criterion for the vowels had already been achieved in the lowest age group.

Table 5.2: Percentage of correct vowels distribution in each age group.

Vowel	2:6-2:11	3:0-3:5	3:6-3:11	4:0-4:5	4:6-4:11	5:0-5:5	5:6-5:11	6:0-6:5
a	95.73	97.56	97.61	98.01	98.37	97.49	98.76	99.68
a:	99.32	100	100	100	100	98.64	99.09	100

u	90.44	97.06	100	99.38	99.17	99.15	99.50	100
u:	100	100	100	100	100	92.14	97.12	100
i	26.32	30	48.84	31.25	54.17	57.5	60.53	89.47
i:	100	99.16	95.45	98.21	100	84.29	94.29	100
o:	100	100	100	100	100	100	100	100
e	91.4	94	96.65	98	99.7	99.96	100	100
e:	99.8	99.97	100	100	100	99.8	100	100

The results indicated that short vowel /i/ has much higher error rate than other vowels. There are three possible reasons which could explain the late and low rate accuracy for vowel /i/ comparing to other vowels in Syrian children. First reason is that speakers of SYAreplace /i/ by /e/ (Ambros, 1977; 17).

Versteegh (1956) adds that /i/ is not only represented by /e/ it is also represented by /ᵊ/. The second reason is that this vowel becomes long vowel when it comes in word final position (ambros, 1977: 16). The last reason is that in most words which assessed /i/ in test items it comes in weak syllable deletion which was omitted in most younger Syrian children as in words /hisˁa:n becomes /sˁa:n/ “horse”, and word /miftah: / becomes/ ta: h/ “a key”.

5.6 CONSONANT PRODUCTION

The production of the consonants in the different age groups is illustrated in Figure 5.1. The results indicate that there is a gradual development in the percentage of speech sounds that are produced correctly. At age 2:6-2:11, 71.53% of consonants are produced correctly and this goes up to 96.3% in children aged 6:0-6:5.

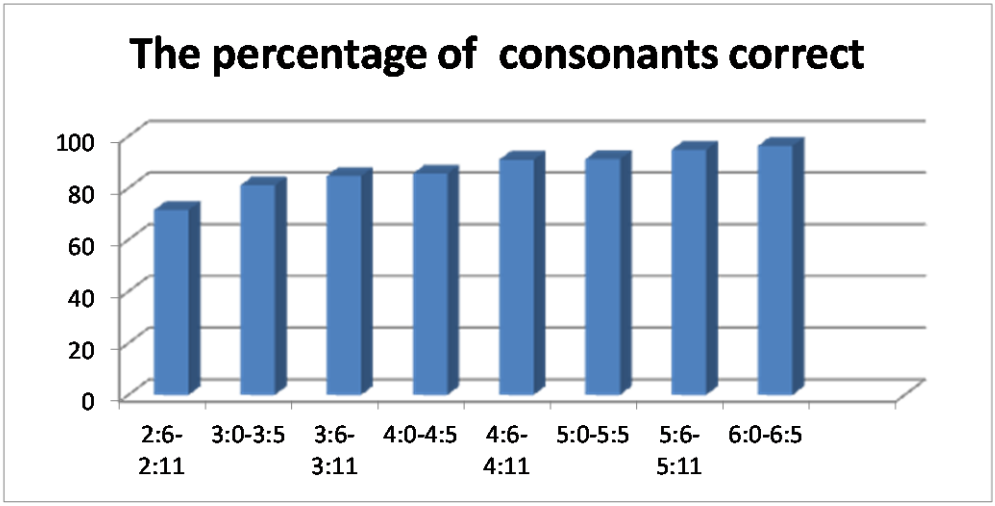

FIGURE 5.1 THE PERCENTAGE OF CONSONANTS CORRECT IN THE DIFFERENT AGE GROUP.

The relationship between speech sound production and age was examined using a one-way ANOVA. The results reveal there is a significant development of pronunciation accuracy as a function of age ($F(7, 135) = 111.94$, $P < 0.0001$). This result is consistent with the construct validity of the test.

5.7. PRONUNCIATION ACCURACY AND WORD POSITION

Pronunciation accuracy of the consonants was also investigated as a function of word position: a comparison was made between consonant accuracy in word-initial, medial and final position and these results are summarized in figure 5.2:

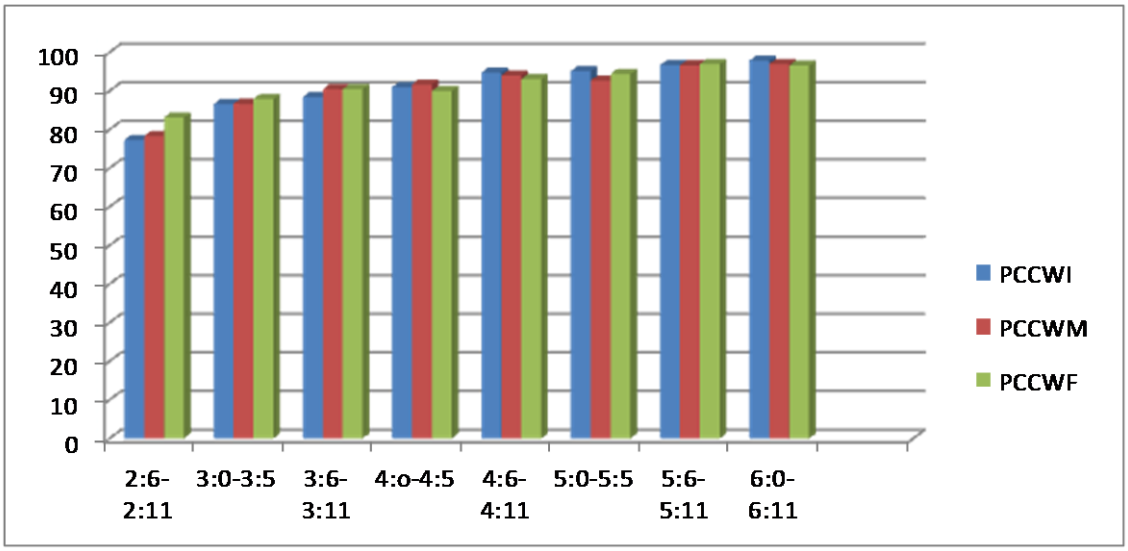

FIGURE 5.2 THE PERCENTAGE OF CORRECT CONSONANTS IN WORD- INTIAL(PCCWI),WORD-MEDIAL(pccwm) AND WORD-FINAL POSITION(PCCWF).

In order to investigate consonant realisation in the three word positions, a one-way ANOVA was carried out with consonant accuracy as the dependent variable and word position as the independent variable. A one-way ANOVA indicates that

pronunciation accuracy is significantly related to word position (F (05, 14) = 1.981, p = 0.015). Overall, pronunciation accuracy in word-initial and word-medial position amount to 86.73 % and 86.91 %, while it stands at 88.22 % in word-final position. This result is important to determine the criterion for speech sound acquisition. Since the difference between initial and medial positions is not significant, the acquisition criterion was such that a consonant has to be pronounced accurately by 90% of the children in either initial or medial and final position.

5.8 GENDER DIFFERENCES

The difference in consonant accuracy between the 80 girls and 80 boys in the test is summarized in figure 5.3:

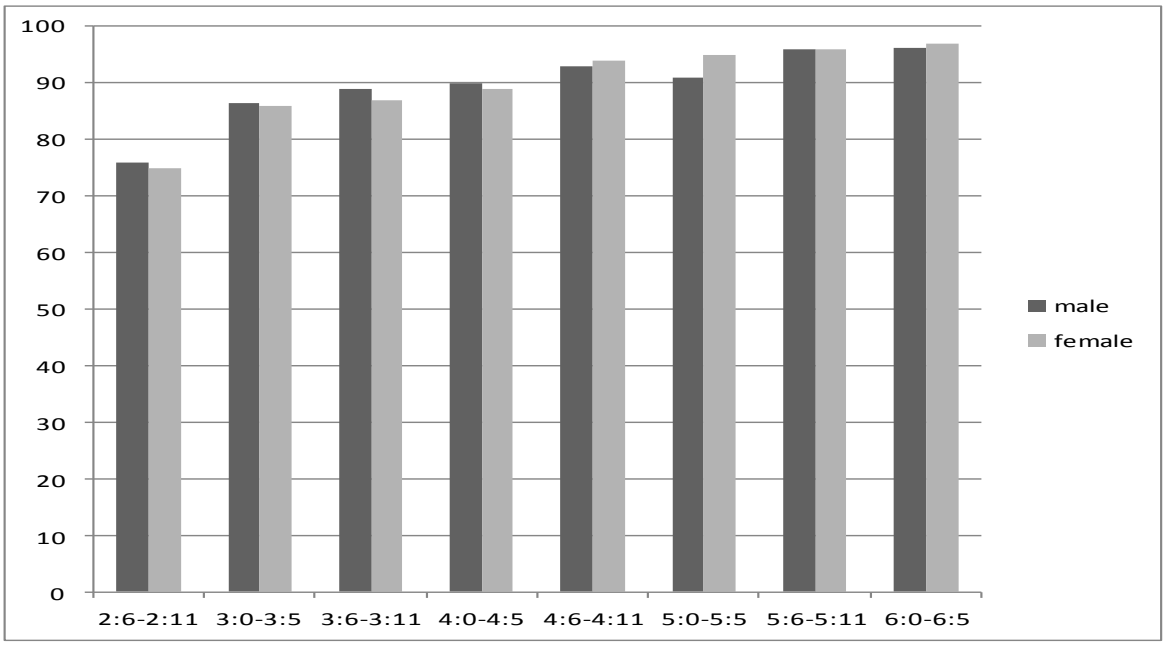

FIGURE 5.3 THE PERCENTAGE ACCURACY IN GIRLS AND BOYS FOR THE DIFFERENT AGE GROUPS.

On average, consonants were pronounced correctly by 88.4% of the boys and 89.45 of the girls. This difference in pronunciation accuracy was analyzed by means of a one-way ANOVA and the results indicate that the differences are not significant ($F(1, 7) = 0.11$, $p = 0.92$). As a result, norms for boys and girls will not be separated out, but they will be considered as one group in the further analysis of the results. The relationship between percentage accuracy of the each speech sound class in girls and boys was examined by a one way ANOVA, the speech sound class accuracy (plosives, nasals, fricatives, approximants, lateral approximant) was a dependent variable and children sex was independent variable. A one way ANOVAs results indicates that the difference in the pronunciation accuracy for most speech sound classes is not significantly related to sex so there are no difference between girls and boys in correct production for most speech sound classes, only the difference between girls and boys in nasals accuracy was significantly related to sex that girls produces more correct nasals than boys ($F(05, 4) = 5.6$, $p=0.049$).

5.9 THE AGES OF CONSONANT ACQUISITION

A consonant was considered as acquired when 90% of children produced it correctly in initial or medial position AND in final position. The results in table 5.3 show that

nasals, glides, anterior plosives and liquids are among the earliest acquired consonants. Fricatives and posterior plosives are acquired at an intermediate age, while the last acquired consonants are the alveolar trill, the emphatic consonants and the affricate.

Table 5.3: Age of consonants acquisition in Syrian children.

Age group	Age	90% criterion
1	2:6-2:11	b, f, j, h, m, n, l, w, ʔ, t,
2	3:0-3:5	d, h
3	3:6-3:11	ʕ, s, z
4	4:0-4:5	X,
5	4:6-4:11	k, dˤ, tˤ
6	5:0-5:5	ɣ
7	5:6-5:11	r, sˤ , ʃ,
8	6:0-6:5	-

The percentages for the acquired consonants as a proportion of the total number of consonants ranged from 30.76% at the age of 2:6-2:11 to 88.5% at the age of 6:0-6:5. Overall, consonant acquisition did not reach 100% in the children tested in this study. This is because there are some consonants, such as /q, ʒ, ðˤ/ which did not achieve the acquisition criterion. /ʒ/ achieved the 75 % criterion in three word

positions at the age of 6:0-6:5. / ðˤ/ achieved the 90% criterion only in medial position in age group 6:0-6:5.

5.9.1 THE ACQUISITION OF PLOSIVES

Pronunciation accuracy for the **voiced bilabial plosive** is summarized in figure 5.4. This clearly shows that correct production of /b/ was already at 95% in the youngest age group. This means that this plosive is acquired before the age of 2:5, which is the youngest age group in this study.

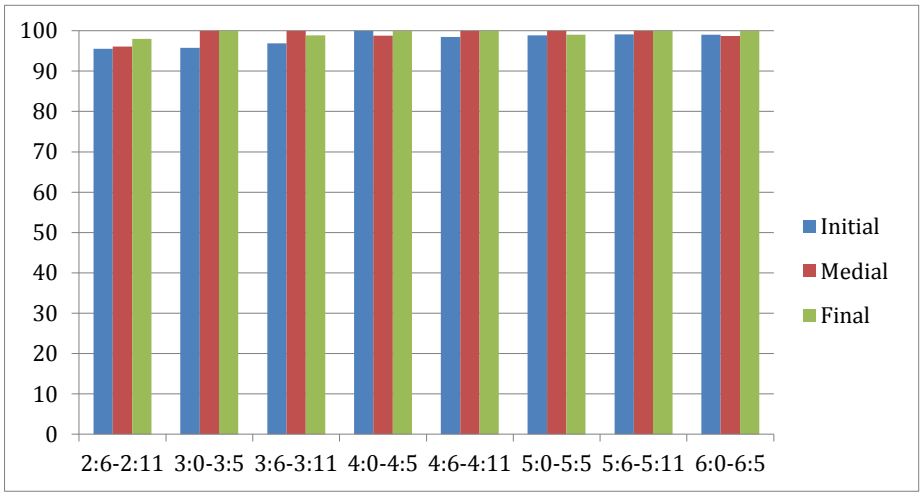

FIGURE 5.4 THE PERCENTAGE OF CORRECT PRODUCTION FOR /b/ ACROSS ALL AGE GROUPS.

The results for the **voiceless denti-alveolar** plosive are summarized in figure 5.5,

which indicates that the 90% acquisition criterion is reached between the ages of 2:6-2:11. It is noted that there is some regression in the accuracy of /t/ in the older children above the age of 5:5

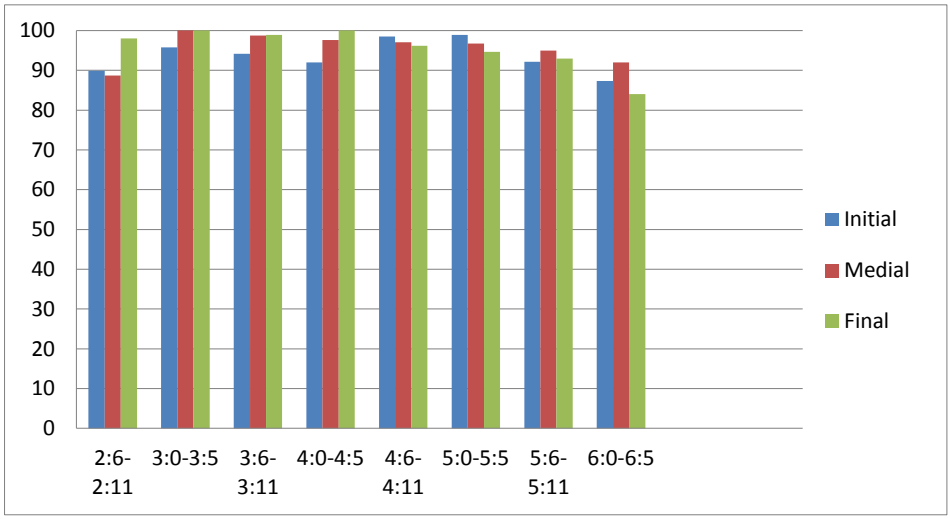

FIGURE 5.5: THE PERCENTAGE OF CORRECT PRODUCTION FOR/t/ AS A FUNCTION OF AGE.

The accuracy of the **voiced denti-alveolar plosive** is summarized in figure 5.6 which shows that the accuracy of /d/ increases with age. The 90% criterion was achieved by children in the age group 3:0-3:5. The results also indicate that there are substantial differences in accuracy according to word position.

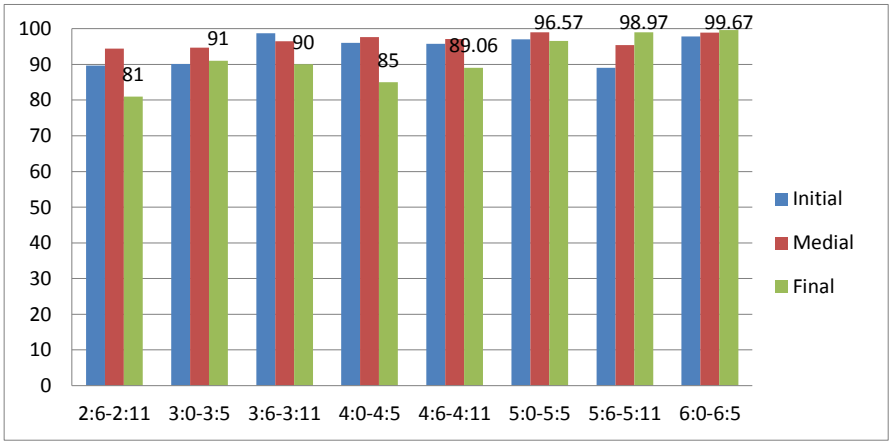

FIGURE 5.6: THE PERCENTAGE OF CORRECT PRODUCTION FOR /d/ ACROSS ALL AGE CROUPS.

The voiceless alveolar emphatic plosive /tˤ/ showed a considerable development in accuracy over time. It reached the 90% acquisition criterion in the group of children ages 4:6-4:11.

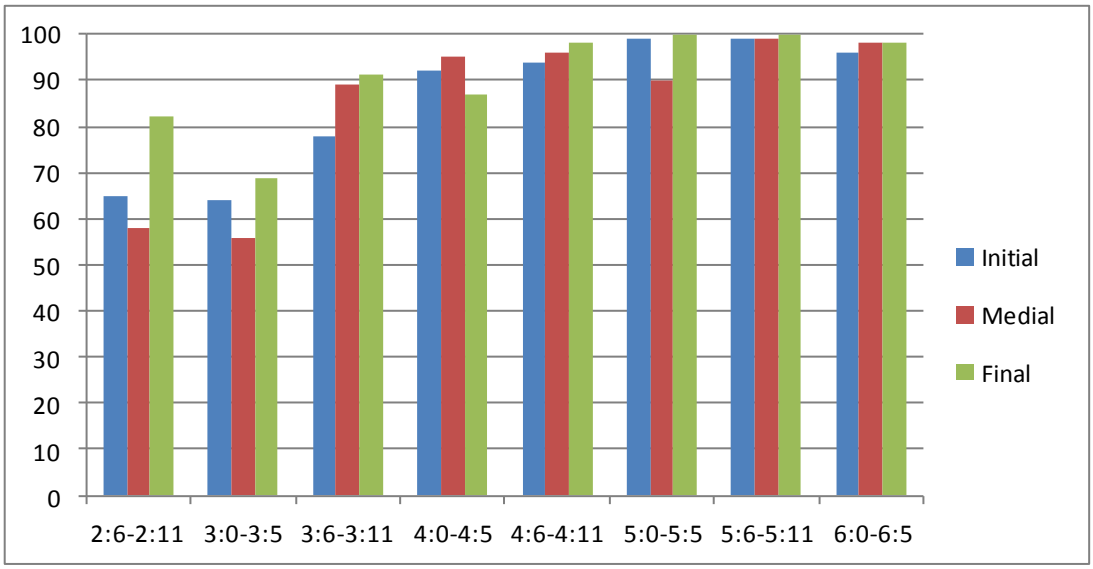

FIGURE 5.7: THE PERCENTAGE OF CORRECT PRODUCTION FOR /tˤ/ ACROSS ALL AGE GROUPS.

Correct production of the **voiced alveolar emphatic plosive** /dˤ/ showed a strong developmental progression over time. This is shown in figure 5.8. The 90% correct criterion for this sound was reached in the age group 4:6-4:11.

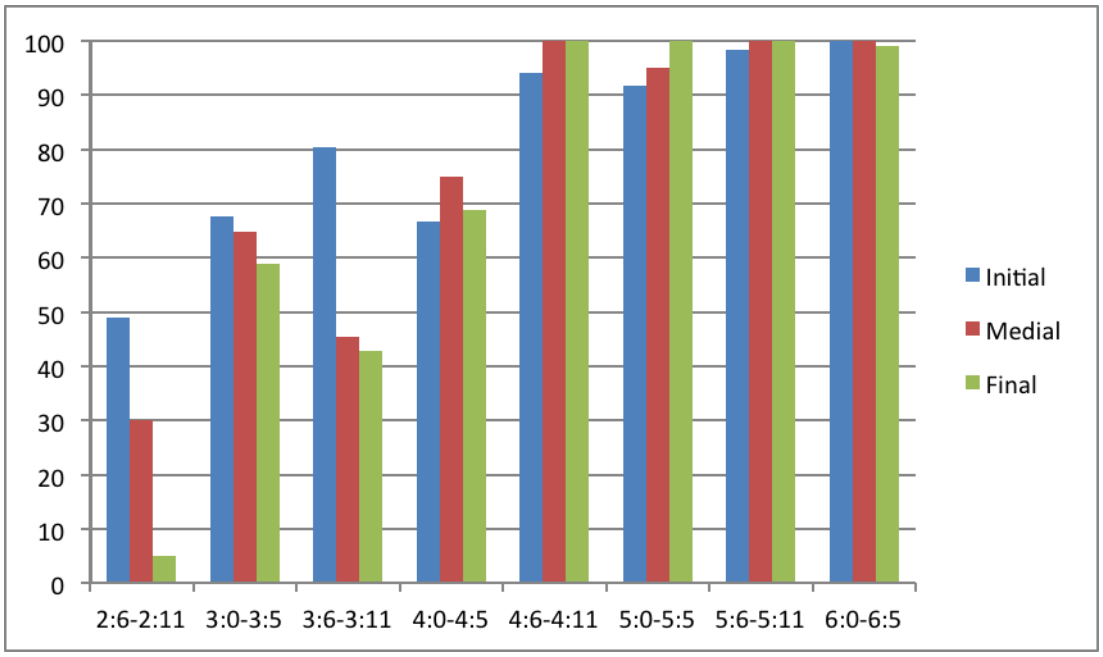

FIGURE 5.8: THE PERCENTAGE OF CORRECT PRODUCTION FOR /dˤ/ ACROSS ALL AGE GROUPS

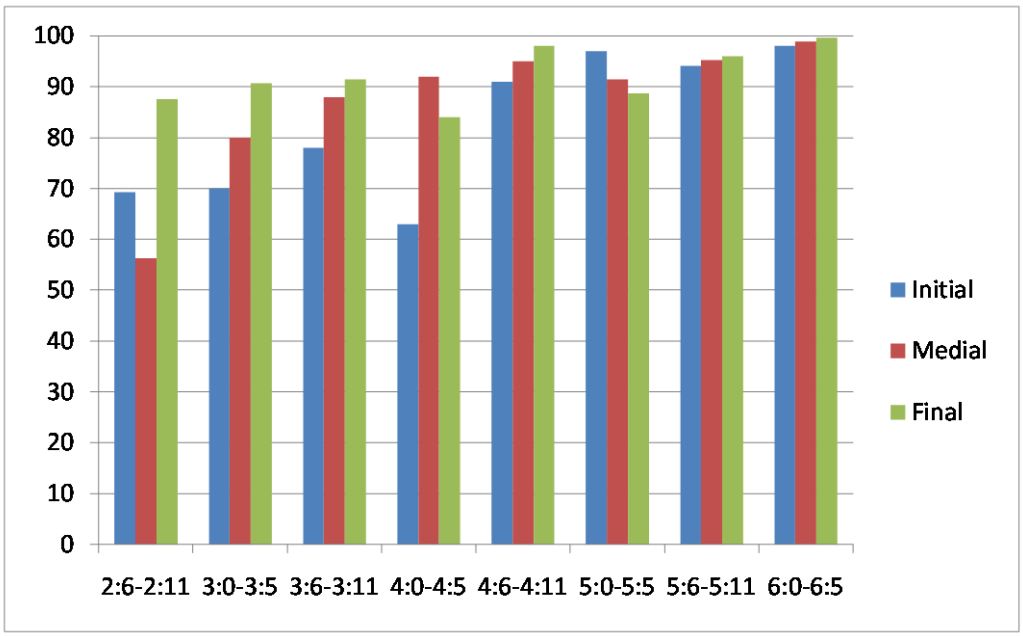

FIGURE 5.9: THE PERCENTAGE OF CORRECT PRODUCTION FOR /k/ ACROSS ALL AGE GROUPS.

The accuracy of the **voiceless uvular plosive /q/** is illustrated in figure 5.10. This sound is not commonly used in the southern and central Syrian varieties that were investigated in this study. It only occurs in a few words and it only emerges when children enter primary school at the age of 6. However, Syrians use it in some words such as /qurʔa:n/ (Eng.: "the holy Muslim book" and /qetˤa:r/ (Eng.: "train"). The results of this study indicate that this sound has not been acquired and only occurs in very few children. Its correct production begins to appear in the age group of 4:0-4:5, with 12.5% in initial position only (see figure 5.10). This percentage increases until it reaches 73.88% in the age group 6:0-6:5. This consonant was never

produced correctly in medial and final position for any age group.

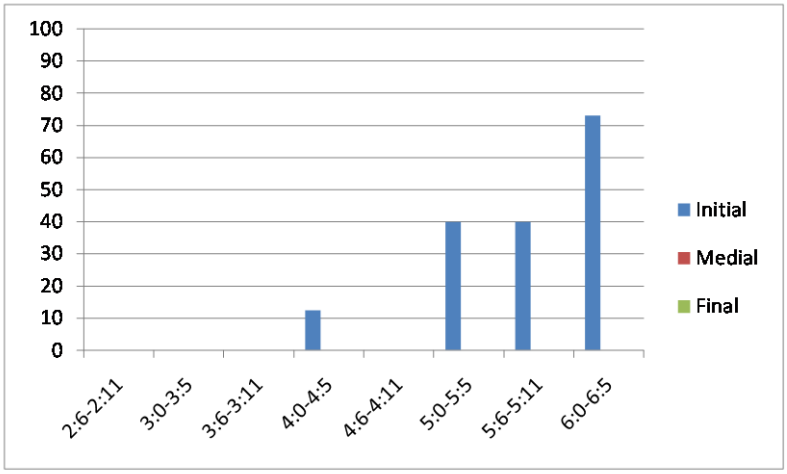

FIGURE 5.10: THE PERCENTAGE OF CORRECT PRODUCTION FOR /q/ ACROSS ALL AGE GROUPS.

The acquisition of the **glottal plosive** is summarized in figure 5.11. It is important to mention that /ʔ/ does not occur frequently in medial position as it is omitted in most words in Syrian Arabic: e.g. /raʔs/ > / raas/. /ʔ/ is rarely used in final position and is usually omitted: e.g. /sama:ʔ/ (Eng: sky) > /sama/. In this study, omission of /ʔ/ in medial and final position was nevertheless accepted as correct regardless of whether /ʔ/ was omitted or not. As shown in figure 5.11, the 90% criterion was reached in the very first age group 2:6 2:11.

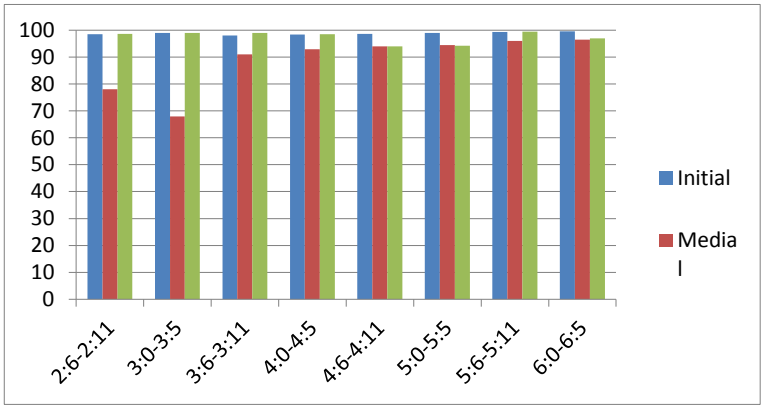

FIGURE 5.11: THE PERCENTAGE OF CORRECT PRODUCTION FOR /ʔ/ ACROSS ALL AGE GROUPS

5.9.2 THE ACQUISITION OF NASALS

The acquisition of the **voiced labial nasal** is illustrated in figure 5.12, which indicates that the acquisition age is 2:6. This leaves little room for further development.

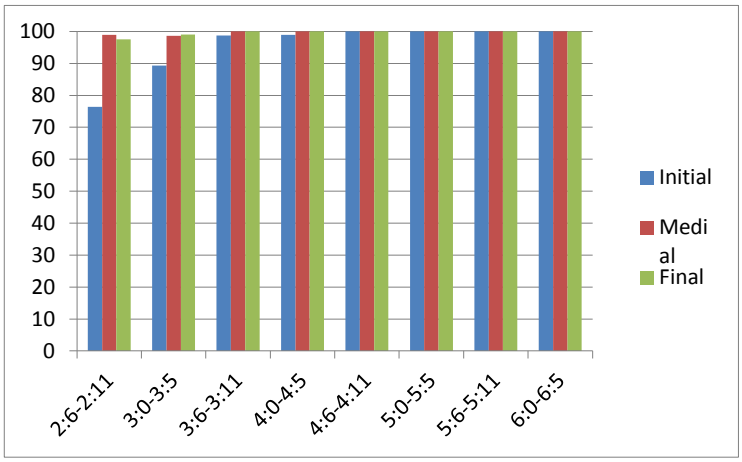

FIGURE 5.12: THE PERCENTAGE OF CORRECT PRODUCTION FOR /m/ ACROSS ALL AGE GROUPS

The **voiced denti-alveolar nasal** is illustrated in figure 5.13. The pronunciation results indicate that /n/ in Syrian Arabic is acquired at an early age as the accuracy was above 90% in all age groups. It can be noted that the accuracy drops marginally below the acquisition criterion in the age group 6:0-6:5, but this is unlikely to be of any significance.

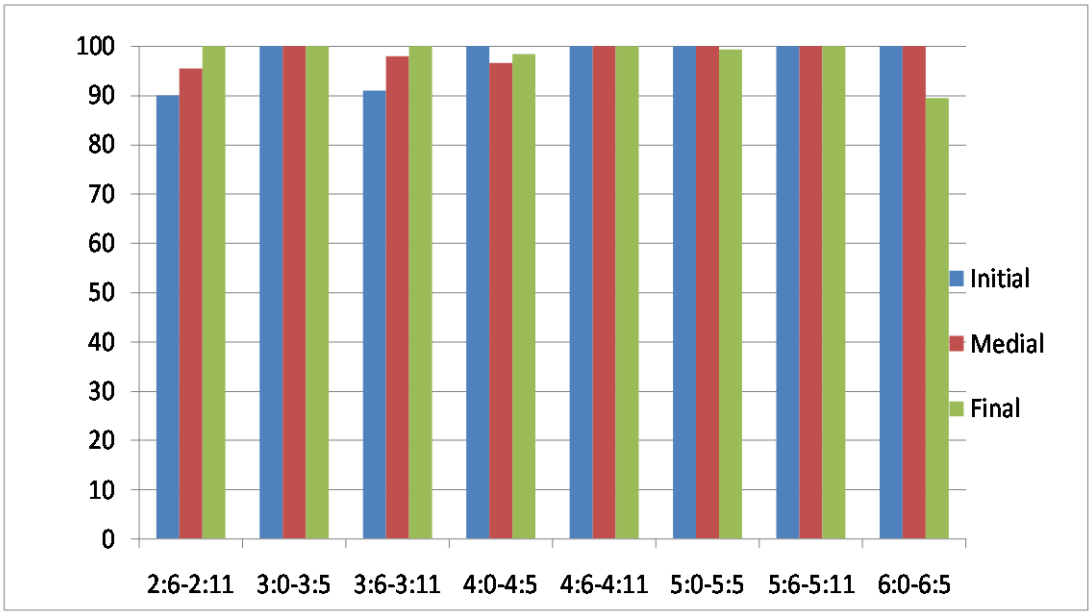

FIGURE 5.13: THE PERCENTAGE OF CORRECT PRODUCTION FOR /n/ ACROSS ALL AGE GROUPS

5.9.3 THE ACQUISITION OF THE TRILL

As shown in figure 5.14, there is a strong development in the accuracy of /r/ over time. It reaches the acquisition criterion in the age group 5:6-5:11. The results also

show that there is a clear difference in its accuracy between the different word positions: children seem to produce this sound much better in word-final position. This difference was examined by means of an ANOVA and the results indicate that this effect is significant overall F (2, 7) = 3.8, p = 0.039). The application of a Tukey HSD shows that the accuracy in final position differs significantly from the other two word positions.

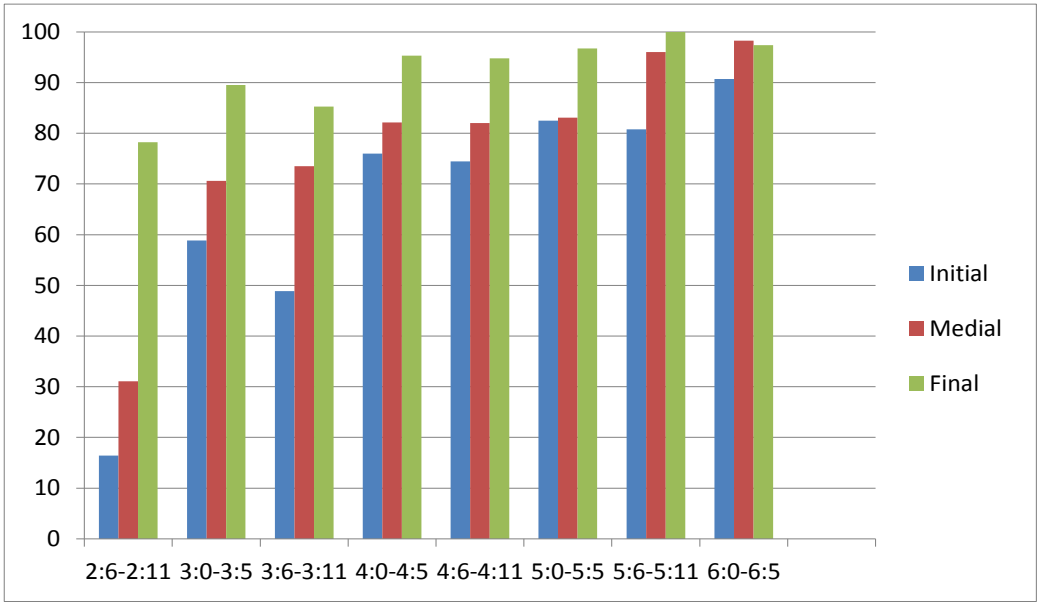

FIGURE 5.14: THE PERCENTAGE OF CORRECT PRODUCTION FOR /r/ ACROSS ALL AGE GROUPS

5.9.4 THE ACQUISITION OF THE FRICATIVES

The **voiceless labio-dental fricative** /f/ is among the earliest fricatives to be acquired. As can be seen in figure 5.15, it reaches the 90% acquisition criterion in

the age group 2:6-2:11:

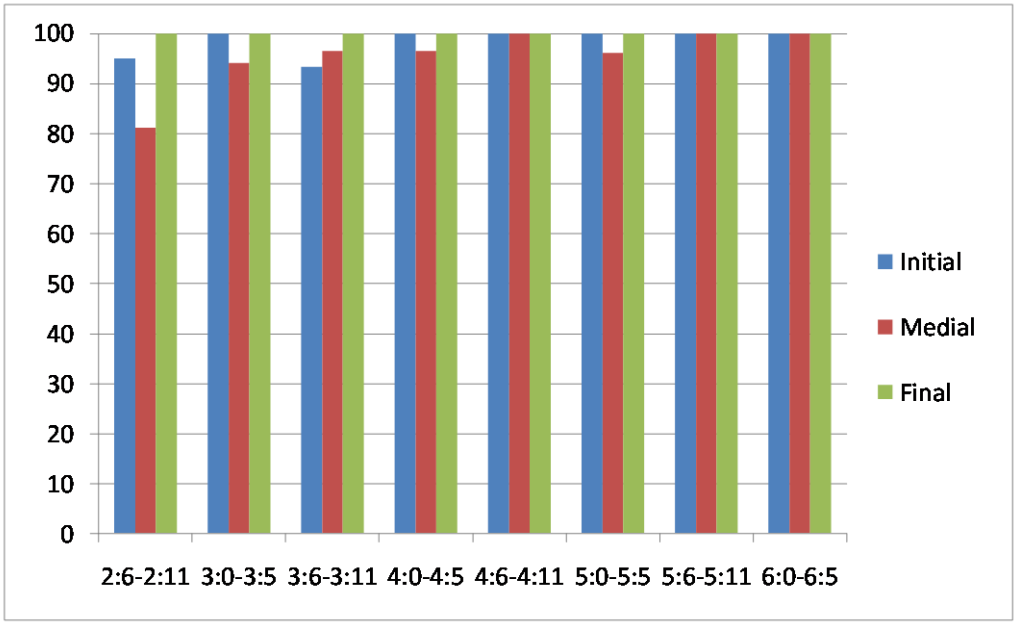

FIGURE 5.15: THE MEAN PERCENTAGE OF CORRECT PRODUCTION FOR /f/ACROSS ALL AGE GROUPS.

The **voiced emphatic fricative** /zˁ/ is one of the late acquired speech sounds in Syrian Arabic. Figure 5.16 shows the percentage of correct production for/zˁ/across all age groups. It is clear that this sound is not used in initial position. Further analysis indicates that children consistently replace this fricative with /dˁ/in initial position. The fact that it does not occur in final position has to do with the fact that it was not targeted in this position because there are no suitable words for children to use in preschool age. In medial position, correct production increases considerably from 21.05 % for the age group of 3:6-3:11 to 94.44 % for the age group 6:0-6:5. The results also show a dip in the accuracy in the age group 5:0-5:5.

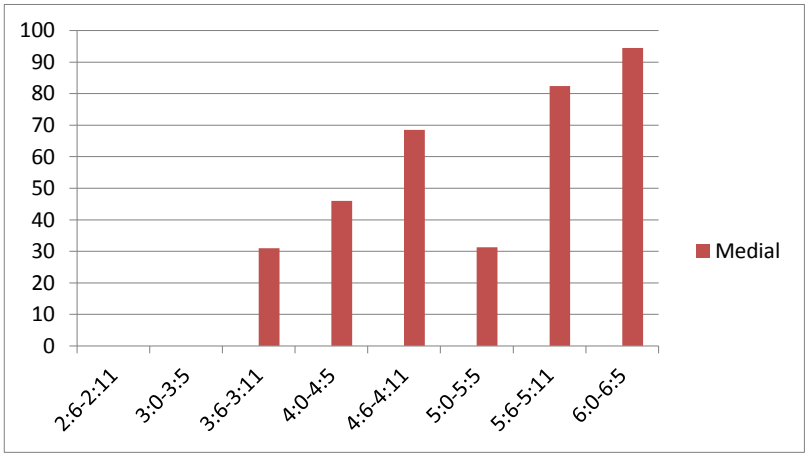

FIGURE 5.16: THE PERCENTAGE OF CORRECT PRODUCTION FOR /z$^{\varsigma}$/ /ACROSS ALL AGE GROUPS

The results for the **voiceless alveolar fricative** /s/ are summarized in figure 5.17. There is a gradual increase in the accuracy of /s/ across age groups. The 90% acquisition criterion is reached in age group (3:6-3:11).

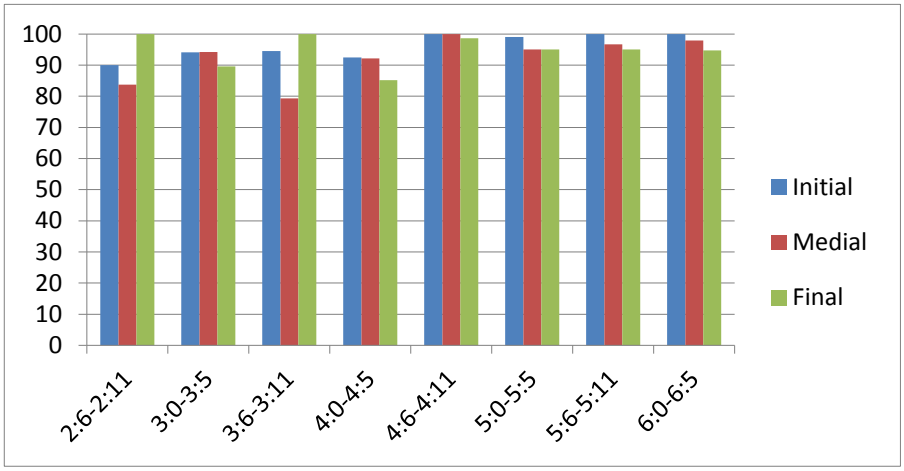

FIGURE 5.17: THE PERCENTAGE OF CORRECT PRODUCTION FOR /s/ /ACROSS ALL AGE GROUPS

The acquisition of the **voiced alveolar fricative** /z/ is illustrated in figure 5.1

8, which shows a steady development over time. It was acquired at 3.6-3:11. Like other fricatives, there is a difference in the accuracy in different word positions. Correctness in initial position was consistently higher than in medial and final position in all age groups. An ANOVA reveals that this difference is significant F (2, 7) = 5.5, p = 0.00416).

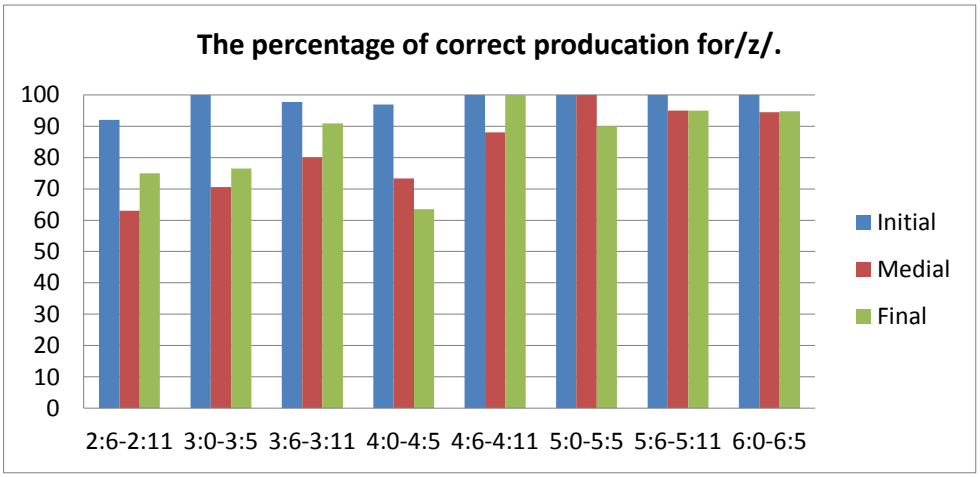

FIGURE 5.18: THE PERCENTAGE OF CORRECT PRODUCTION FOR /z/ /ACROSS ALL AGE GROUPS

The results for the **voiceless pharyngealized alveolar fricative** are summarized in figure 5.19. There is quite a strong development in the accuracy of this sound. /sˤ/ is clearly a late acquired consonant as it was mastered in the age group 5:6-5:11.

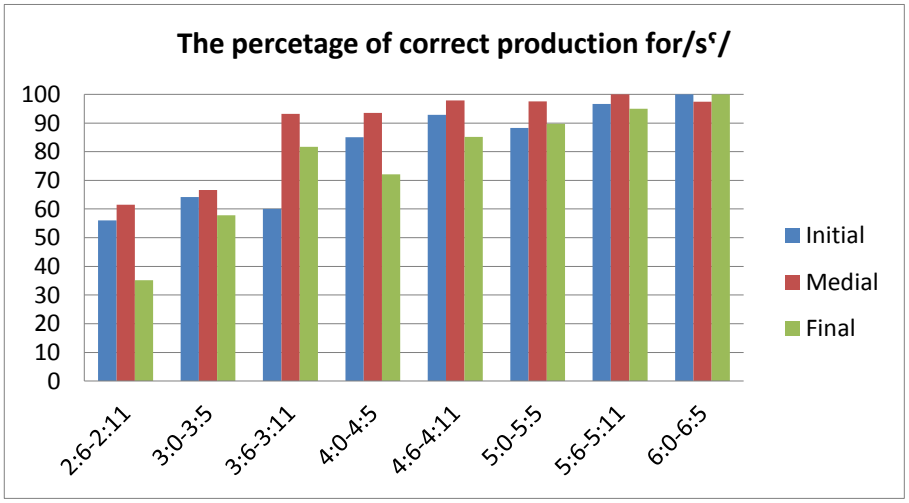

FIGURE 5.19: THE PERCENTAGE OF CORRECT PRODUCTION FOR /sˤ/ /ACROSS ALL AGE GROUPS

For the **voiceless post-alveolar fricative** /ʃ/ there is quite a strong development in the correct production over time. This is summarized in figure 5.20. The results also show that there is a regression in the initial and medial positions in the speech of children aged between 5:6 and 5:11. However, /ʃ/ was one of the last acquired fricatives that achieved the 90% acquisition criterion at the age of 5:6-5:11.

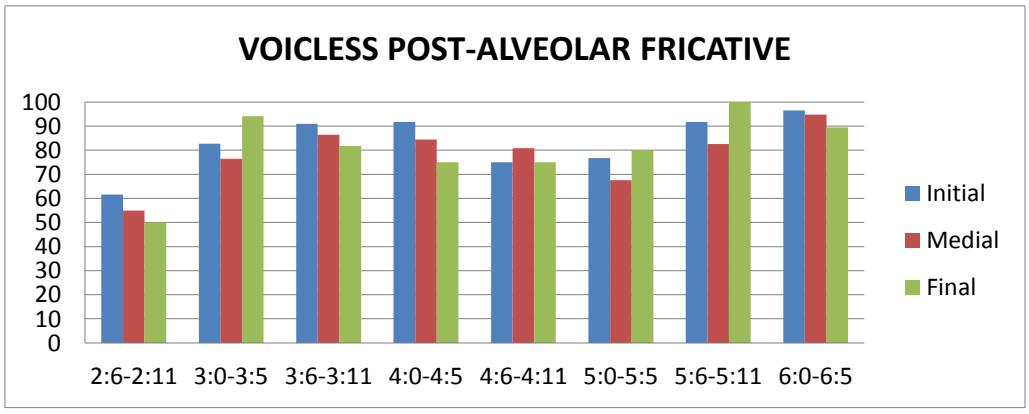

FIGURE 5.20: THE PERCENTAGE OF CORRECT PRODUCTION FOR /ʃ/ ACROSS ALL AGE GROUPS

The **voiceless velar fricative** /x/ was mastered in the 4:0-4:5 age group. An increase in development is noted in the three word positions (see figure 5.21).

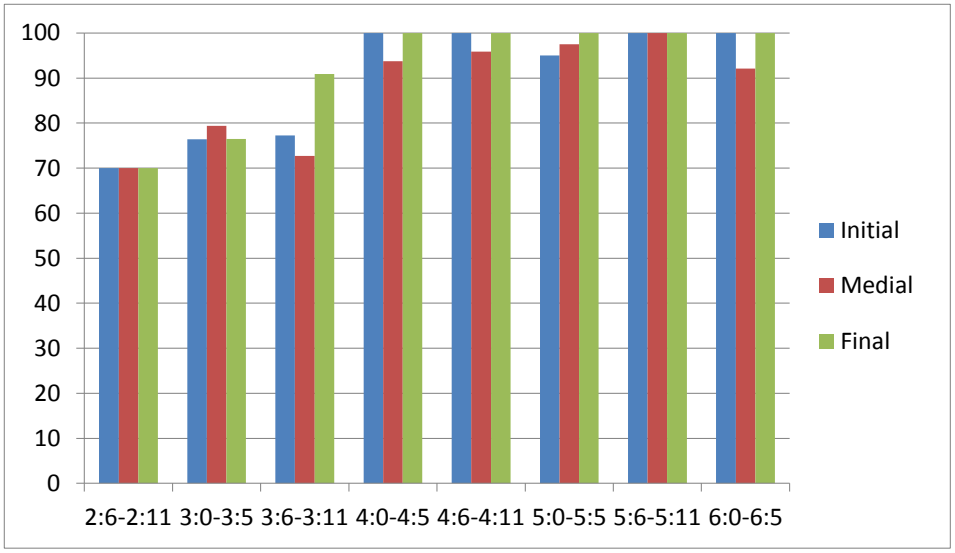

FIGURE 5.21: THE PERCENTAGE OF CORRECT PRODUCTION FOR / x /ACROSS ALL AGE GROUPS.

As far as the **voiced velar fricative** is concerned, there is a gradual increase in accuracy in three word positions (see figure 5.22). The 90% acquisition criterion was reached at 5:0-5:5.

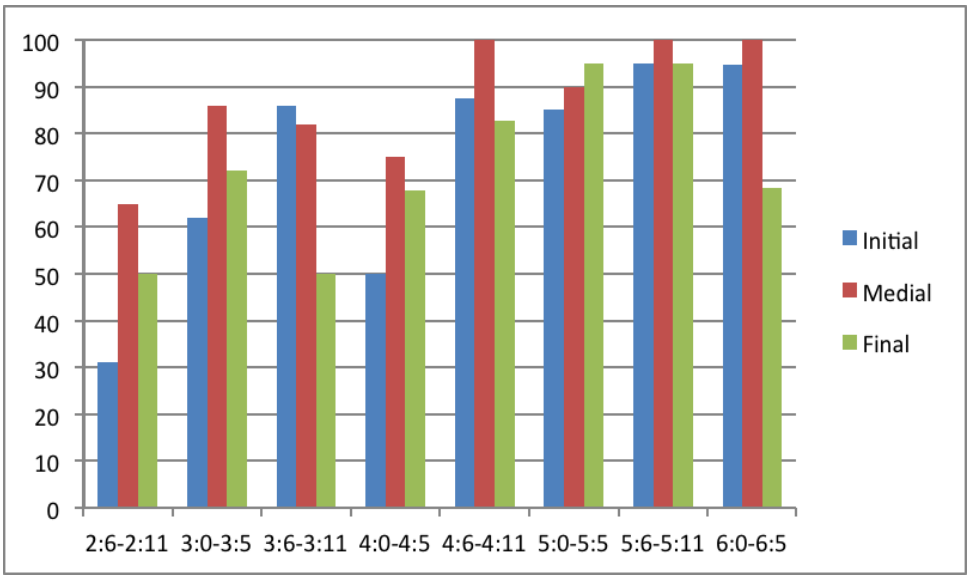

FIGURE 5.22: THE PERCENTAGE OF CORRECT PRODUCTION FOR / ɣ /ACROSS ALL AGE GROUPS.

The **voiceless pharyngeal fricative**/ħ/ is the earliest fricative to be acquired. The acquisition criterion is reached in the age group 2:6-2:11 (see figure 5.23)

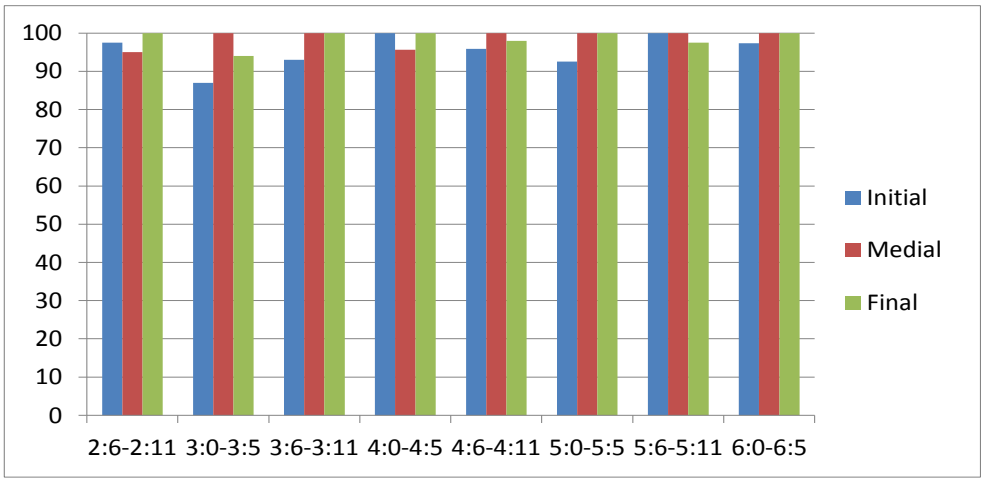

FIGURE 5.23: THE PERCENTAGE OF CORRECT PRODUCTION FOR /ħ/ ACROSS ALL AGE GROUPS.

The **voiced pharyngeal fricative** /ʕ/ shows consistent development and was acquired at the age 3:6-3:11 (see figure 5.24).

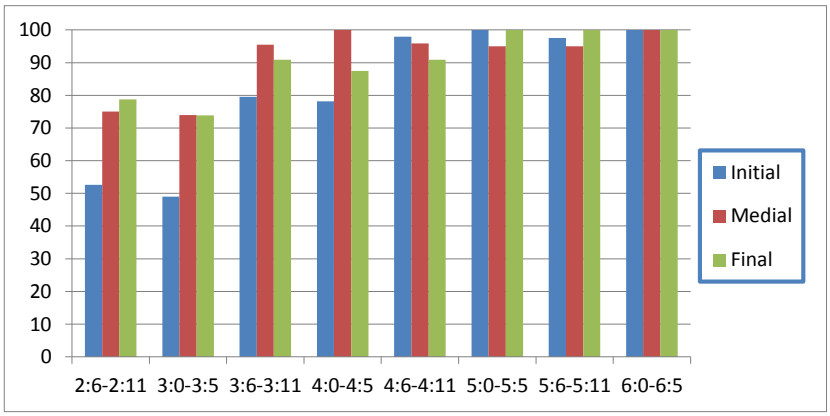

FIGURE 5.24: THE PERCENTAGE OF CORRECT PRODUCTION FOR / ʕ /ACROSS ALL AGE GROUPS.

The **voiceless glottal fricative** /h/ is acquired between 3:0-3:5 years (see figure 5.25). It is worth mentioning that the fricative was targeted in three word positions in the test but that it was considered to be acquired only in initial and medial positions as Syrians rarely use this consonant in final position. Instead it is replaced by /u/: e.g. /reʒlah/→ /reʒlu/, (Eng: his leg).

5.9.5 ACQUISITION OF THE FRICATIVE /ʒ/

The **frictive** / ʒ / is also among the late acquired consonants in Syrian children (figure 5.26). This consonant shows a consistent development across age groups and its accuracy varies greatly with position. It is acquired after the age of 6:5 as it does not reach the acquisition criterion in any age group.

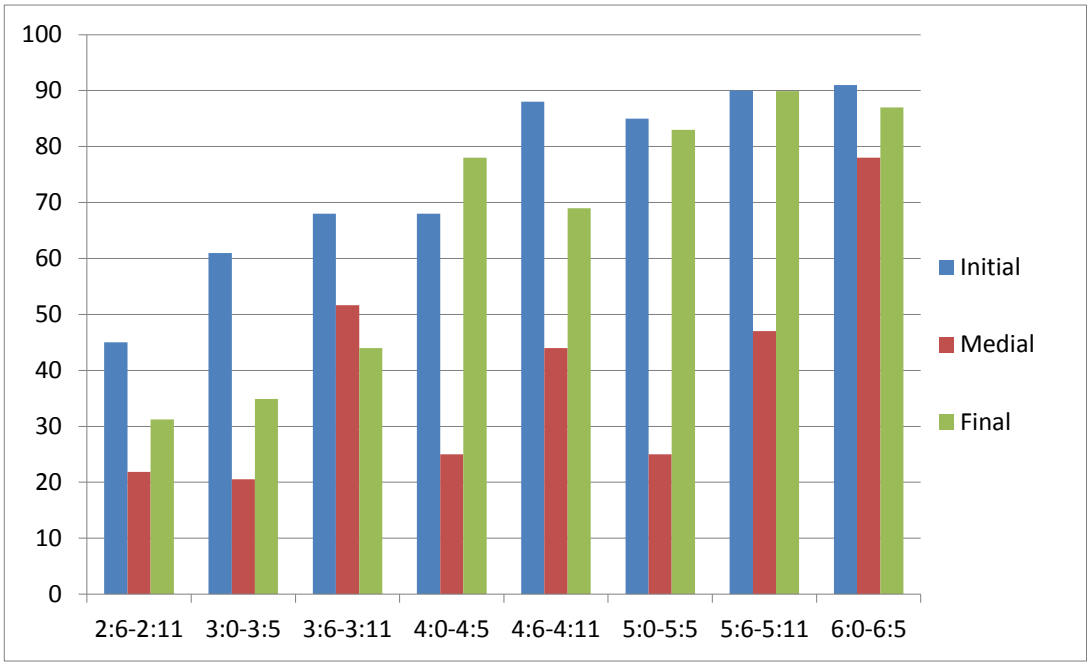

FIGURE 5.26: THE PERCENTAGE OF CORRECT PRODUCTION FOR / ʒ /ACROSS ALL AGE GROUPS.

5.9.6 ACQUISITION OF THE APPROXIMANTS

The **voiced labio-velar approximant** /w/ is one of the earliest consonants as all children have acquired it by the age of 2:6. Accuracy reaches 100% from age group

2:6-2:11 (figure 5.27).

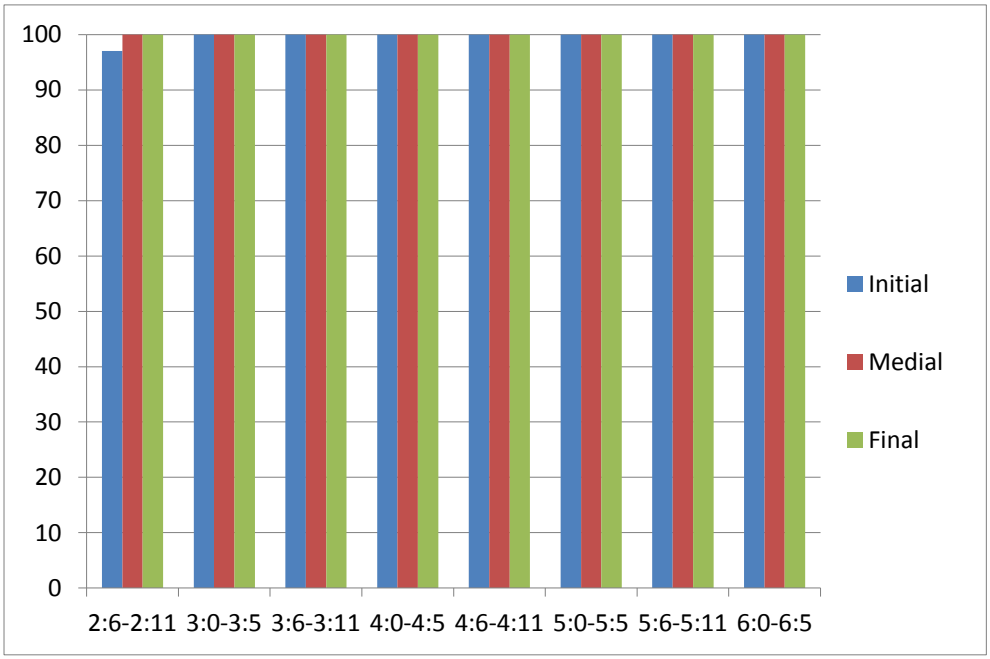

FIGURE 5.27: THE PERCENTAGE OF CORRECT PRODUCTION FOR / w /ACROSS ALL AGE GROUPS.

As far as the **voiced palatal approximant** /j/ is concerned, figure 5.28 shows that it is acquired before the age of 2:6. There is a slight difference across word positions in that the final and initial positions appear to be more accurate than the medial.

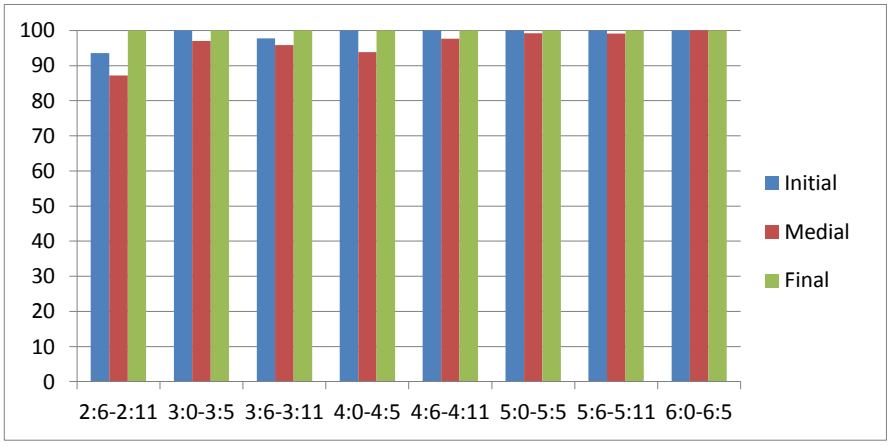

FIGURE 5.28: THE PERCENTAGE OF CORRECT PRODUCTION FOR / j /ACROSS ALL AGE GROUPS.

The **voiced alveolar lateral approximant** /l/ is acquired early by Syrian children in the first age group of 2:6-2:11.

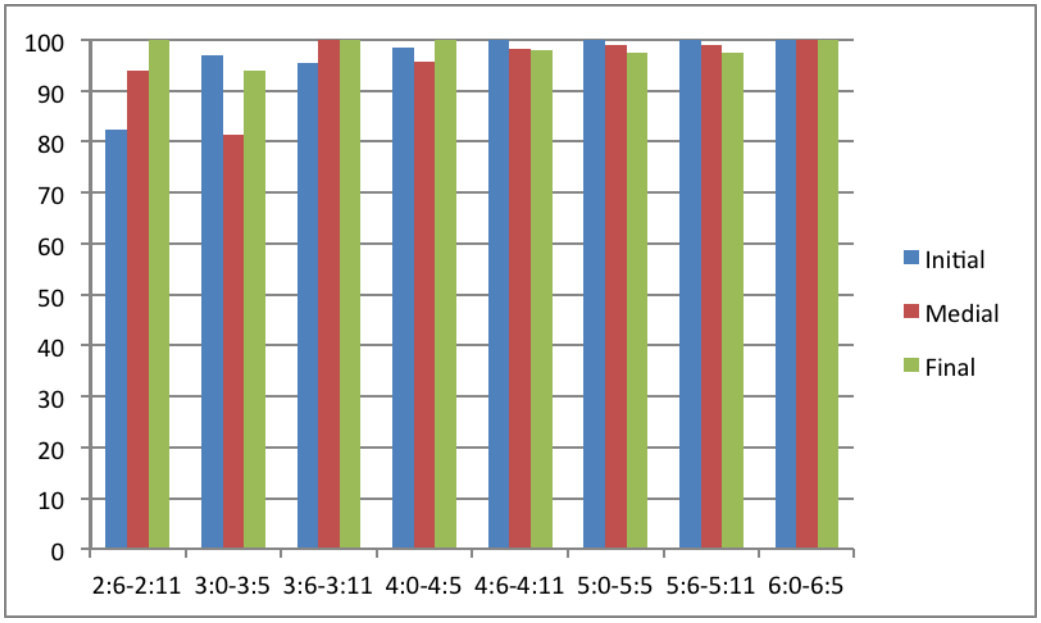

FIGURE 5.29: THE PERCENTAGE OF CORRECT PRODUCTION FOR / l /ACROSS ALL AGE GROUPS.

5.10 DISCUSSION

The results of this study on 160 Syrian children aged between 2:6-6:5 years were analysed to investigate the age of speech sound acquisition in Syrian Arabic. For the age and order of speech sound acquisition, it was found that the vowels are acquired very early in development (before 3 years). The youngest group of children was able to produce all the vowels correctly. Thus, the acquisition of SYA vowels was almost complete by the age of 3. However, diphtongs were problematic. The two diphthongs which were examined in the test (ai:, au:) did not appear in the children's speech samples until the age of 5:0-5:5 and even then their accuracy was poor. The age group 6:0-6:5 achieved only 64%, thus that the acquisition criterion was not fulfilled.

For the consonants, there is a gradual development in the percentage of speech sounds that are produced correctly; accuracy ranged from 71.36. % at the age of 2:5-2:1 and 94.3% at the age of 6:0-6:5. All SYA consonants were acquired by the age of 6:5, except for the affricate /ʒ/. These findings confirm the construct validity of the test. The order of consonant acquisition in terms of sound class was central approximants > nasals > plosives > lateral approximant /l/ > fricatives > trill > affricate.

The results for the age of consonant acquisition showed that 12 consonants

are acquired between 2:5-4:0. These consonants are /b, f, j, m, n, l, t, d, h, ʔ, w, h/, i.e. anterior plosives, nasals and fricatives. Three are produced in the posterior portion of the oral cavity, i.e /h, ʔ, ʕ/. Seven consonants were acquired between the ages of 4:0 and 5:0. These were /x, s, z , ʕ, tˤ, dˤ, k/. Most of these are fricatives and emphatic plosives. The late acquired consonants are / ʃ, r, sˤ, ɣ/ which only appear between the ages of 5:0-6:5.

Speech sound acquisition in Syrian Arabic is visualized in table 5.4 in which the light green cells indicate early acquired consonants and dark green the late acquired consonants.

Table 5.4: Summary table of speech sound acquisition

	Bilabial	Labio-Dental	Dental	Alveolar dental		Palatal	Velar	Uvular		Pharyngeal		Glottal
Plosive	B			t	d		k	q				ʔ
				tˤ	dˤ							
Nasal	M			n								
Trill			r									
Fricative		f	zˤ	s	z	ʃ		x	ɣ	ħ	ʕ	h
				sˤ								
Affricate						dʒ(ʒ)						
Approximant	W					j						
Lateral-approx				l								

5.11 SPEECH SOUND ACQUISITION IN SYRIAN ARABIC AND ENGLISH

There are some consonants that are shared between English and Syrian Arabic. These consonants are /b, m, n, l, d, f, k, w, j, s, z, h, ʒ, ʃ /. Other consonants, however, are unique to either English or Syrian Arabic. Some consonants are

acquired earlier in English than in Syrian Arabic such as /k, s, z, ʒ, ʃ/. All with the exception of two are fricatives. /d/ and /h / are acquired at the same age in both languages, i.e. between the ages of 3:0 and 3:5. While the results of this study indicate that the consonants /b, m, n, l, f, j, h/ are acquired earlier by Syrian children (i.e. in the age group of 2:6-2:11) it is important to point out that these consonants have never been examined in English children before the age of 3. In the comparisons, reference will be made to Dodd et al. (2003).

As far as the plosives are concerned, Dodd et al. (2003) found that these are acquired by English children before the age of 3:5. The results from this study indicate that plosives are acquired earlier by Syrian children, i.e. by the age of 3:0, except for /k/ and /d/ which are acquired at the same age. This excludes the emphatic plosives /tˤ, dˤ/ which are not acquired until the age of 4:11. However, these cannot be compared to English, since they do not occur in this language.

The nasals are acquired earlier in Syrian children: nasal acquisition occurs between the ages of 2:6-2:11, while English children acquire nasals at age of 3:0-3:5.

There is a considerable difference in the age of acquisition of fricatives between the two languages with acquisition in English being completed earlier than in Syrian Arabic. English children have acquired most fricatives by the age of 5:0-5:5. English children acquire /s, z/ before the age of 3:5 while Syrian children do not acquire

these until the age of 4. /ʃ/ is considered a late acquired consonant in both languages: at the age of 5:0-5:5 by English children and at 5:5-5:11 by Syrian children.

Finally, the approximants are acquired early by Syrian children, i.e. before the age of 3. English children do not acquire these consonants until the age of 3:5.

The differences and similarities in the age of speech sound acquisition across languages have generally been accounted for by either biological or environmental factors. The biological point of view argues that there are universal tendencies which determine speech sound acquisition. In contrast, the environmental view hypothesizes that there is a greater influence of environmental factors such as input frequency, functional load and articulatory complexity (Menn 1983). The differences and similarities between the results of our study and those of Dodd et al. (2003) are discussed in the light of these two views.

In the context of the assumed developmental universals, Jakobson (1941/1968) made several claims which have influenced our view on speech sound acquisition. The most general claim is that there are universal principles which influence the composition of speech sound inventories in all the languages of the world, and that these principles structure and determine how children acquire speech sounds. More specifically, Jakobson assumed that the first acquired speech sounds are the same

for all children regardless of language, and that there is a universal order in which these sounds are acquired. Our study provides evidence for and against Jakobson's claims.

Evidence which supports Jakobson's universal claim pertains to the acquisition of sounds with different voicing, different manners and places of articulation. As far as voicing is concerned, Jakobson indicates that voiceless sounds are acquired earlier than voiced ones. Some results of our study on Syrian Arabic are in agreement with this idea. For example, /t/ was acquired at the age of 2:6-2:11, while /d/ was acquired later between the ages of 3:0-3:5. The same is true for the voiceless velar fricative /x/ which was acquired before the voiced velar fricative. Similarly, the voiceless pharyngeal fricative /h/ was acquired before the voiced /ʕ/. This is consistent with studies on other languages such as English, where it was found that voiceless plosives are acquired 2 years earlier than voiced plosives (Macken & Barton 1980). Similar results have been reported for Cantonese (Clumeck, Barton, Macken & Huntington 1981), Thai (Gandour, Petty, Dardarananda, Dechongkit & Mukongoen 1980), French (Allen 1985) and Hindi (Davis 1995). These studies attribute the reason for the earlier acquisition of voiceless sounds to the relative ease of articulation of these consonants. Kent (1992) suggests that voiced consonants only emerge when children develop more precise and consistent control that is required to co-ordinate supra-laryngeal gestures and with the fine timing of larynx activity which is essential to the voicing contrast.

As far as manner of articulation is concerned, it appears that Syrian children acquire plosives, nasals and approximants early, while most fricatives, the trill and the affricates are not acquired until much later: plosives are firmly in place by the age of 5:0 while the last fricative /ʃ/ was acquired between the ages of 5:5 and 5:11. Similar patterns of speech sound acquisition have been reported for English (Prather et al. 1975, Smit et al. 1990, Dodd et al. 2003) and for other languages such as German (Fox 2000), French (Chevrie-Muller & lebreton 1973), Spanish (Dinnsen 1992), and Xhosa (Mowrer and Burger 1991).

As far as place of articulation is concerned, the results of our study agree well with the idea that anterior consonants are acquired earlier than posterior consonants. The anterior plosives /b, t/ are acquired earlier by Syrian children than the posterior consonants /k, q/. In addition, the labio-dental fricative /f/ was acquired earlier than fricatives at other places of articulation. Similar observations have been made with respect to German where /d/ is acquired earlier than /k/ and /g/ (Fox 2000). Teixeira (1980-1985) found that labials are acquired earlier than coronals in Brazilian Portuguese. It is generally assumed that anterior consonants are acquired earlier than posterior ones since they are clearly visible to children and consequently easier to imitate.

While there is ample evidence supporting Jakobson's universal theory, many researchers have found considerable variability in the age and order of speech

sound acquisition across languages. This seems to indicate that language specific factors may also play a significant role (Macken et al. 1980, Stokes & To 2002, Nishimura 1980, Li & Edwards 2006) Ingram (1999) for example compared consonant acquisition in English, Quiché, Turkish and Dutch, and found clear differences between them. Chevri-Muller & Lebreton (1973) also found evidence that /l/ was acquired earlier by French children than English children. Similarly, Zhu and Dodd (2000) found that Chinese children acquired the post-alveolar retroflex, alveolo-palatal affricates and fricatives /tɕ, tʂ, tʂ^{h}, tɕ^{h},ɕ, ʂ/ at an earlier age than English children.

Our study also provided evidence for language-specific issues in the age of consonant acquisition by Syrian children. It was found for example that some posterior consonants are among the earliest acquired speech sounds in Syrian children: /ʔ/ and /h/ have been acquired by the age of 3:00. Also, it was found that the fricative /ʒ/ has been the latest acquired SYA consonant. In contrast, /ʤ/ and /ʒ/ is acquired at the age of 4:5by English children (Dodd et al. 2003) and before the age of 3 and a half by Maltese children (Grech 1998).

Besides biological factors, it has been suggested that a range of environmental factors play a role in speech sound acquisition. One of these factors is the frequency of occurrence of speech sounds in languages. The results from our study provide some evidence, which supports this idea. The consonants /k, s, z, h, ʒ, ʃ/ are

acquired earlier by English children in comparison to Syrian children (Dodd et al. 2003). In terms of the frequency of occurrence of these consonants in both languages clear differences are observed. For example, Mines, Hanson & Shoup (1978) found that the acquisition order of /k, s, z/ was 8, 3 and 11, their frequency of occurrence was 5.30, 7.88 and 4.70. In contrast, the rank of these consonants in our study is 13, 14, and 11 with percentages of occurrence standing at 3.2, 2.97 and 0.62. This observation is consistent with the idea that these consonants are acquired earlier in English because the frequency of these sounds in English is substantially higher. On the contrary, the consonants /b, m, j/ are acquired earlier by Syrian children than by English children. The rank of order of these consonants in English is 12, 9 and 18 with an occurrence of 3.24, 5.11 and 1.87 (Miles et al. 1978). In this study, the rank order of these consonants is lower (7, 3 and 2) with higher frequencies of occurrence (6.23, 8.86 and 9.88).

Frequency of occurrence as a determining factor for speech sound acquisition has also been evidence in languages other than English. Pye, Ingram, and List (1987) compared the development of initial consonants between Quiché Mayan children and English children. They found that the affricate /tʃ/ and the alveolar lateral /l/ in Quiché are acquired earlier than in English and that there was a strong correlation between the order of acquisition and the frequency of occurrence of these sounds in Quiché (0.75), while this was much lower for English (0.55).

Some studies investigated the extent to which frequency of occurrence predicts the age of speech sound acquisition. For example, Stoke and Surendon (2005) examined the relative role of input frequency and other factors, such as articulatory complexity and functional load as predictors of consonant development in Cantonese, American English and Dutch. The results indicate that there is a difference between the three languages in terms of the effectiveness of these in determining the accuracy of consonant production. For Dutch, the frequency of occurrence and articulatory complexity had a strong significant correlation with the accuracy of consonant production. For English children, the only factor with a strong correlation with the accuracy of consonant production was articulatory complexity.

Edwards and Beckman (2008) investigated the effect of frequency of occurrence on the age of consonant acquisition across languages. The examined languages were American English, Cantonese, Greek, Japanese, Korean and Mandarin. The results indicate that some of the differences in consonant acquisition are related to speech sound frequency. For example, Greek children acquire the consonant /θ/ earlier than English children. According to Edwards & Beckman (2008) the difference in /θ/ acquisition is due to it being less frequent in English than in Greek. Similarly, the results indicated that /t, ts/ are acquired earlier in Cantonese than in Greek. Also in this case these consonants are more frequent than in Cantonese.

In French, /l/ is acquired earlier than in English (Chevri-Muller et al. 1973). This was

attributed to a difference in the frequency of occurrence of /l/ in the two languages. Yoneyama, Beckman and Edwards (2003) found that /k/ is more frequent than /t/ in Japanese and was acquired earlier than /t/ by Japanese children. This differs from English in which /t/ is more frequent than /k/ and /t/ is acquired before /k/.

Mowrer et al. (1991) explained the way in which the frequency of occurrence could enable children with an early acquisition of high frequency consonants. They suggested that Xhosa children had fewer errors in fricatives than English children because the Xhosa consonant inventory has more fricatives. Therefore, Xhosa children will hear fricatives more frequently and as a consequence they will discriminate them earlier which will facilitate acquisition. This could explain why English children acquire /ʤ/ earlier than Syrian children because the English sound inventory has more affricates which enable English children to practice this manner of articulation more intensively than Syrian children who only have one affricate in their inventory which appear in borrowed words and it is allophone to the fricative /ʒ/.

Some researchers argue that frequency of occurrence of speech sound acquisition in some cases will not provide an adequate explanation for the similarities and differences in speech sound acquisition across languages. There are languages which have high-frequency consonants, but which are nevertheless acquired later than others with a lower frequency. For example, Baayen, Piepenbrock & Gulikers (1995)

describe the descending order of consonant frequency in English as / ð s t h b f w m k p n d r l j g ʃ ʤ v θ z ʒ/. Although / ð/ has the highest frequency of occurrence, many studies on speech sound acquisition in English indicate that it is one of the latest acquired consonants (Dodd et al. 2003, Wellman et al. 1931, Templin 1957, Olmsted 1971).

The second environmental factor that is often mentioned in studies of speech sound acquisition is that of functional load. Pye et al. (1987) determine the functional load of a speech sound by its frequency of occurrence in maximal opposition or the number of minimal pairs within a language. Pye et al. (1987) explain the early acquisition of /ʧ/ and /l/ in Quiché compared to English in terms of differences in functional load. In Quiché, /ʧ/ and /l/ occur in more phonemic contrasts than in English and this makes these two consonants more salient than in English.

Amayreh (2003) examined the acquisition of late developing consonants in Jordanian children to explore the influence of functional load and articulatory complexity. He concluded that the late acquisition of consonants might be a result of a combination of these two factors. However, the functional load across languages is difficult to establish and this idea does not always seem practical. For example So and Dodd (1995) argued that the “notion of functional load does not explore the relationship between the order of speech sound acquisition and the role of these speech sounds in a given language environment “(p. 16).

On the basis of our study, it is not possible to provide additional evidence regarding the potential role of functional load in explaining speech sound acquisition, since there are no studies which have determined the functional load of speech sounds in Syrian Arabic.

The last environmental factor that is often referred to is articulatory complexity of speech sounds. Articulatory complexity is based on maturational theory, which explains the difference in phonological acquisition as a result of biological and physiological constraints during development. Locke (1983) was one of the first to advocate a maturation explanation of the order of speech sound acquisition. He suggested that the latest acquired consonants will be those that are the most difficult to perceive and produce. In contrast, the earliest acquired speech sounds will be those that are easiest to produce which are the most salient to perceive. Smit et al. (1990) use this explanation for the observation that plosives in English are acquired earlier than affricates because they are less complex.

Amayreh (2003) found that the latest acquired Arabic consonants which are the most susceptible to error in Jordanian are /tˤ, dˤ, q, z θ ð/. Amayreh suggests that articulatory complexity is the reason for the late acquisition of these consonants. However, it is worth pointing out that Amayreh did not quantify the articulatory complexity of these speech sounds. In the current study, the articulatory complexity of speech sounds was quantified on the basis of a model proposed by Kent (1992),

which consists of four sets of physiological features that reflect the involvement of motor control to produce speech sounds of increasing difficulty. This model is summarized in table 5.5:

Table 5.5: Four sets of physiological characteristics reflecting increasing motor control to articulate consonants of increasing articulatory complexity.

Set	**Movement**
1	Rapid articulatory movement (e.g. plosive) slow (ramp movement characterized by constant velocity over a relatively long duration) articulatory movement (e.g., slide) velo pharyngeal evolving, plosives and nasal present Voicing adjustment: voiced and voiceless items present (e.g., /m, h/). Primary places of articulation: bilabial, alveolar and glottal.
2	Additional items in the rapid or ballistic movement category additional items in the ramp movement category Fine force regulation for frication Additional primary place of articulation: velar.
3	Additional items in the rapid or ballistic movement category voicing (laryngeal) adjustment tongue configuration (bending)(e.g., /l/

4	Tongue configuration for dental, alveolar, and palatal fricatives fine force regulation for frication at each place of fricative articulation

Note. From "The Biology of Phonological Development", by R. D. Kent 1992, in C. Ferguson, L. Menn, & C. Stoel-Gammon (Eds.), Phonological Development: Models, Research, Implications (pp.74-75), Timonium, MD: York Press. Copyright 1992 by Pro-Ed, Inc. Adopted with permission.

The results of our study indicate that emphatic consonants are acquired late in Syrian Arabic. These consonants have a high articulatory complexity according to Kent (1992). This also holds for the acquisition of /r/ in Syrian Arabic and English. Syrian children acquire /r/ late and it is also late acquired consonant by English speaking children. While /r/ in Syrian Arabic is considered to be an alveolar trill or tap, /r/ in English is a retroflex approximant. Shriberg and Kent (1995) consider the English /r/ to be difficult to articulate as its formation is highly context dependent and there is a noticeable effect of neighbouring sounds on its production (Kanter & West 1960). In this context it should be pointed out that in English there are some sounds besides /r/ which also undergo a noticeable effect from neighbouring sounds. This is particularly true for /k/ the precise realisation of which also differs according to vowel context. It's articulation is more forward before front vowels, while before back vowels it's articulation may be more canonical velar or uvular. Nevertheless, this contextual variation does not seem to prevent the early

acquisition of this speech sound in English.

The third factor that has been used to account for differences in speech sound acquisition between languages is the phonological salience of speech sounds. This can be exemplified by the later acquisition of /s/ and /z/ in Syrian Arabic as compared to English. Arguably, /s/ and /z/ have a higher phonological salience in English as these fricatives differentiate lexical meaning more often than in Syrian Arabic. In word-final position /s, z/ distinguish between singular and plural forms in English. Therefore, they affect the meaning of words especially nouns. For example, 'kiss' becomes kisses (/ˈkɪsɨz/) in the plural, dish becomes dishes in /ˈdɪʃɨz/, cat becomes cats (/kæts/) and boy becomes boys /bɔɪz/. However, the alveolar fricatives do not function in this way in Syrian Arabic.

The role of phonological salience in consonant acquisition is also supported by the findings from other studies. For example, So et al. (1995) compared the rate of consonant acquisition in Cantonese and English. They found that the rate of consonant acquisition in Cantonese was more rapid than that of English. This was also reported by Parther et al. (1975) who suggested that the acquisition differences between these two languages reflect a different phonological salience since there are fewer consonants and clusters in Cantonese (17) in comparison to English (24 and 49 clusters). The larger number of consonants and clusters in English gives the consonants a lower salience and this leads to slower acquisition.

Mowrer et al. (1991) suggested something similar and concluded that Xhosa children acquire consonant speech sounds earlier than English children. Mowrer et al. attributed this to the structure of Xhosa syllables, which hardly allow clusters as a result of the basic CV structure of the language. The lower number of clusters and a fixed syllable structure gives the consonants a higher saliency, which explains their early acquisition compared to English. Similarly, the earlier acquisition of consonants in Syrian Arabic can be accounted for by the greater salience of consonants.

5.12 COMPARISON OF THE AGE OF SPEECH SOUND ACQUISITION IN SYRIAN ARABIC AND OTHER VARIETIES OF ARABIC

In this section, we compare speech sound acquisition in Syrian and other varieties of Arabic, i.e. Jordanian (Amayreh 1994) and Egyptian (Ammar et al. 2006). From our study, it appeared that older children produce vowels and consonants more correctly than younger children. Syrian children have acquired 90% of the SYA consonants at the age of 5:0. This reflects a gradual development of speech sound acquisition in Syrian children over time. As the purpose of this section is to make a comparison with studies on other Arabic varieties, the criterion used to determine speech sound acquisition had to be adjusted to match the criterion used for these other studies. In Jordanian Arabic a speech sound was considered to be acquired when it was produced correctly 75% in all word positions. So when comparing with Jordanian, the data on Syrian Arabic was also viewed in the light of this 75% acquisition criterion. From the comparison, it appears that there are some clear similarities and some obvious differences in the age and order of speech sound acquisition between this study

and studies on other varieties of Arabic.

A comparison of the findings obtained in this study and Amayreh (1994) reveals that Syrian children acquire the majority (57.69%) of the SYA speech sounds at an earlier age than Jordanian children. These speech sounds are /b, d, tˤ, dˤ, h, s, h, x, ʕ, z, ɣ, sˤ, l, r, ʃ/, i.e. 8 fricatives, 3 emphatics, 2 plosives, the trill and the lateral approximant. Some speech sounds are acquired earlier in Jordanian, i.e. /m, k, ʤ (ʒ), ðˤ/. In addition, there are 6 consonants that are acquired at the same age in both languages, i.e. /f, j, t, n, w, ʔ/. The remaining consonant /q/ is not acquired by children in either study. The ages of speech sound acquisition in Syrian and Jordanian children are summarized in table 5.6: the Egyptian data was not included in this table because the ages of several speech sounds were not provided by months and years so we can make comprehensive comparison with results from current study and other Arabic consonants studies.

Table 5.6: Age of consonant acquisition by Syrian Jordanian and Egyptian children.

Consonant	Syrian Arabic	Jordanian (Amayreh 1994)	Egyptain (Ammar & Morsi 2006)
b	2:6-2:11	3:0-3:4	
d	2:6-2:11	3:0-3:4	
dˤ	4:6-4:11	After 6:0-6:4	
t	2:6-2:11	2:6-2:10	By age 4

tˤ	4:6-4:11	5:6-5:10	
K	3:6-3:11	2:6-2:10	By age 4
ʔ	2:6-2:11	2:6-2:10	By age 4
f	2:6-2:11	2:6-2:10	By age 4
l	2:6-2:11	3:6-3:10	By age 4
j	2:6-2:11	2:6-2:10	By age 4
ðˤ	After 6:0-6:4	6:0-6:4	
Z	4:0-4:5	>6:0-6:4	
s	3:0-3:5	5:0-5:4	
sˤ	4:6-4:11	>6:0-6:4	
ʃ	3:6-3:11	5:0-5:4	By age 4
ɣ	4:6-4:11	After 6:0-6:4	
x	3:0-3:5	5:0-5:4	By age 4
ʕ	3:6-3:11	After 6:0-6:4	
ħ	3:0-3:5	After 6:0-6:4	
h	2:6-2:11	5:0-5:4	By age 4
ʒ	6:0-6:5	4:0-4:4	
m	2:6-2:11	Before 2:0-2:4	By age 4
n	2:6-2:11	2:6-2:10	By age 4

r	4:0-4:5	5:0-5:4	
w	2:6-2:11	2:6-2:10	By age 4

As far as the **plosives** are concerned, there are some clear differences between SYA and Jordanian Arabic. The most notable difference relates to /b, d, ʔ/ which were acquired 6 months earlier than in Amayreh (1994). A comparison to Morsi (2003) shows that these consonants are acquired at the same age by Egyptian and Syrian children. Furthermore, /k/ was acquired one year later than in Egyptian and Jordanian.

With respect to the emphatic plosives, Syrian and Egyptian children acquire /dˤ/ at a similar age (4:0-5:0). Jordanian children, however, acquire this consonant about two years later. The earliest age of acquisition for /tˤ/ is reported in Egyptian children (Morsi 2003) who acquire the voiceless emphatic alveolar between the ages of 2:6 and 3:0. Syrian children master this consonant at the age 4:6-4:11 which is one year earlier than Jordanian children who acquired /tˤ/ between the age of 5:6 and 5:11.

Syrian children achieve the acquisition criterion for **nasals** at a similar early age as in the other Arabic varieties. However, Amayreh (1994) and Khattab (2007b) report that Jordanian and Lebanese children acquire nasals before the age of 2, while this study and Morsi (2003) found that nasals were acquired later between the age of 2:6 and 2:11. It is important to note that none of these studies have included children younger than 2:6 and these results may have differed if younger children had been included.

One of the late acquired consonants in Syrian and Jordanian children is the trill. There is only a small difference in the age of /r/acquisition in both languages. Amayreh (1994) reported that Jordanian children acquire /r/ at the age of 5:0-5:5, while Syrian children acquire it at the age of 5:6. However, Egyptian children acquire this sound much earlier at the age of 3:0-4:0.

Comparing the results for fricatives in Amayreh with the results of this study, it can be seen that there are 7 fricatives /s, z, x, ʃ, ʕ, ɣ, h / which reach the 75% criterion at an earlier age in Syrian children. Syrian children acquire all the fricatives earlier than Jordanian children, except for /f/ and /h/. Syrian children acquire /h/ at the age of 2:5 while Jordanian children acquire it at the age of 5:0-5:5. A factor that may explain the big difference in the age of /h/ acquisition in the two varieties is that there is a difference in the criterion of /h/ acquisition between the two studies. In our study /h/ is considered to be acquired when a child produces it correctly 75% in two word positions only, i.e. initial and medial. This is because Syrians rarely use it in final position where it is replaced by /w/: e.g. /rash /Eng. “his head”) becomes/ rasw/.

Table 5.7: The age of fricative acquisition by Syrian and Jordanian children (Amayreh 1994)

	s	Z	x	ʃ	ʕ	ɣ	h
Current study	3:0-3:5	4:0-4:5	3:0-3:5	3:6-3:11	3:6-3:11	4:6-4:11	3:0-3:5

Amyreh (1994)	5:0-5:4	>6:0-6:4	5:0-5:4	5:0-5:4	5:0-5:4	>6:0-6:4	>6:0-6:4

The fricative /s/ is among the earliest fricatives to be acquired by Syrian children at the age of 3:0-3:5. It was acquired by Jordanian children by the age of 5:0-5:4: this suggests a two year difference between Syrian and Jordanian children. Morsi (2003) reported the earliest age for /s/ acquisition among all Arabic varieties, i.e. 2:6.

The alveolar fricative /z/ is acquired about 2 years earlier in Syrian children than in Jordanian children (Amayreh, 1994) and one year earlier than Egyptian children (Morsi, 2003, Ammar et al. 2006).

There are also differences in the age of acquisition between Syrian, Jordanian and Egyptian children for the emphatic alveolar /sˤ/. While Syrian children acquire / sˤ/ two years earlier than Jordanian children, Morsi (2003) reported that Egyptian children acquire /sˀ/ half a year earlier still.

From Morsi (2003) and Ammar et al. (2006) it is clear that Egyptian children acquire postalvealor /ʃ/ earlier than Syrian and Jordanian children. However, Syrian children acquire it about one year before Jordanian children (Amayreh 1994).

The same is true for the age of acquisition of /z, ʃ/. Syrian children achieve the 75% acquisition criterion between the ages of 4:0-4:5 for/z/ and between 3:6-3:11 for/ ʃ/. These fricatives did not reach the acquisition criterion in Jordanian children until the age of 6. The difference in the age of acquisition for / ɣ, ʕ / is about 3.5 years between Syrian and Jordanian children.

Morsi reported the earliest age of acquisition of /x/: Egyptian children acquired /x/ at the age of 2:6-3:0. The results from the current study are consistent with the study of Ammar et al. (2006), who found the age of /x/ acquisition to be 3:0-3:5. However, in the study by Amayreh the age of /x/ acquisition was 5:0-5:4, i.e. about two years later than Syrian children and 3 years by Ammar et al. (2006).

In the acquisition of fricatives in Syrian and other varieties of Arabic, the general trend is that acquisition is earlier in Egyptian and later in Jordanian with Syrian Arabic featuring in between.

As far as the approximants are concerned, there are no differences in the age of acquisition of /j/ and /w/ in the three languages: Syrian, Jordanian and Egyptian children acquire these at the same age; between ages of 2:6-2:11. The lateral approximant is acquired at the same age (2:6-2:11) in SYA and Egyptian, while Jordanian children acquire it one year later.

From the above, it is tricking that the majority of speech sounds are acquired earlier in Syrian as compared to other varieties of Arabic. The major conclusions are: (1) Syrian, Egyptian and Jordanian children acquire nasals, trills and approximants at a very similar age; (2) Syrian children acquire plosives earlier than Jordanian and Egyptian children except for [k]; (3) All fricatives are acquired earlier by Syrian children than Jordanian, except for [f], and [h]; (4) Egyptians acquire some fricatives earlier than Syrian children. These differences will be discussed in light of the frequency of occurrence and functional load of consonants within these varieties, the acceptable free variation within speech sounds due to dialect variation, and methodological differences between these studies.

In an attempt to explain the differences in the age and order of speech sound acquisition

across languages and across different varieties, many researchers have argued that the acquisition of speech sounds is related to the frequency of speech sounds in the language.

Numerous studies have discussed the relationship between speech sound frequency in a language and their acquisition (Yoneyama et al. 2003, Ferguson 1978, Edwards & Beckman 2008, Stoke & Surendon 2005). They suggest that more frequently occurring consonants are acquired earlier than the less frequent speech sounds because they are more familiar to a child. For example Dyson et al. (2000) examined the frequency rank order of consonants used by adults who speak Educated Spoken Arabic. They found a similar ranking between the speech sounds that were acquired early (less than 3:6 years) and the frequency occurrence of these consonants. In Amayreh (1994), the first eight acquired speech sounds in Jordanian Arabic (/n, m, t, ʔ, l, j, b, l/) are also the most frequently occurring consonants. The same relationship can be found between the speech sounds that were acquired last, i.e. /tˤ, dˤ, q, ðˤ, ð, θ, z, sˤ, ʕ/. All of these, with the exception of /ʕ/, are amongst the least frequently occurring speech sounds. These findings do support the view that there is a relationship between the frequency of occurrence of speech sounds and the rate of acquisition.

Examining the difference in the age and order of consonant acquisition between SYA and Jordanian, the results indicate that fricatives are acquired earlier in SYA than in Jordanian. This difference may also have to be attributed to the difference in the frequency of occurrence of consonants in the two varieties. The results from studying consonant frequency in Syrian children indicates that fricatives occur more frequently in Syrian children than in Jordanian children (SYA 24.21, while Jordanian 23.01). For example, the

rank order of /h/ in SYA was 8 with a 5.75 % occurrence, whereas the rank order in Jordanian was 15 with a percentage of occurrences of 2.91 %. The same applies to emphatic consonants, which are acquired earlier by Syrian children. Also in this case the rank order and the frequency of occurrence of emphatic consonants in SYA is higher than in Jordanian.

Furthermore, it is interesting to see that 41.66 % of the consonants that are acquired early by Syrian children are also the more frequently occurring consonants. In Jordanian, only 33.3% of the earliest acquired consonants have a higher frequency of occurrence.

This study also provides evidence that the frequency of occurrence of some consonants do not always support the claim regarding the relationship between age of consonant acquisition and the frequency of occurrence in a language. For example, the rank order of the frequency of occurrence of /r/ is fifth in Syrian children, making it one of the most frequently occurring consonants in SYA. However, Syrian children acquire it rather late between 5:0-5:5 years. Therefore, the high frequency of this consonant does not correlate with it being a late-acquired speech sound. The same was evident for /k/. Smit et al. (1990) concluded that a high frequency of occurrence of some consonants does not necessarily predict the age of acquisition of speech sounds.

The fact that Syrian children acquire some consonants earlier than children from other Arabic varieties can also be attributed to the different structure of Arabic varieties in general and to the specific phonological characteristics of each variety. In the present study Syrian children acquire emphatic consonants about one and a half years earlier than Jordanian children. These consonants are acquired after the age of 6:4 by Jordanian children, compared to Syrian children who acquire these emphatic consonants between the

ages of 4:6-4:11. This may be due to the dialect differences. In fact, the participants in the study by Amayreh (1994) were from the Amman area and according to Daana (2009), the Ammani speakers pronounce emphatic consonants /tˤ, dˤ, sˤ/ as non-emphatic. Therefore Amman children do not use emphatic sounds until they go to primary school and this could explain why they are acquired later by Jordanian children. Since Syrians do not replace these consonants by other dialectal variants, emphatic consonants are more common in SYA and are therefore acquired earlier than Jordanian children.

Dialect differences could also be relevant to explain differences in the age of consonant acquisition. Saleh et al. (2007) reported a difference in the use of some consonants in Egyptian children in two different studies. Saleh et al. (2007) reported a clear difference in the acquisition age of /l, r, ʃ, h, ʕ/: Egyptian children have mastered these sounds by the age of 2:6, whereas these consonants are not used by Egyptian children at this age (Omar 1973). Saleh et al. (2007) concluded that this difference might be due to the dialect differences between the rural communities in the study by Omar and urban Cairo in the study by Saleh et al.

There are also some studies on English, which support the claim that dialect differences may be relevant to explain differences in speech sound acquisition. For example, Pearson, Velleman, Bryant & Charko (2009) compared the age of consonant acquisition in 537 children who spoke African-American English (AAE) and 317 children who spoke Mainstream (MAE) American English. The results showed that individual consonants were mastered along different trajectories in the two varieties. They suggested that there is an influence of the adult target dialect on the rate and order of acquisition of specific

consonants and consonant clusters. For example, AAE children AAE children acquired /ð/ at a significantly later age than MAE children. Pearson et al. (2009) concluded that the difference between the ages of /ð/ acquisition in the two varieties is due to a difference in pronunciation. AAE adults tend to substitute it with either /d/ or /f/ and the low frequency of /ð/ in adult AAE speakers decreases the opportunity for children to hear it and consequently to acquire it early. Velleman and Pearson (2010) extended Pearson's study (2009) to 148 children with speech sound disorders (SSD): 72 learning General American English and 76 learning African American English only. The results indicated that consonants were mastered at different rates, even among children with speech sound disorders. For example /t, k, g, ʃ, ðˤ/ were acquired earlier in children with General American English, while /j, f, s, v, tʃ, ʤ, r/ were mastered earlier by children learning African-American English. They concluded that dialect does impact on consonant acquisition and relying on norms based on General American English only, may not be appropriate for speakers of another dialect.

CHAPTER 6: PHONOLOGICAL ERROR PATTERNS

6.1 INTRODUCTION

This chapter looks at the phonological error patterns which occur in the speech data of Syrian children. This normative information of phonological error pattern provides a guide for appropriate referral to treatment services, that knowledge of the types of phonological error patterns which typically occur at different ages is essential when making a correct diagnosis. It also will enable SLTs to formulate more appropriate objectives and procedures of treatment. These also give us useful developmental and cross linguistic data that it present valuable information whether phonological error patterns are similar across languages and thus provide those working in universal theory with important evidence to either support or refute their theoretical claims.

6.2 DATA PROCESSING

In order to calculate the number of times a specific phonological error pattern occurred in the articulation test data, first and foremost the number of potential occurrences of an error was established. In the case of 'stopping' for example, this means that the number of fricatives was counted which could potentially change to plosives in the articulation test. The potential occurrences of each error pattern are summarized in table 6.1. Subsequently, the actual incidence of each error pattern

was counted and expressed as a percentage of the number of potential occurrences. The target phonological error patterns were weak syllable deletion, consonant deletion, stopping, fronting, backing, de-affrication, voicing change, gliding, glottalization, dentalization, de-emphasis. These phonological error patterns were chosen because their occurrence in the speech of typically developing children is very common across languages (Shriberg & Kwiatkowski 1980). De-emphasis and glottalization were also analyzed because previous studies on other Arabic varieties have shown that these processes occur in preschool Arabic children (Dyson & Amayreh 2000).

Table 6.1: The number of possible occurrences for each phonological error in the articulation test.

Phonological error	Possible occurrence in the articulation test
Weak syllable deletion (WSD):	39
Consonant deletion CD	148
Gliding	12
Stopping	70
Fronting	11
Backing	48
Dentalization	15

Deaffrication	3
Glottalization	64
De-emphasis	16
Voicing change	23

The phonological error patterns in Syrian children are summarized in figure 6.1. The results clearly indicate that the number of errors decreases gradually as children become older. Starting with 7.60% in the youngest age group, the number of phonological errors decreases to 3.15% in age group 5:6-5:11. By the age of 6:0 all phonological errors have disappeared. These results provide further evidence of the construct validity of this articulation test.

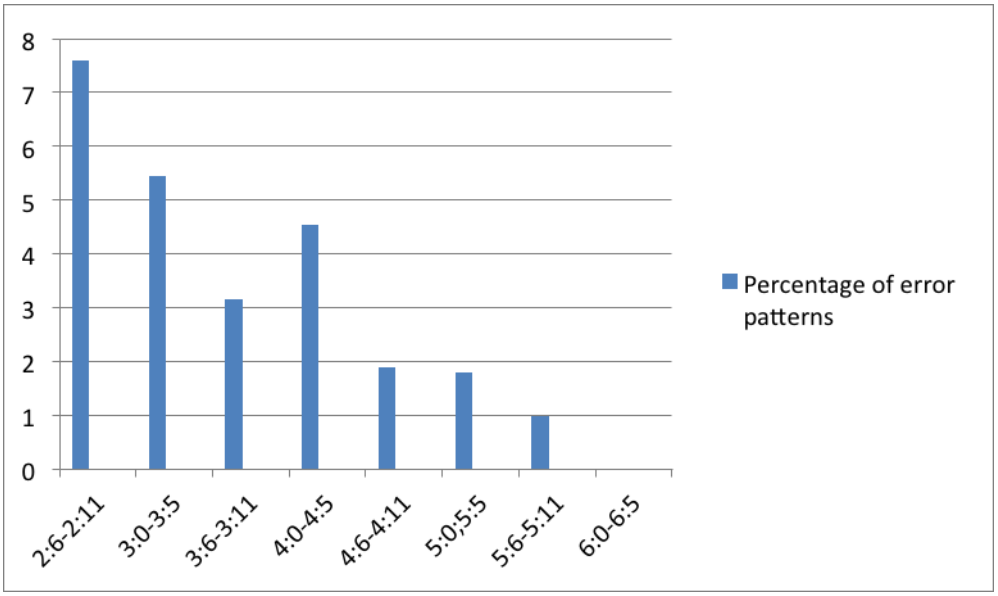

FIGURE 6.1 : PERCENTAGE OF ERROR PATTERNS IN EACH AGE GROUP.

The prevalence of individual phonological error patterns is summarized in table 6.2

and figure 6.2. From this, it appears that there is a marked decrease of all phonological errors between the ages of 2:6 and 6:5. The most common error patterns are /r/-deviation, de-emphasis, fronting and dentalization. The number of errors drops below 5% between the ages of 5:6 and 5:11.

Table 6.2: The percentage of phonological error patterns in Syrian children in different age groups (%)

	2:6-2:11	3:0-3:5	3:6-3:11	4:0-4:5	4:6-4:11	5:0-5:5	5:6-5:11	6:0-6:5
WSD:								
M	6.74	4.90	4.80	2.05	0.28	0.28	0.36	0
SD	3.57	3.74	3.73	3.58	0.19	0.19	0.91	0
CD:								
M	0.52	1.3	0.62	0.77	0.19	0.19	0.09	0
SD	0.58	1.25	1.17	1.37	0.39	0.50	0.29	0
r-deviation								
M	25.25	12.9	11.49	8.82	9.21	4.99	3.71	0
SD	17	15	14.3	13.6	16.12	9.59	4.88	0

Stopping	M	1.55	0.45	0.15	0.71	0.42	0	0.15	0
	SD	1.94	1.06	0.65	1.82	1.39	0	0.65	0
Fronting	M	21.26	10.6	7.96	7.96	8.73	7.48	5.91	0
	SD	17.73	13.3	10.96	10.96	10.59	10.47	9.00	0
Backing	M	3.11	2.71	1.03	1.7	0.37	0.09	0	0
	SD	3.63	3.01	1.55	3.23	0.98	0.42	0	0
Dentalization									
	M	18.47	14.3	11.96	10.7	4.20	3.98	3.5	0
	SD	15	13.5	10.20	14	5.5	4.99	4.15	0
Deaffrication									
M		6.6	4.5	4.07	2.13	0.54	0.49	0.27	0
SD		3.61	3.13	3.17	3.01	0.42	0.26	0.74	0
Glottalization									
M		3.40	3.05	0.46	0.28	0.17	0.52	0.15	0
SD		2.75	3.02	0.89	0.19	0.50	1.24	0.69	0

Devoicing M	8.42	5.26	2.71	3.90	1.65	1.22	0.95	0.57
SD	4.62	4.68	3.03	4.96	2.53	2.64	1.87	1.49
De-emph M	26.33	20.6	12.33	12	2.033	5.61	2.22	0
SD	13.33	17.8	8.98	11.4	3.91	6.38	4.34	0

The table seems to show that there is a parallel fall in error rates for WSD, dentalisation, and de-emphasis between the ages of 4:0-4:5 and 4:6-4:11. This speech sound could be explain in that at age 4:6-5:0 years most Syrian children enter nursery, they begin to listen to speech sounds and take phonetics courses so their teachers begin to alert them to sound and help them to correct their articulation error hence some error patterns disappear from their speech.

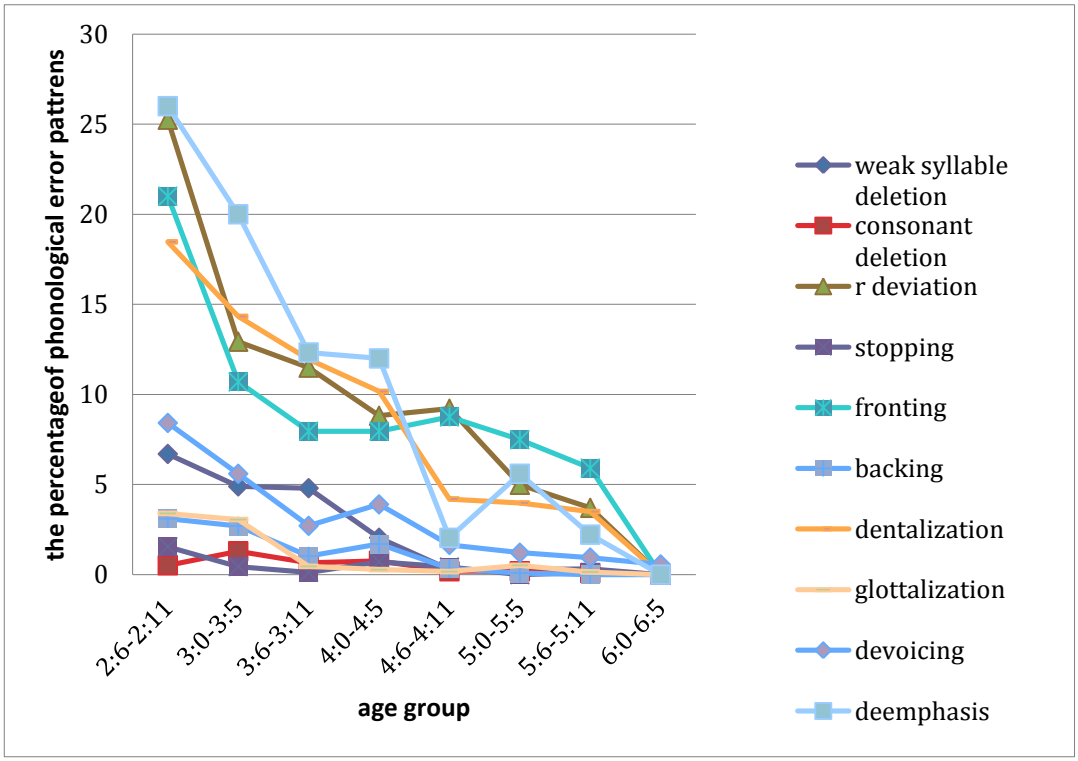

FIGURE 6.2 : THE PERCENTAGE OF PHONOLOGICAL ERROR PATTERNS IN SYRIAN CHILDREN IN DIFFERENT AGE GROUP.

As a further step in the analysis, it was investigated whether phonological error patters were developmental or not. Developmental errors are phonological errors which most typically developing children use in a specific age group and which subsequently disappear with maturity. The speech samples were analysed to determine the developmental phonological error patterns. Errors were considered to be developmental (age appropriate) when they appeared 5 times (twice in the case of weak syllable deletion) in a child's speech sample and in more than 10% of all children in an age group. This criterion to determine developmental error patterns was adopted from Zhu Hua & Dodd (2006). Table 6:3 provides information

about the developmental error patterns in each age group.

Table 6:3: developmental error patterns in Syrian children.

Age	WSD	Consonant deletion	Gliding	Fronting	Backing	Glottalization	Dentalization	De-emphasis	Devoicing
2:5-2:11	x	x	x	x	x	x	x	x	x
3:0-3:5	x	x	x	x	x	x	x	x	x
3:6-3:11	x	x	x	x				x	x
4:0-4:5	x	x	x				x	x	x
4:6-4:11			x	x					
5:0-5:5			x	x					
5:6-5:11									
6:0-6:5									

On the basis of the criteria specified earlier, it was noted that WSD, consonant deletion, gliding, fronting, backing, glottalization, dentalization, de-emphasis and devoicing are phonological errors which occur in the two youngest age groups.

Backing, glottalization and dentalization disappear by the age of 3:6-3:11. In the age group 4:0-4:5 fronting has disappeared. Furthermore, dentalization met the criterion for this age group, having not achieved it in previous age group. Between the ages of 4:6 and 5:5 the only errors which appear in children's speech are gliding and fronting. After the age of 5:5 no error can be considered as age-appropriate.

6.3 ERROR PATTERNS ACCORDING TO PLACE, MANNER AND VOICING

The phonological errors in this study were classified according to changes in manner, place and voicing. These are summarized in figure 6.3. From this, it is clear that the phonological errors affecting the manner of articulation are more frequent than those affecting place and voicing features. The percentage of manner and place errors is 19.99 % and 11.41% respectively at age 2:6-2:11. This number decreased gradually by age. The voicing errors were fewer than 6% in all groups. In older children the number of errors affecting manner, place and voicing are very similar and less than 3%.

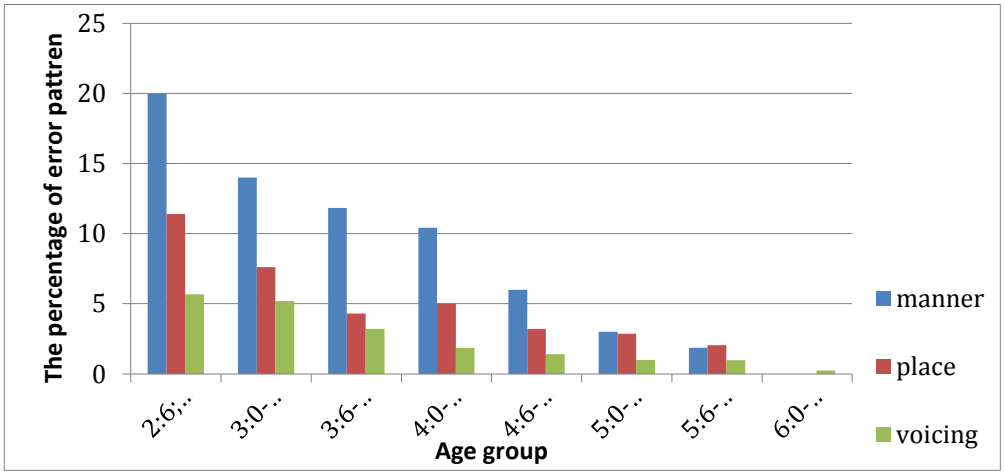

FIGURE 6.3: THE OCCURRENCE OF ERROR PATTERNS ACCORDING TO PLACE MANNER AND VOICING IN THE DIFFERENT AGE GROUP.

6.3.1 ERROR PATTERNS PERTAINING TO THE MANNER OF ARTICULATION.

The errors pertaining to the manner of articulation are summarized in figure 6:4.

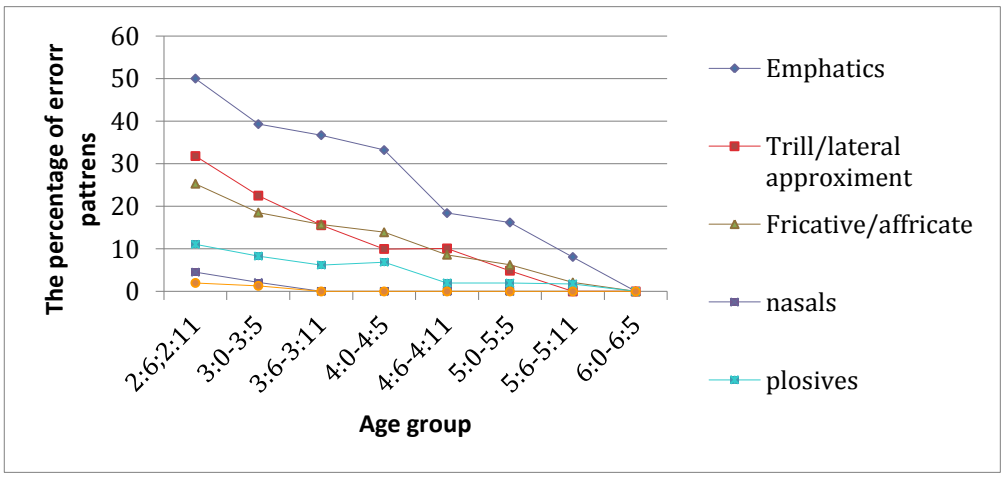

FIGURE 6.4: THE PERCENTAGE OF ERROR PATTERNS FUNCTION OF MANNER OF ARTICULATION.

The results clearly show that errors occurring for the emphatics are most frequent. These were followed by the lateral approximant, the trill and the fricatives. Nasals and central approximants showed the lowest number of errors with less than 5% in

children from the youngest age group. Plosives occupy a position between fricatives and nasals/approximants.

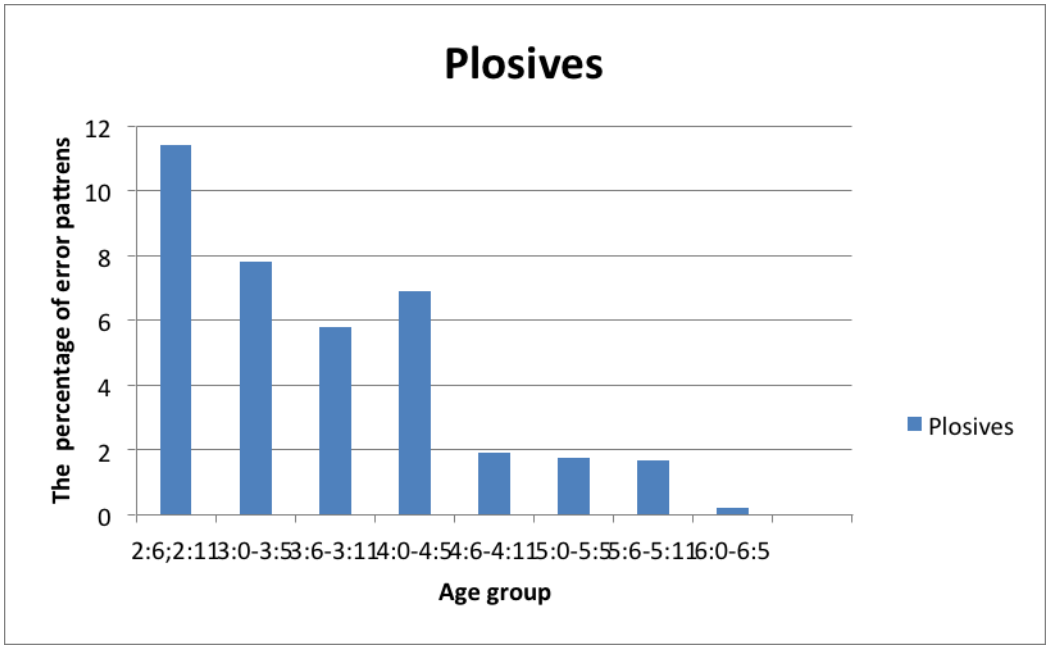

FIGURE 6.5: SUMMARY OF THE INCIDENCE OF THE PERCENTAGE OF ERROR PATTERNS INVOLVING PLOSIVES.

From figure 6.5 it appears that the most common errors pertaining to plosives are fronting, devoicing and deletion.

The phonological error patterns concerning nasals are very rare in Syrian children as can be seen in figure 6.6:

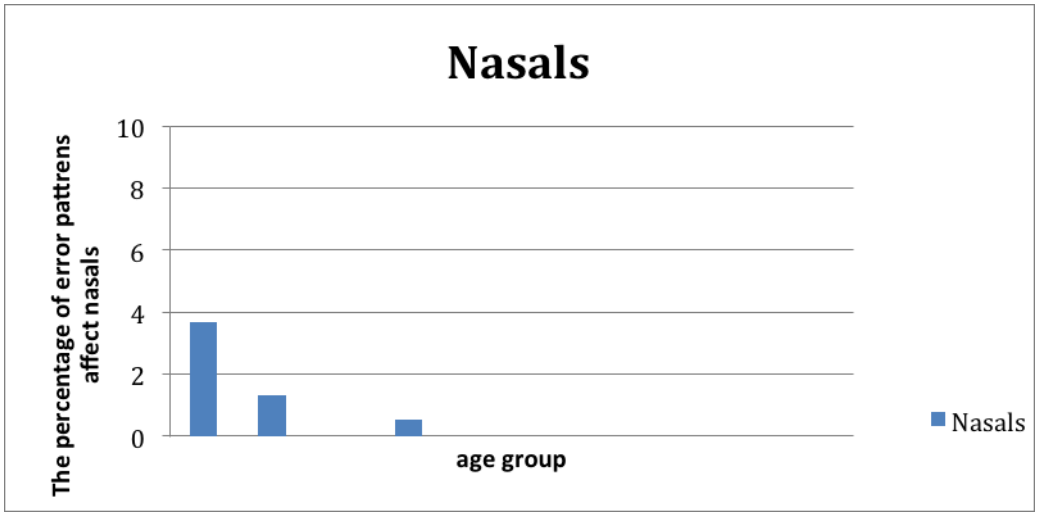

FIGURE 6.6: THE PHONOLOGICAL ERROR PATTERNS CONCERNING NASALS.

The most common error for /m, n/ is de-nasalization and omission. Nasal errors occur at 3.66 % in the age group 2:6-2:11 and 1.33% in the age group of 3:0-3:5. Subsequently, these errors disappear entirely from children's speech.

The errors concerning /r/ realisation are summarized in figure 6.7.

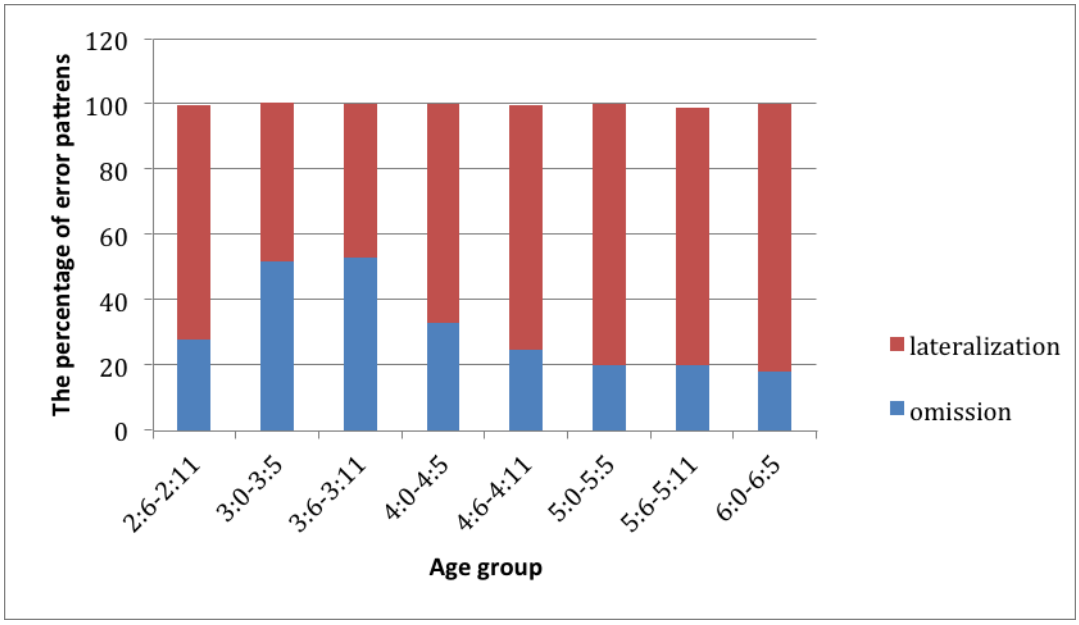

FIGURE 6.7: DIFFERENT PHONOLOGICAL ERRORS CONCERNING /r/ REALISATION.

Examination of the type of error for /r/ shows that the predominant error was lateralization, i.e. the replacement of /r/ by /l/. This error is clearly developmental. Another error affecting /r/ is omission, with an overall occurrence of 24 %. A less frequent error is the substitution of /r/ by /w, j/ which occurred less than 5% in any age group.

The percentage of errors affecting fricatives and affricates is illustrated in figure 6.8:

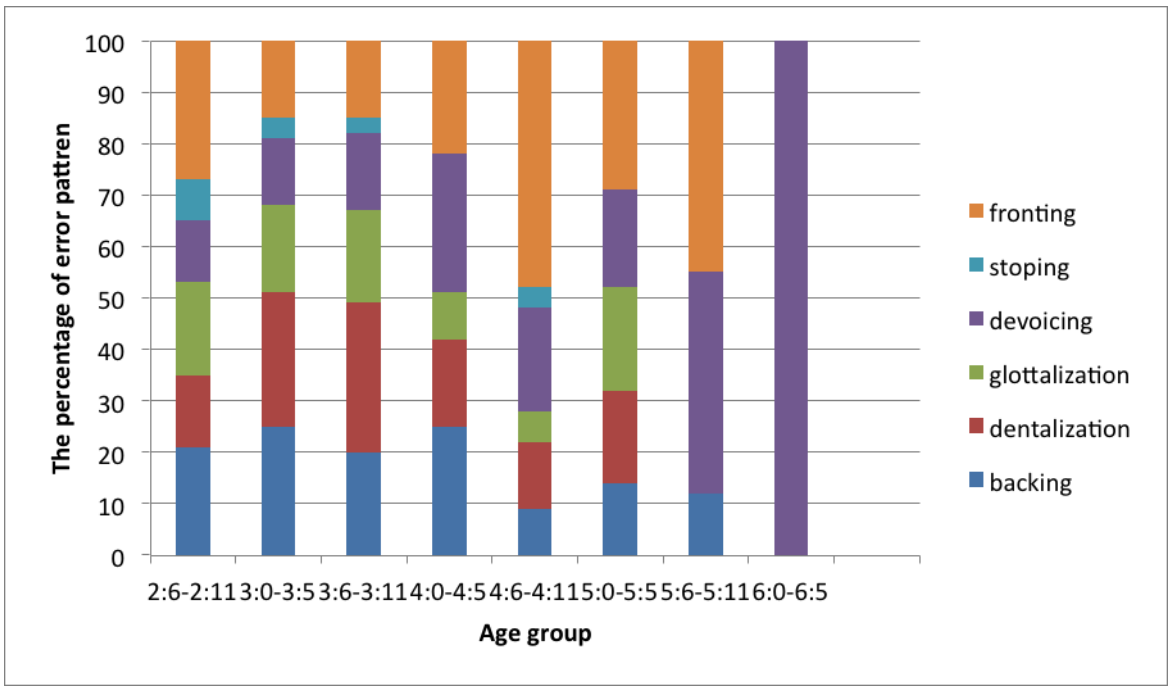

FIGURE 6.8: THE PERCENTAGE OF PHONOLOGICAL ERRORS AFFECTING FRICATIVES.

It can be seen that there various errors and few of them occur with a frequency higher than 25% (fronting, devoicing, glottalization, dentalization, backing). The

pattern that occurred most often for fricatives was fronting, which varied between age groups (27.14% for ages 2:6-2:1 and 50% for the age group 5:6-5:11). The second most frequently occurring error for fricatives was devoicing, especially in word final position. There are very few voicing errors in word-initial position (2%). The occurrence of glottalization and dentalization decreased over time. Backing was frequent in fricatives, but only in children aged 2:6-2:11 to 4:0- 4:5.

With respect to the number of phonological errors involving approximants, it can be seen in figure 6.9 that the percentage of errors in approximants is less than 5% in any of the age groups.

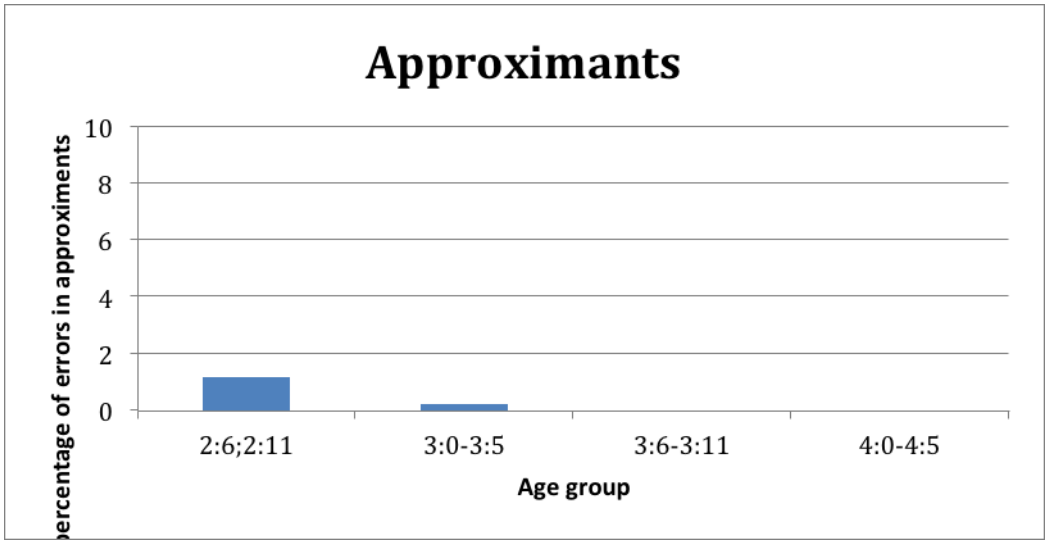

FIGURE 6.9: PHONOLOGICAL ERRORS INVOLVING APPROXIMANTS.

No errors were found in children's speech after the age the age of 3:11. The only error pattern affecting approximants is deletion. Rare error patterns occurred for /l/ less than 2%, the most frequent was gliding /l→j, l→w/ with a very low

percentage.

The percentage of errors affecting emphatic consonants decreased gradually with age. This is evident from figure 6.10:

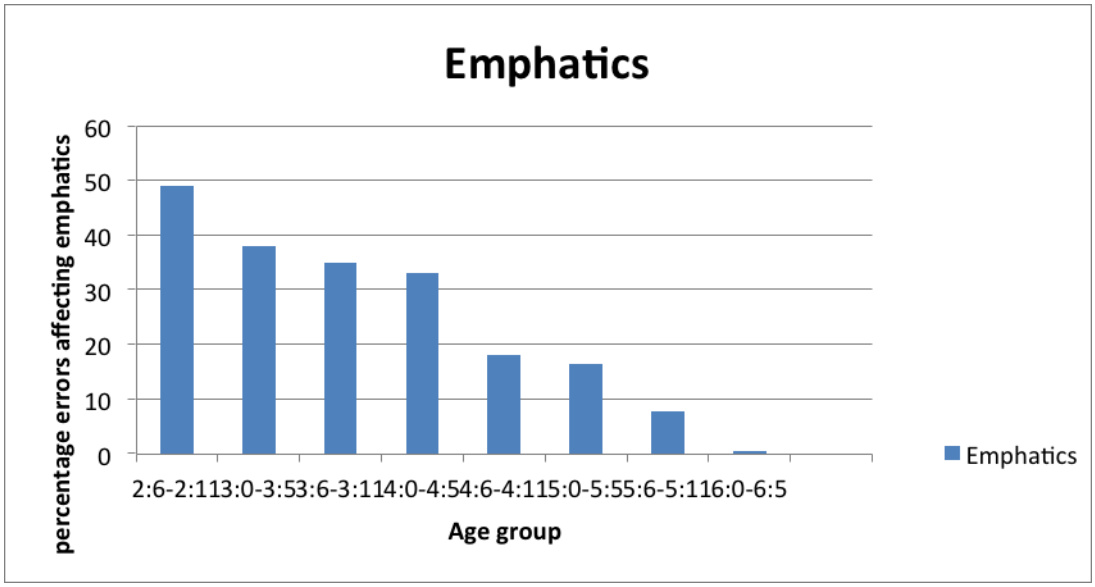

FIGURE 6.10: PERCENTAGES OF ERRORS INVOLVING EMPHATICS.

There are two prominent error patterns occurring in emphatics: de-emphasis /tˤ, dˤ, sˤ/, and dentalization of /sˤ/. In general, the percentage of de-emphasis errors was higher than dentalization errors for all age groups. The only exception was for the age group 4:6-4:11.

6.3.2 ERROR PATTERNS AFFECTING PLACE OF ARTICULATION

The errors affecting place of articulation are summarized in figure 6.11:

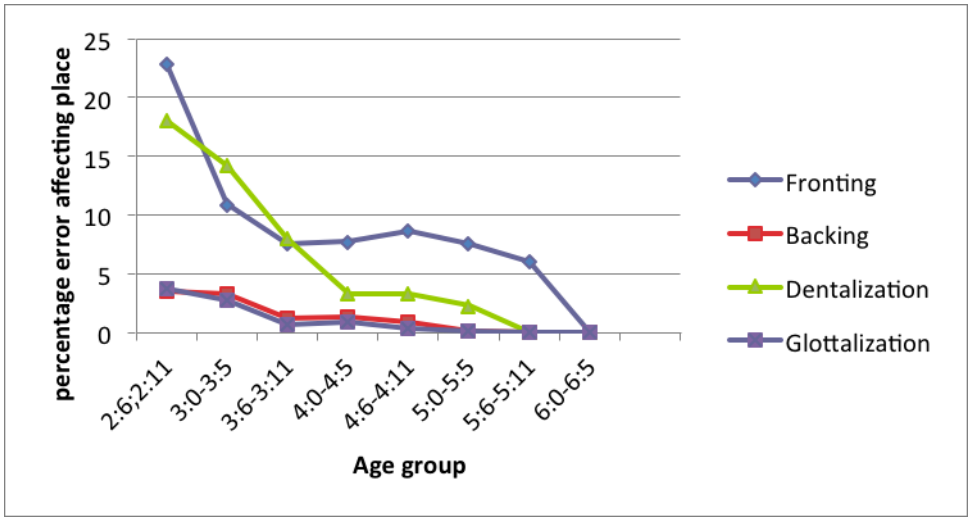

FIGURE 6.11 : PERCENTAGE OF OCCURRENCE OF PLACE ERRORS AS FUNCTION OF AGE.

It appears that fronting and dentalization are the predominant error patterns in that both occur more than 17% in the age group of 2:6-2:11. Dentalization decreases to less than 4% at the age of 4:6-4:11. Fronting occurs more than 5% in older children except between the ages of 6:0 and 6:5. Neither backing nor glottalization occurred in more than 5% in all age groups. All error patterns involving place of articulation have disappeared by the age of 6.5.

6.3.3 VOICING ERRORS

There are two voicing changes observed in children's speech, i.e. final devoicing and initial voicing. Their frequencies are summarized in figure 6.12. Word-final devoicing was the most frequent error in all age groups. The occurrence of initial voicing was not very common generally.

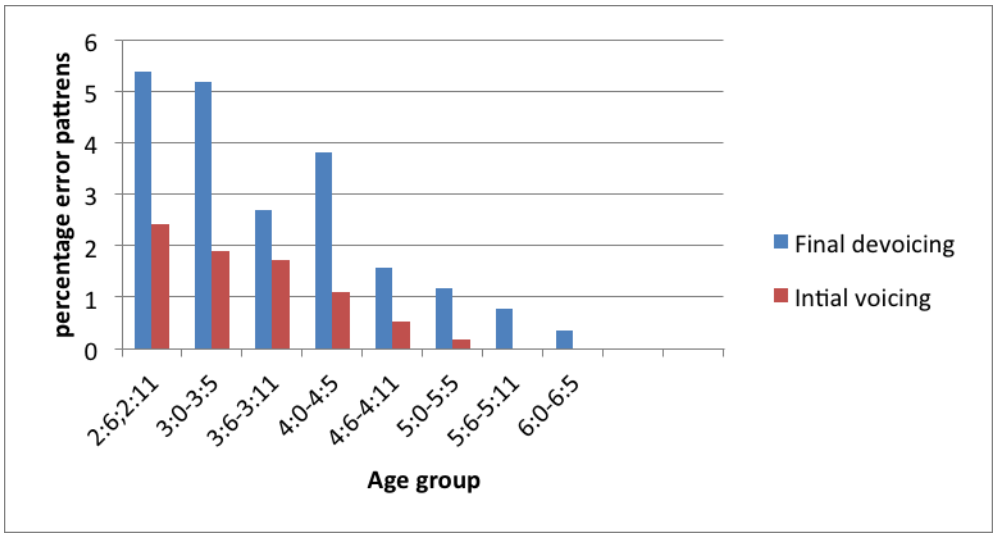

FIGURE 6.12 : PERCENTAGE OF OCCURRENCE OF VOICING ERRORS AS FUNCTION OF AGE.

6.3.4 GENDER DIFFERENCES IN ERROR PATTERNS AFFECT EACH SPEECH SOUND CLASS

A comparison was made between Syrian males and females in percentage of all phonological error patterns for all types of phonological error patterns . One way ANOVA test was used to discover whether the difference between male and female is significant or not in each error type at each age with sex as

the independent variable

A one –way ANOVA results indicate that there are not any significant differences between male and female in percentage of most of phonological error pattrens(except stopping F(1,14)=4.99, p=1.000.

Here is a summary of carring out a one –way ANOVA:

The difference is not significant for consonant deletion f(1,14) =4.60, p= 0.67.

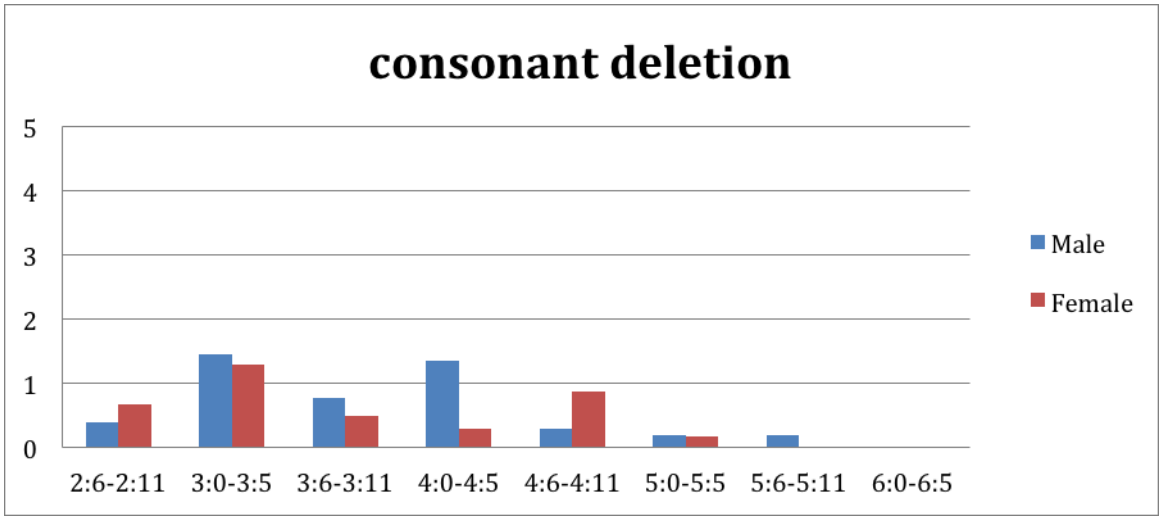

FIGURE 6.13: PERCENTAGE OF OCCURRENCE OF CONSONANT DELETION IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE .

For **stopping** the difference is significant for stopping F(1,14)=4.99, p=1.000.

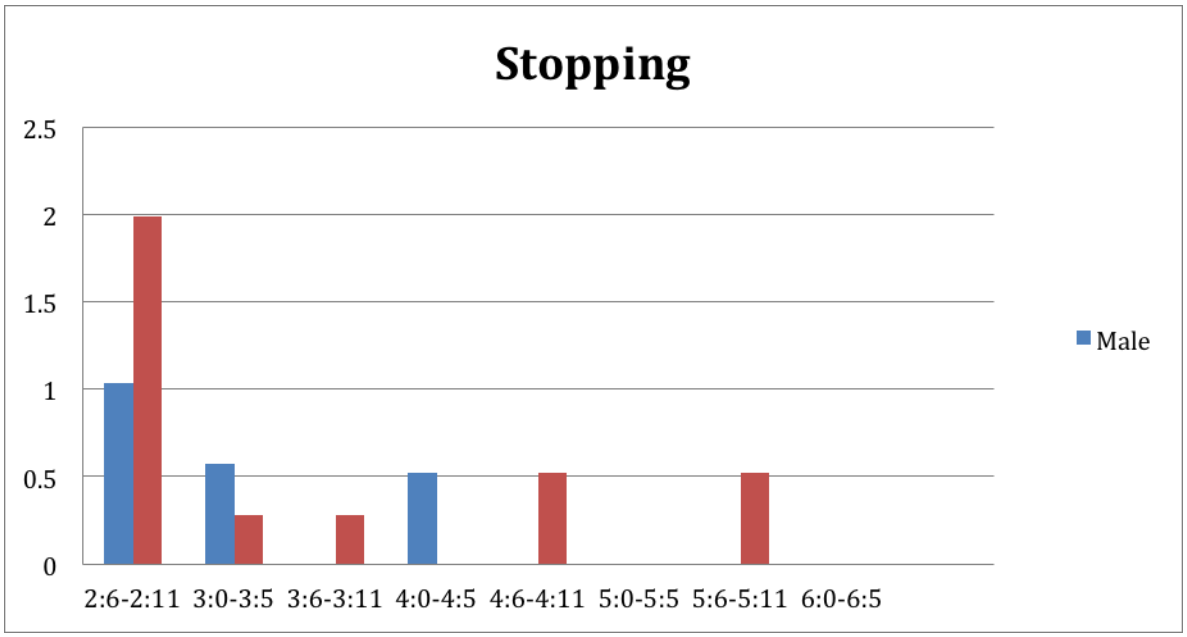

FIGURE 6.14: PERCENTAGE OF OCCURRENCE OF STOPPING IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

For **Weak syllable deletion**:The difference is not significant F(1,14) =4.60, p= 0.46

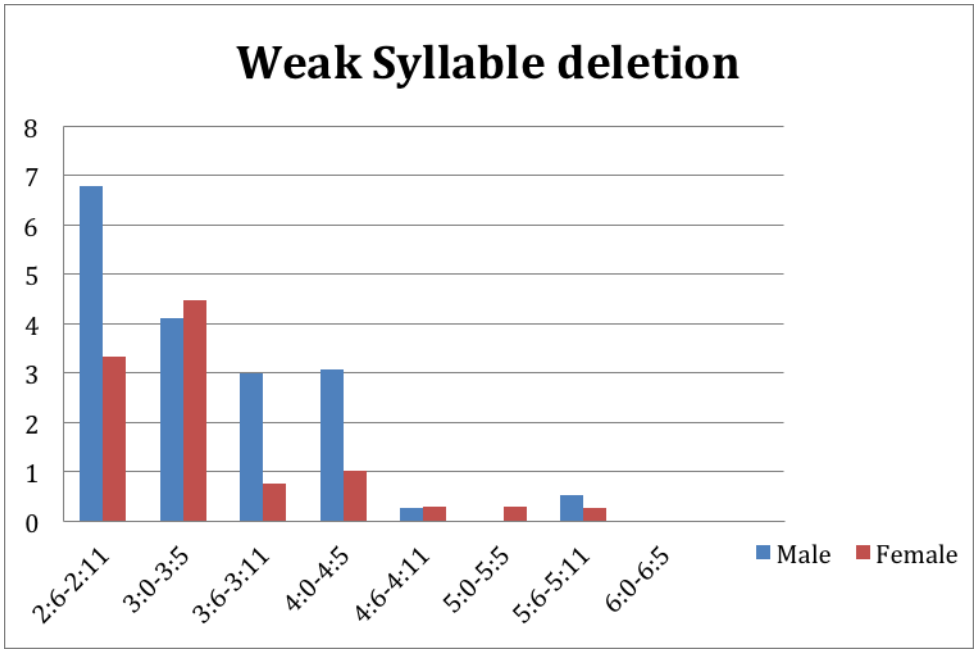

FIGURE 6.15: PERCENTAGE OF OCCURRENCE OF WEAK SYLLABLE DELETION IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

For **devoicing** the differences are not significant F(1,14) =4.60, p= 0.704.

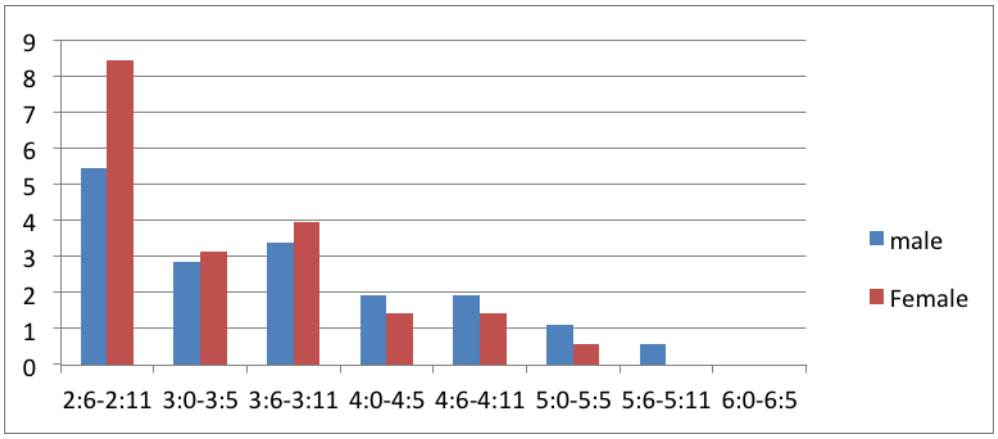

FIGURE 6.16: PERCENTAGE OF OCCURRENCE OF DEVOICING IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

For de-emphasis the differences areis not significant F(1,14) =4.60, p= 0.92.

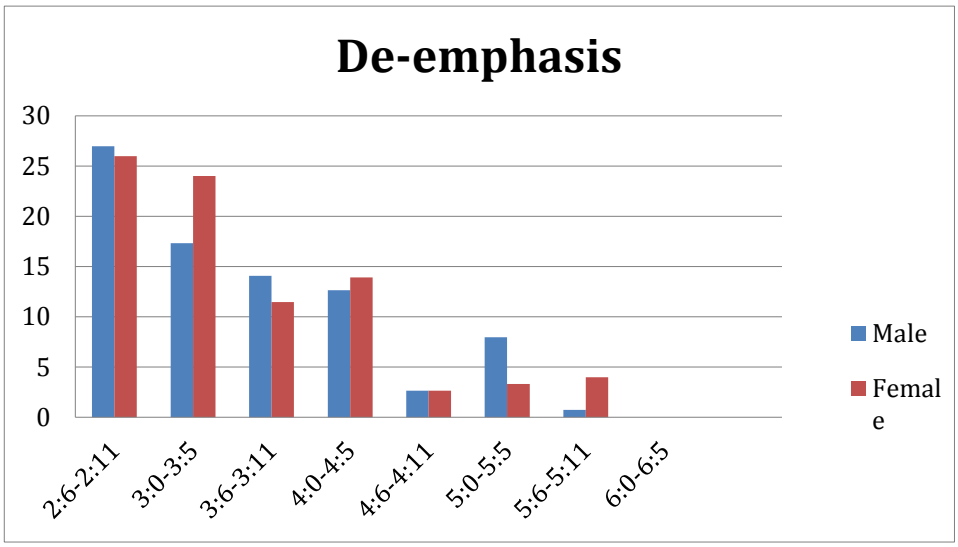

FIGURE 6.17: PERCENTAGE OF OCCURRENCE OF DE-EMPHSIS IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

For **glottliztion** also there is no significant difference between boys and girl

F(1,14) =4.60, p= 0.87.

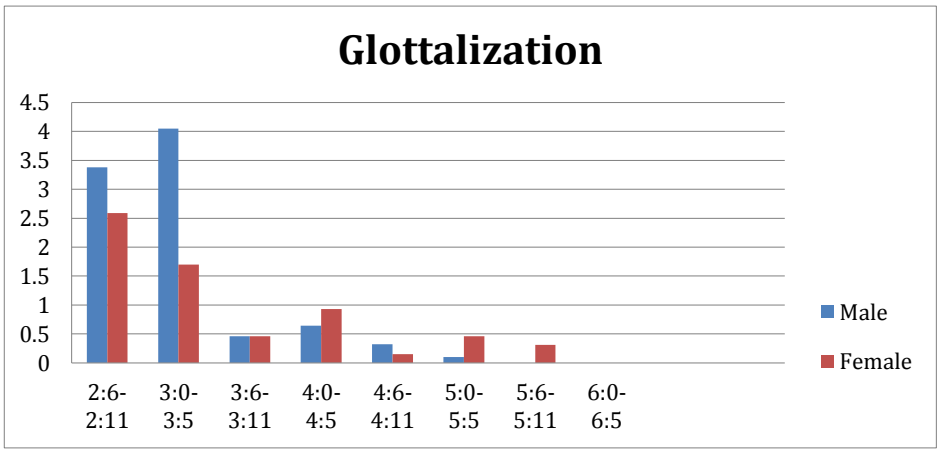

FIGURE 6.18: PERCENTAGE OF OCCURRENCE OF GLOTTLIZTION IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

For/ **r/ deviation** there is also no significant difference between boys and girl

F(1,14) =4.60, p= 0.92.

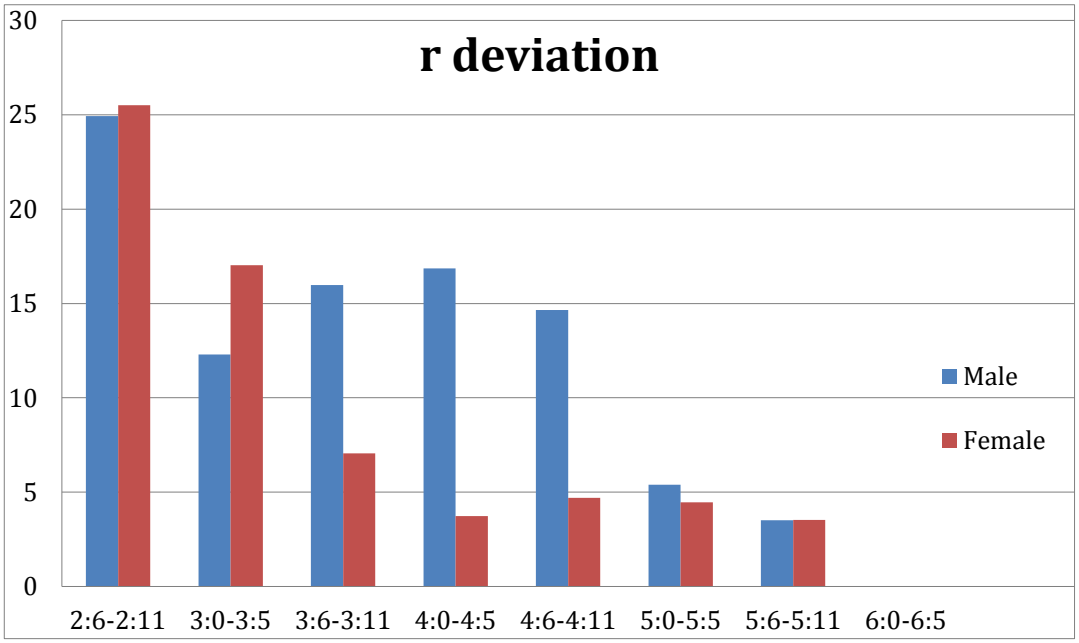

FIGURE 6.19: PERCENTAGE OF OCCURRENCE OF R DEVIATION IN SYRIAN MALE AND FEMALE AS FUNCTION OF AGE.

6.4 COMPARING PHONOLOGICAL ERRORS IN SYRIAN AND OTHER VARIETIES OF ARABIC

Phonological error patterns are defined in this study as a consistent difference between child and adult production of the target words. Two analyses were carried out to study phonological error patterns in Syrian children; the percentage of common phonological error patterns and the percentage of children who use each error. The percentage of occurrences for each phonological process was determined for each child by dividing the actual number of errors occurring for each process by the total number of identical occurrences of that process responding to the articulation test. This method was used to quantify the error patterns and to determine the different types of phonological error patterns used and to establish

differences between Syrian Arabic and other languages. In addition, the percentage of children using each phonological error pattern in each age group was used to determine the developmental error patterns and the age at which phonological error patterns disappear in Syrian children. The criterion to calculate the percentage of children who used phonological error patterns was that an error should occur in the child's speech five times and the error should be used by more than 10% of children in an age group. If the percentage of children in an age group, who used a phonological error pattern, was less than 10%, it was concluded that it had disappeared. This criterion for identifying developmental errors and the age of disappearance was based on Zhu et al. (2006).

The results of this study indicate that a total of 11 phonological error patterns occur in the speech of Syrian children. A survey of these errors is given in table 6.4:

Table 6.4: phonological error patterns in Syrian children's speech.

Error pattern	Identification	Example
r-deviation	/r/ becomes either /j/or [l/]	/baqara/ Eng. (cow) becomes/ baqaja/. /ʔarnab/ becomes ʔalnab Eng. (rabbit).
Fronting	Back sounds replaced by front sounds	/kase/ becomes /tase / Eng. (a class) /.
Stridency deletion	Omitting strident sounds or replacing strident sounds with non-strident consonants.	/saʕa/→/aʕa/ Eng. (a clock).
De-emphasis	Replacing emphatic consonants with non- emphatic.	/batˁtˁa/→ //batta/ Eng. (duck).
Weak syllable deletion	Omitting one syllable of multi syllable word, usually unstressed or weak syllable.	/tefa ħa /→ / fe ħa / Eng. (an apple).
Stopping	Replacing continuing consonants with plosive consonants.	/samake/→ /tamake/ Eng. (a fish).
Backing	Replacing front and mid consonants with back consonants.	/tefa: ħ/ becomes/ tefa: ħ/ "apples".

Glottalization	Replacing non-glottal sounds with glottal consonants.	/ʕe:n/→ / /ʔe:n/ Eng. (an eye)
Devoicing	Replacing a voiced consonant with a voiceless consonant.	/jad/→ /jat/ Eng. (a hand).
Assimilation	In this process one sound becomes more like a nearby sound.	/najem /→ /majem / Eng. (he is sleeping).

One dialectal phonological error pattern called epenthesis is where a vowel may be placed between consonants to separate them to make pronunciation easier (e.g. /bent/ → /benet/,"Eng. girl").

On the basis of a developmental criterion to define the phonological error patterns used by Syrian children, it can be concluded that there are 9 normal phonological errors. These errors are: r -deviation, fronting, stridency deletion, de-emphasis, weak syllable deletion, consonant deletion, backing, glottalization and devoicing. The results of this study indicate that Syrian children no longer use developmental error patterns by the age of 5:5 years. The developmental phonological error patterns were divided into two categories according to the age at which they disappeared. The phonological errors that were suppressed before the age of 3:6 are backing and glottalization and in the age group 4:0-4:5 all phonological error patterns had disappeared except for r-deviation and fronting which were the last errors to disappear in Syrian children.

6.5 COMPARING PHONOLOGICAL ERROR PATTERNS IN ENGLISH AND SYRIAN ARABIC

The comparison of phonological error patterns between Syrian children and children speaking other languages is complex and may be controversial as the methodology between studies varies greatly. The results of this study indicate that there is some correlation between Syrian Arabic and other languages regarding the type of phonological errors. Some errors occurred in both SYA and English such as r-deviation, de-affrication, fronting, weak syllable deletion and stopping. However, some phonological errors are specific to one language. For example, de-emphasis is specific to Syrian children whereas cluster reduction is restricted to English children.

As far as the common phonological errors in English and SYA are concerned, it can be seen that weak syllable deletion was slightly more common in SYA than in English (Roberts et al. 1990). In the current study the percentage of weak syllable deletion was 6.74 % in the youngest age group (2:6-2:11), whereas it was 2.8% in English children. The occurrence of r-deviation in the two languages was very similar: its occurrence in English was 24.5% (Roberts et at. 1990) while it amounted to 25.25% in Syrian Arabic. Fronting of posterior consonants was more frequent in SYA (21.26%) than in English (18.3%). Finally, there is a considerable difference concerning stopping in the two languages. The percentage of stopping in Syrian children was 1.55%, while it was far more frequent in English children (9.8%).

6.5.1 PLOSIVES

Smit (1993) reported that there are two common errors that affect plosives in English children. The fronting of word-initial velars to alveolars is a common error (5-15%). She also found that fronting affects word initial plosives far more often than final plosives. In addition to fronting, Smit (1993) found that de-aspiration of initial voiceless plosives is the second most frequent error against the plosives in English children. The results of the current study indicate that similar errors affect the plosives in Syrian children: the most common errors are fronting, devoicing and deletion. Fronting occurs most frequently (41.66%), followed by devoicing (33.33%) and omission (25%). It should be noted that de-aspiration was not attested in SYA, since plosives in SYA are never aspirated. Conversely, there are also errors found in SYA that are not reported in English children. These are de-emphasis and dentalization and they affect emphatic plosives, which are consonants that do not occur in the English sound inventory. The percentage of de-emphasis in plosives is 49.8% in the youngest age group (2:5-2:11). This decreases gradually with age to reach 7.81% in the age group 5:6-5:11.

6.5.2 NASALS

Nasals are acquired early by both English and Syrian children, however there are occasional errors in most age groups (2:0-9:0). The results of Smit (1993) indicated

that dentalization occurs occasionally and that [n] substitution is the most common error which affects /ŋ/. Furthermore, [m, ŋ] are sometimes used instead of /n/ in final positions. There are more errors in word-final nasals than in word-initial position. In Syrian Arabic, denasalization and omission are the most common errors affecting nasals with a percentage of 3.66 % in the earliest age group of 2:6-2:11. Phonological errors affecting nasals have disappeared in Syrian children by the age of 3:0-3:5.

6.5.3 FRICATIVES

In English, the most prominent error for fricatives is stopping in initial position and the substitution of target fricatives by another fricative. For alveolar and post-alveolar fricatives, the most common errors are final consonant deletion and stopping in the youngest age group. \Devoicing of final /z/ and initial /z/, /s/ stopping errors are common in the three youngest age groups. Dental distortions remain common throughout all the age groups where the use of dental distortions has decreased to about 5%. Dentalization of fricatives is very common in English children as reported by Smit (1993).

In contrast, the main errors pertaining to fricatives in SYA are fronting, devoicing, glottalization, dentalization and backing. The most frequent error is fronting which occurred in 27% of the age group 2:6-2:11. The second most frequent error is devoicing. Backing is also a quite frequent pattern in fricatives but this disappears in

the speech of children aged between 2:6-4:5. Two prominent errors which affect fricatives and which are shared with English are dental distortions and glottalization. The percentage of stopping is greater in English (9.8%) than in SYA (1.55%). Another error which Syrian children use and which is restricted to SYA is de-emphasis of [sˤ].

6.5.4 TRILL

The trill is a different consonant in English and SYA so the comparison between two languages is not true.

6.5.5 APPROXIMANT

The errors affecting approximants in English are deletion and substitution. Deletion of /j/ is more common than deletion of /w/ and /w, d, h, l/ are relatively common substitutions for /j/.

The results of Smit (1993) also indicated that English children use gliding /w, j/ instead of initial /l/, and replace /l/ by [w] and [d] in intervocalic position. Assimilation is among the less frequent errors and this includes the use of [n, v] instead of /l/ e.g. knighting for lighting, veaf for leaf /naitiŋ, / for /laitiŋ, / and /vif/ for /lif/)

There are rare errors including distortion. Rare error patterns occurred for /l/ in SYA, the most frequent was gliding /l→j, l→w/ with a very low percentage of less than 2%. Examination of gliding for /l/ revealed that most of these substitutions are assimilations such as /lajmo:n→jajmo:n/ (Eng: lemo:n).

6.6. UNIVERSAL AND SPECIFIC ERROR PATTERNS IN SYRIAN CHILDREN

The phonological error patterns in Syrian children in this study reveal that there are both universal error patterns and language specific error patterns. There are some phonological errors that are similar across languages such as weak syllable deletion, fronting, backing, de- affrication and stopping. These errors have been reported in several languages such as English (Dodd et al. 2003; Smit 1993), Putonghua (Zhu 2002), Cantonese (So et al. 1995), Italian (Bortolini & Leonard 1991), Xhosa (Mowrer et al. 1990), Turkish (Tophas & Yavaş 2006), and Spanish (Yavaş et al. 1998). For example the substitution of [t] for /k/ is reported as amongst the most common errors in English (e.g. Ingram 1976). In addition to these similarities across languages, phonological error studies have noted specific errors, which are found in one language and not in others. Also this study has found unique errors that occur in the speech of Syrian children during their speech development. One of these errors is de-emphasis, which has to do with emphatic consonants in the Syrian sound inventory, which do not occur in English. This reflects a difference in consonant inventories between two languages.

6.6.1 UNIVERSAL TENDENCIES

The results in the current study provide some evidence that phonological error

patterns in Syrian children can be considered common and general patterns in children from different language backgrounds. This may well support a universal tendency in speech acquisition. For example, r deviation is a common error pattern which is not only used by Syrian children but is also common in many other languages as this phonological error was reported for English (Dodd et al. 2003), Putonghua (Zhu 2002), Maltese (Grech 1998), Spanish (Yavaş 1998) and Xhosa (Mowrer et al. 1990). Many of the phonological studies interpret the errors in /r/ production as a result from its articulatory complexity.

Other examples which are consistent with the universal tendency of phonological errors in Syrian children are fronting, weak syllable deletion and changes in voicing. These processes have also been documented in a wide range of other languages such as Greek (Pal 1995), Norwegian (Simonsen 1990), Portuguese (Yavaş 1988), English (Dodd et al. 2003), Spanish (Yaveş 1998) and German (Fox 2000).

Zhu and Dodd (2006) explain these errors in different languages by the tendency to use an unmarked feature to replace a marked feature. Plosives are universally unmarked relative to affricates and front consonants are universally unmarked relative to back consonants. Similarly, voiceless consonants are unmarked compared to voiced ones. In this perspective, markedness is interpreted as ease of articulation. For example, fricatives and affricates are replaced by plosives, which are arguably easier. There is a similar case for replacing posterior consonants by anterior, which are not only easier to produce but are also easier to perceive for

young children.

The universal order of speech sound acquisition and phonological error pattern in Syrian children could be also interpreted in terms of “markedness”, in that there is a tendency among Syrian children to replace marked feature by an unmarked one. The error pattern de-emphasisation is an example in which emphatic consonants, which is a marked, are replaced with non-emphatic sounds which is unmarked consonants. Another example comes from devoicing in which Syrian children use unmarked as substitution or marked sounds. They replaced voiced consonants with voiceless sound such as /walad/ becomes / walat / a boy.

6.6.2 LANGUAGE SPECIFIC ERROR PATTERNS

Some phonological error patterns are restricted to SYA compared to other languages. The first most frequent phonological error pattern that occurs in Syrian children was de-emphasis with 45.8% of the children substituting an emphatic by a non-emphatic consonant (e.g. [t] for /tˁ/). The emphatic consonants are unique to Syrian Arabic and other Arabic varieties and are also classified as the most difficult consonants by Kent (1992).

Many studies have reported that there are some error patterns that occur in certain languages only. For example, Li and Edwards (2006) found that Japanese children acquire dental or alveolar /s/ considerably later than /ʃ, tʃ, ʤ/ and that the most

common error pattern for /s/ is its substitution by /ʃ/ or/ tʃ/. This differs from English in which the typical error pattern for /ʃ/ is fronting to [s]. Similarly, Zhu and Dodd (2000) found that the second most frequent error pattern in Putonghua is backing as 65% of Putonghua children replaced the posterior consonants for a dental place of articulation. In Cantonese So & Dodd (1995) found that there are some specific errors that are used by Cantonese children, for example the affrication of /s/ was very common (e.g. [tsoej] for /soej/). This pattern would be considered uncommon in English children who acquire fricatives earlier than affricates. In contrast the most common error pattern which affects affricates is stopping.

6.7 DISCUSSION

Motor difficulty has been used to interpret the similarities and differences in the order of speech sound acquisition and the differences in error patterns across languages. The substitutions provide evidence of the role of motor complexity in the type of error pattern across languages. Most studies investigating phonological error patterns have revealed a tendency to replace difficult consonants with easier speech sounds. Many languages have reported the replacement of posterior consonants by anterior consonants (fronting) and fricatives by plosives (stopping).

The results of this study indicate that the most common error pattern in Syrian children is de-emphasis. In this error Syrian children use a non-emphatic sound

instead of an emphatic one as the emphatic sounds in SYA /tˤ, dˤ, sˤ/ are more difficult to pronounce because they require two places of articulation (Ladefoged 1993). These consonants are acquired later compared to non-emphatic consonants /t, d, s/. In addition, emphatic consonants are not only difficult to articulate, but they are also rare in language inventories. The percentage of languages that have 4 emphatic consonants like SYA is restricted to 0.22% of the languages of the world as sampled by UPSID (Maddieson 1983) this provides evidence that this is a truly unique feature of SYA and Arabic in general. The phenomenon of de-emphasis supports the claim that children not only acquire unmarked consonants before marked ones, but they also use them to simplify their speech.

The difference in percentage of r deviation in SYA (25.25%), and English-speaking (24.5%) children is very small. However, the results in the current study indicate that Syrian children substituted /r/ with [l], whereas English children replaced /r/ with [w]. This difference in replacement between the two languages could be due to the difference in the place and manner of articulation. SYA /r/ is a tap or trill, which has the same place of articulation as /l/, i.e. alveolar. Whereas in English /ɹ/ was described as approximant, which involves retroflexion and no alveolar consonant is used to replace it. So /w/ is more similar to American English /ɹ/ than to the trill in Arabic (Shriberg and Kent 1995). In fact using /l/ to replace /r/ is not specific to SYA, as many studies of different languages have found that /r/ was substituted by /l/. For example, Bortolini and Leonard (1991) for Hindi, Pye et al.

(1987) for Quiché`, Yavas and Lamprecht (1988) for Portuguese, Anderson and Smith in Spanish (Anderson & Smith 1987), Mowrer and Burger in Xhosa (1990).

It is worth noting that the /r/ in all of these languages is either a trill or tap, not an approximant. The explanation for these different replacements is not the same for all these studies. Bortolini and Leonard 1991 attributed the replacement of /r/ by [l] in Italian children to the restricted distribution of /w/ and /j/ in Italian so that the Italian children cannot use them as a replacement for /r/. However, in English the distribution of /w/ and /j/ is not so restricted and their frequency of occurrence is very high. In Swedish, Nettelbladt (1983) reported that Swedish children used a specific error pattern of /r/, i.e. the replacement by /h/. Leonard (1995) attributed this error to the similar phonetic characteristics of these consonants in Swedish because /r/ and /h/ are both uvular in the southern Swedish Dialect (Leonard 1995).

Stopping is one error pattern, which, in the results of the current study, showed a noticeable difference between SYA and English. There were three factors that could contribute to these different results. First, there was a difference in the age of fricative acquisition, as Syrian children acquired fricatives before the age of 7 (Dodd et al. 2003). Second, the definition of this process in the current study differed slightly from that used by Dodd. In the current study we distinguished between stopping and stridency deletion, in which strident consonants are deleted or replaced by a non-strident one. So the different findings in the two studies could be due to the classification of some stopping errors in SYA as stridency deletion errors.

The results of the current study also indicate a clear difference in the occurrence of weak syllable deletion in Syrian Arabic (6.74%) and English (2.85%). Most of the previous studies which examined weak syllable deletion across languages attribute this to the number of polysyllables in the words that were sampled. In studies with five or more polysyllabic words and non-final weak syllables, weak syllable delection occurred more frequently and it disappeared later (Echols & Newport 1992; Haelsig & Madison 1986; Vihman & Greenlee 1987) than in studies with four or fewer polysyllabic words and non-final weak syllables (Dodd, Holm, Zhu & Giosbie 2003; Khan & Lewis 1986; Robert, Burchinal & Footo 1990). The results in the current study are consistent with previous studies about the number of syllables and the effect on weak syllable deletion. The results also found other factors which could affect weak syllable deletion such as the number of non-final weak syllables and unfooted weak syllables, whether or not the syllable contains a trill or lateral approximant and voiceless obstruent onsets.

In our study the percentage of polysyllabic words is 63.88 %, while Robert used the Goldman and Fristoe articulation test to determine the phonological process in children. The percentage of polysyllabic words was smaller than 12% in Robert study, so the number of polysyllabic words in the Goldman and Fristoe articulation test was smaller than monosyllabic words. The difference in the number of polysyllabic words between the tested words in the current study and the Goldman and Fristoe articulation test could explain the difference in the number of weak

syllable deletion between this study and that of Roberts et al. (1990).

The results in the current study indicate that more than 97% of the deleted syllables in SYA are in initial position and this may be due to prosodic factors such as word stress. In SYA, word stress is associated with final or penultimate syllables, while initial syllables in SYA are rarely stressed. This makes them weaker than other syllables and more prone to deletion.

6.8 COMPARISON IN PHONOLOGICAL ERROR PATTERNS BETWEEN SYRIAN AND OTHER ARABIC VARIETIES

This section discusses the major differences between the findings in the phonological error patterns which were observed in the current study and other varieties of Arabic in the light of three possible explanations: i.e. frequency of occurrence, the influence of variety and the influence of the age of acquisition on some consonants.

Many studies explain the differences in the occurrence of phonological error patterns between languages in terms of differences in the frequency of occurrence of specific sounds in different languages.

The results of this study indicate that the percentage of stopping in Syrian children is 1.55%, while the percentage of stopping in Jordanian is 15%. This considerable difference in the frequency of stopping errors may be due to the dialect differences

as stopping affects fricatives and the number of fricatives is different in Syrian and Jordanian speech. For example, Dyson et al (2000) indicate that / θ, ð, ðˤ / become /t, d, dˤ /respectively. In fact these fricatives are not used by Syrians. They only use these fricatives in schools and in Standard Arabic. Thus, the percentage of fricatives that can potentially be replaced by plosives in Jordanian is higher than in Syrian children.

Another reason for the difference between Syrian and Jordanian Arabic regarding the occurrence of stopping is that the definition of stopping may be more restricted in some studies. While Dyson et al consider glottalization as an instance of stopping; the current study treated the replacement of fricatives by a glottal stop as an instance of glottalization.

De-emphasis in this study differed from Dyson et al (2000) as this error was less frequent in Syrian children. The percentage of de-emphasis in the current study is 26.35%, while it is 48% in Jordanian children. This difference seems related to differences between the two regional varieties. Although the Syrian and Jordanian Arabic inventories have the emphatic consonants /tˤ,dˤ,sˤ, ðˤ/, the Jordanian variety replaces the consonants /t ˤ/, / d ˤ/and /s ˤ/ by /t/, /d/ and /s/ (Assad (2009)). However, Syrians do not replace emphatics. As a result, Syrian children hear and use emphatics more frequently and hence they learn to distinguish these consonants much better from non-emphatic consonants which lead to fewer errors in SYA.

A further example of the influence of linguistic variety on the difference in the number of errors between Syrian and Jordanian Arabic is that the number of fricatives in Jordanian is 15 (/ f θ ð ðˤ s sˤ z ʃ ʒ x ɣ h ʁ ʕ h /), while SYA has only 12 fricatives (/ f s, sˤ, z ,ʃ x ɣ h ʕ h ʒ ðˤ /). The smaller number of fricatives in SYA may lead to a smaller number of errors in these consonants.

Fronting was another phonological error in which Syrian children differ from Jordanian children. It was more frequent in Syrian children; however, Dyson et al (2000) reported that two fronting errors in Jordanian children's speech were velar fronting /k/ and uvular fronting /q/. It is important to note that these two errors were observed in Syrian children in the current study but the results indicate another fronting error which is fronting of palatal /ʃ /. This may explain the higher percentage for fronting in Syrian children than in Jordanian children.

There is a clear difference in the percentage of devoicing between Syrian and Jordanian children. While the percentage of devoicing in Jordanian children is 23%, this percentage is lower than 10% in Syrian children. The difference between the two varieties is probably due to the age of consonant acquisition. For example, the Syrian children in the current study acquire /t/ at the age of 2:6-2:11 and /d/ by the age of 3:0-3:5. Thus, there is not a large difference between the two consonants in terms of the age of acquisition. Syrian children may, therefore, discern the difference between /t, d/ from an early age. This would reflect the small difference in devoicing errors in Syrian children compared with Jordanian speaking children.

The Syrian children acquired /tˤ, dˤ/ earlier than the Jordanian. Syrian children acquired them in the same age, 4.6-4.11, which is the age of /tˤ, dˤ /acquisition.

6.9 SUMMARY

The results of the present study correspond well with those of previous Arabic studies investigating phonological error patterns in Arabic children (Dyson & Amayreh, 2000; Ammar & Morsi, 2006). The results indicate that /r/ deviation, de-emphasis and stridency deletion are the most commonly occurring phonological patterns. Whereas weak syllable deletion fronting, stopping, final consonant deletion, and assimilation occurred less frequently than previous errors. The results from the current study diverge from those in the available literature with respect to two processes; fronting and voicing.

Chapter 7: CONCLUSIONS

The lack of norms for speech sound acquisition and error patterns in the Syrian variety of Arabic is one of the challenging aspects of the diagnosis and treatment of speech and language disorders. There are no normative data which speech and language therapists in this field can use to assess the phonological skills of Syrian children. This may lead to inappropriate diagnosis and incorrect treatment decisions. In order to address this problem, a detailed study of Syrian Arabic was carried out for this thesis. The aim of this study was to acquire normative data on children's speech development by investigating the age of speech sound acquisition and the occurrence of phonological error patterns. This chapter summarizes the key findings of these studies. The clinical implications of the research findings are discussed, the limitations are described and areas requiring further investigation are mentioned.

In the context of this thesis, a cross-sectional study was carried out involving 160 typically developing Syrian children between the ages of 2:6 to 6:5. The speech sample was collected by means of a single word picture naming test which was specificially designed for this study. Normative data were collected regarding the age of speech sound acquisition and the occurrence of phonological error patterns.

Regarding the ages of speech sound acquisition, the results indicated that the

acquisition of the SYA vowels was almost complete by the age of 3. For the consonants, there was a gradual development in the correct production of speech sounds. All SYA consonants were acquired by the age of 6:5, except the fricative/ʒ /. The order of consonant acquisition according to sound class was approximants > nasals > plosives > the lateral approximant /l/ > fricatives > the trill. There were differences in the percentage of correctly produced consonants in different word positions in that sounds in word-final position are more often correct than in initial and medial positions. The findings also demonstrated minor differences between boys and girls, but these were not significant. Therefore, the same norms can be used for both female and male children for the purpose of assessment and intervention.

As far as the phonological error patterns are concerned a total of 12 phonological error patterns were identified in Syrian children. These errors were: r-deviation, fronting, stridency deletion, de-emphasis, de-affrication, weak syllable deletion, stopping, backing, glottalization, devoicing and assimilation. There was also one dialectal phonological error pattern called epenthesis, in which a vowel is inserted between consonants in order to simplify their pronunciation. Using a developmental criterion to define the phonological error patterns used by Syrian children, the study revealed that there are 9 typical phonological errors. These errors are: r-deviation, fronting, stridency deletion, de-emphasis, weak syllable deletion, consonant deletion, backing, glottalization, and devoicing. The majority

of developmental phonological processes decreased with age and it was found that Syrian children no longer produce developmental errors by the age of 5:5.

The present study showed that the developmental patterns of speech sound acquisition and error patterns in Syrian children tends to follow a similar course as in other languages and this suggests that speech sound acquisition develops along universal principles. The findings which are consistent with universal tendencies in speech sound acquisition are that Syrian children acquire plosives, nasals and approximants earlier than fricatives, the trill and the affricate which are late acquired consonants. Furthermore, voiceless consonants were found to be acquired earlier than voiced consonants. Finally, this study found that anterior consonants were acquired earlier than posterior consonants. The anterior plosives /b, t/ were acquired earlier by Syrian children than the back consonants /k, q/.

Similar patterns of universal speech sound acquisition have been reported for several languages such as English (Parther et al. 1975, Smit et al. 1990, Dodd et al. 2003), German (Fox 2000), French (Chevrie -Muller& lebreton 1973), Spanish (Dinnsen 1992), Xhosa (Mowrer a et al. 1990), Cantonese (Clumeck, Barton, Macken, & Huntington 1981), Thai (Gandour, Petty, Dardarananda, Dechongkit, & Mukongoen 1980), French (Allen 1985) and Hindi (Davis 1995).

In addition the evidence presented above, the phonological error patterns findings provide qualified support for universal acquisition. For instance, R- deviation, weak syllable deletion and changes in voicing are common error patterns which are not only used by Syrian children but were also found to be common in several other languages such as English (Dodd et al. 2003), German (Fox 2000), Cantonese (So et al. 1995), Maltese (Crech 1998), Turkish (Topbaş &Yavaş 1998), Irish English (Hickey 1997), Dutch (Beer 1995) and Lebanese Arabic (Mcleod 2012).

However, the findings revealed that not all universal patterns proposed by Jakobson materialized in that there were specific patterns in both speech sound acquisition and phonological error patterns. Regarding the acquisition of speech sounds, there is substantial variability in the age and order of some speech sounds compared to other languages. This could suggest that language specific factors also influence the order of speech sound acquisition. For example, the posterior consonants /ʔ, h/ are among the earliest acquired speech sounds in Syrian children and this goes against Jakobsen's principle of universality in acquisition.

In addition, plosives in English children are acquired substantially earlier (3:0-3:5 years) than in Syrian Arabic (5:0-5:5). This was caused by the emphatic consonants which are the last plosives to be acquired in Syrian Arabic. Likewise, de-emphasis is one of the errors which are restricted to Syrian Arabic compared to other languages.

The similarities and differences of the results this study and that in other languages

were discussed from different theoretical perspectives. First, it was observed that the frequency of occurrence of speech sounds in a language may be an important factor in determining the age of speech sound acquisition. For example, the consonants /k, s, z, h, ʤ(ʒ), ʃ/ are acquired earlier by English children than Syrian children because of their higher frequency of occurrence in English. However, the frequency of occurrence alone is insufficient to explain the similarities and differences in the age of speech sound acquisition across languages for all consonants. For example, although /r/ is considered to be amongst the most frequently occurring consonants it is one of the latest acquired consonants. This also holds for the consonant /h/. It is worth noting that the frequency of occurrence of speech sounds in Syrian Arabic was only studies in a very small number of children, these results may need to be considered with some caution.

Besides the frequency of occurrence of speech sounds it was also observed that the articulatory complexity can be used to explain cross-linguistic differences in speech sound acquisition. Locke (1983) suggested that the latest acquired consonants are those that are the most difficult to produce and perceive.

For instance, plosives are acquired later by Syrian children, because some of the plosives in SYA contain are particularly difficult to pronounce such as the emphatics / tˤ, dˤ, /. This also applies to the most common error pattern in Syrian children, i.e. de-emphasis. Due to the articulatory complexity of emphatic sounds in SYA they are

more difficult to pronounce. In addition, emphatic consonants are not only difficult to articulate but they are also rare in speech sound inventories of languages. Using non emphatic consonants to substitute emphatics supports the claim that children not only acquire unmarked consonants before marked ones but they also use them to simplify their speech. (See further discussion in 6.7)

Phonological salience and the effect of systemic differences between languages were also used to interpret the difference in the rate of acquisition in languages. An example for the effect of phonological salience pertains to the consonants /s/ and /z/: because both consonants have a higher potantial for differentiating lexical meaning in English than in SYA, these fricatives are acquired earlier in English: /s/ and /z/ in English word-final position distinguisthes between singular and plural forms, whereas they do not have such differentiating capacity in Syrian Arabic. An example of systemic differences between languages relates to the fricatives /θ, ð/. These are considered to be among the latest fricatives to be acquired in English (Dodd et al. 2003) while Syrian Arabic does not have these fricatives in its inventory. Consequently the class of fricatives as a whole are acquired earlier in SYA than in English.

Methodological differences between studies were also described in the current study as a factor that could play an important role in accounting for differences in speech sound acquisition between languages. For example, a clear difference

between SYA and English (Dodd, et al. 2003) has to do with the phonological error of stopping and this could be due to using different definitions of this process in both studies. In the current study stopping was differentiated from stridency deletion. Therefore, some stopping errors in SYA have been classified as stridency deletion errors and this decreases the number of stopping errors in Syrians. Similarly, while Dyson et al. consider glottalization as an instance of stopping, the current study treated the replacement of fricatives by a glottal stop as an instance of glottalization which may lead to a difference between Syrian and Jordanian Arabic regarding the occurrence of stopping.

Besides the theoretical relevance of the results presented in this thesis, a number of clinical implications can be derived. As this is the first phonological study of the acquisition of speech sounds in Syrian Arabic, it provides speech and language therapists with a clinical tool (an articulation test) to assess speech disorders in Syrian children. Furthermore, the normative data from the current study will enable speech and language therapists in Syria to make a more accurate diagnosis of speech disorders in children and this may lead to more realistic treatment plans which will be beneficial to the nation's health.

Furthermore, the information obtained in the current study is most likely to be considered as the prerequisite to establish a standardized articulation test after testing its validity and reliability on a larger and more representative sample of Syrian children.

The outcomes of this present study is an encouragement to work harder on phonological development studies of other Arabic varieties rather than just drawing comparisons between these varieties. Likewise, the analysis highlights the similarities and differences between Syrian varieties and other Arabic ones. Last but not least, it generally contributes further knowledge about universal principles in phonological development.

Although the results from this study are extremely valuable, it should be pointed out that the study has its limitations. In the first instance, it should be pointed out that the number of children in each age group is relatively small, i.e. 20 children in each group. This may have affected the validity of the results because of strong individual variations. Furthermore, the normative data obtained in this study does not represent all SYA dialects, because there are many other geographical dialects in Syria which have not been targeted in this study. Rather, the study only focused on the southern and middle regions of Syria. It has to be kept in mind my speech and language therapists that all the children participating in this study lived in Damascus and its suburbs.

As far as the directions of further research are concerned, a further investigation of other varieties of Syrian Arabic has to be considered because Syria has several dialects. The most important ones are as follows: The Southern Syrian Arabic dialect which is spoken in Damascus, Homs and Hama; The Northern Syrian Arabic dialect spoken in the region of Aleppo; The Allied Dialect that is spoken in the coastal

mountains and in Idlib; The Eastern dialect group spoken in the Jabal Al-Arab Mountain; The Eastern dialect group in Al- Hasaka and Deir ez-Zor. There is very little information about the speech inventories and the phonological features of these dialects and these may warrant further investigation. This could serve as a basis for the further standardization of the articulation test which was developed in this thesis. In addition, testing of a larger number of Syrian children in each age group would provide a more representative picture on the ages of speech sound acquisition and phonological error patterns. Investigating additional age groups involving younger and older children could have enriched this study as well. Furthermore, children with speech disorders could be assessed to provide information about the incidence of speech sound disorders in Syrian children.

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Appendix 2 Tables

Tables 1 to 13 summarize the percentage of correct production for each consonant in the three word positions for each age group.

Table 1 The percentage of correct production for each consonant in three word positions for the first age group (2:6-2:11).

Consonant	Initial position	Medial position	Final position
B	95.53	95.96	98
T	92	95	100
D	90	94	81
tˤ	65	56.76	80
dˤ	49	30	5
K	70	55	87
Q	-	-	-
ʔ	98.13	36.36	98.3
F	95	81.25	100
Ɵ	-	-	-
Ð	-	-	-
ðˤ	-	-	-
S	90	83.75	100

Z	92	63	75
sˤ	56	61.54	35.14
ʃ	61.6	55	50
X	70	70	70
ɣ	31	65	50
H	97.50	95	100
ʕ	52.63	75	78.75
H	78..95	97.50	13
dʒ	45	21.8	31.22
M	76.43	98.98	97.50
N	90	95.55	100
L	82.50	94	100
R	16.45	31.09	78.21
W	97	100	100
J	93.75	87.21	100

Table 2 The percentage of correct production for each consonant in three word positions for the first age group (3:0-3:5).

Consonant	Initial position	Medial position	Final position
B		100	100
T	97.65	100	100
D	91.18	95.29	77.72
tˤ	73.53	61.76	81.82
dˤ	67.63	64.71	58.82
K	70.59	92.43	91.18
Q	-	-	-
ʔ	100	45.95	100
F	100	94.12	100
Θ	-	-	-
Ð	-	-	-
ðˤ	-	-	-
S	94.12	94.03	89.55
Z	100	70.59	76.47
sˤ	64.71	66.67	57.81
ʃ	82.75	76.47	94.11

X	76.47	79.41	76.47
ɣ	62.50	94.12	80
H	79.41	100	100
ʕ	63.64	76.47	81.25
H	76.47	82.35	7.14
dʒ	61	20.54	34.88
M	90	98.82	100
N	100	100	100
L	97.06	81.25	94.12
R	58.82	70.59	89.50
W	100	100	100
J	100	97.06	100

Table 3 The percentage of correct production for each consonant in three word positions for the second age group (3:6-3:11).

Consonant	Initial position	Medial position	Final position
B	97.30	100	99.24
T	95.41	98.86	100

D	100	97.27	88.51
tˤ	72.73	87.36	79.55
dˤ	80.30	45.45	42.86
K	79.55	90.48	93.18
Q	-	-	-
ʔ	98.30	53.49	100
F	93.18	96.59	100
Θ	-	-	-
Ð	-	-	-
ðˤ	-	31,58	-
S	94.55	79.31	100
Z	97.73	80	90.91
sˤ	60	93.18	81.71
ʃ	90.91	86.36	81.71
X	77.27	72.73	90.91
ɣ	86.18	81.82	50
H	93.02	100	100

ʕ	79.55	95.45	90.91
H	90.91	97.73	14.63
dʒ	68.18	51.6	51.27
M	97.40	100	100
N	90.91	98.99	100
L	95.45	100	100
R	48.86	73.48	85.23
W	100	100	100
J	97.73	95.87	100

Table 4 The percentage of correct production for each consonant in three word positions for the forth age group (4:0-4:5).

Consonant	Initial position	Medial position	Final position
B	100	98.75	100
T	93.75	96.83	100
D	96.88	97.47	87.50
tˤ	96.88	93.55	96.88

dˤ	66.67	75	68.75
K	62.50	93.75	84.38
Q	12.50	-	-
ʔ	100	64.29	100
F	100	96.67	100
Θ	-	-	-
Ð	-	-	-
ðˤ	-	46.67	-
S	92.50	92.19	85.11
Z	96.88	73.33	62.50
sˤ	85.11	93.55	72.13
ʃ	91.67	84.38	75
X	100	93.75	100
ɣ	50	75	67.75
H	75	100	100
ʕ	78.13	100	87.50
H	100	100	17.86

dʒ	67.75	25.81	78
M	98.21	100	100
N	100	96.50	98.44
L	98.44	100	100
R	76.56	82.11	95.31
W	100	100	100
J	100	93.14	100

Table 5 The percentage of correct production for each consonant in three word positions for the second age group (4:6- 4:11).

Consonant	Initial position	Medial position	Final position
B	99.07	100	100
T	98.61	98.33	100
D	97.92	100	98.96
tˤ	93.75	91.30	95.83
dˤ	94.37	100	87.50
K	91.67	95.83	100

Q	-	-	-
ʔ	100	46	94.52
F	100	100	100
Θ	-	-	-
Ð	-	-	-
ðˤ	-	68.18	-
S	100	100	98.61
Z	100	88	100
sˤ	92.86	97.87	85.11
ʃ	75	80.85	75
X	100	95.83	100
ɣ	87.50	100	82.61
H	95.83	100	97.92
ʕ	97.92	95.83	90.91
H	95.83	100	8.70
dʒ	88	43.67	69
M	98.20	100	100

N	100	100	100
L	100	98.35	97.92
R	74.47	82.52	94.79
W	100	100	100
J	100	97.71	100

Table 6 The percentage of correct production for each consonant in three word positions for the sixth age group (5:0-5:5).

Consonant	Initial position	Medial position	Final position
B	99.44	100	100
T	98.99	97.50	96.67
D	95	98	95
tˤ	100	92.41	100
dˤ	91.67	95	100
K	92.50	90	97.44
Q	40		
ʔ	100	55.10	95
F	100	96.25	100

Θ	-	-	-
Ð	--	-	-
ðˤ	-	31.25	-
S	98.99	95	95
Z	100	100	90
sˤ	88.33	97.50	89.74
ʃ	76.67	67.50	80
X	95	97.50	100
ɣ	85	90	95
H	92.50	100	100
ʕ	100	95	100
H	95	97.50	20.51
dʒ	85	25	83
M	98.57	100	100
N	100	100	99.38
L	100	99	97.55
R	82.50	83.05	96.25

W	100	95	100
J	100	99.09	100

Table 7 The percentage of correct production for each consonant in three word positions for the seventh age group (5:6-5:11).

Consonant	Initial position	Medial position	Final position
B	99.44	100	100
T	94	97.50	93.33
D	90	96	100
tˤ	100	97.50	100
dˤ	98.33	100	100
K	95	95	97.5
Q	40	-	-
ʔ	100	67.75	100
F	100	100	100
Θ	-	-	-
Đ	-	-	-
ðˤ	-	82.35	-

S	100	96.64	95
Z	100	95	95
sˤ	96.67	100	95
ʃ	91.67	82.50	100
X	100	100	100
ɣ	95	100	95
H	100	100	97.50
ʕ	97.50	95	100
H	100	100	37.50
dʒ	89.47	47	89.9
M	100	100	100
N	100	100	100
L	100	99	100
R	80.77	96.44	100
W	100	100	100
J	100	99.09	100

Table 8 The percentage of correct production for each consonant in three word

positions by age group (6:0-6:5).

Consonant	Initial position	Medial position	Final position
B	99.42	98.95	100
T	88.42	92.11	83.93
D	97.37	98.95	100
tˤ	100	100	100
dˤ	100	100	89.47
K	100	100	100
Q	73.68	-	-
ʔ	100	65.63	96.49
F	100	100	100
Θ	-	-	-
Ð	-	-	-
ðˤ	-	94.44	-
S	100	97.37	94.74
Z	100	94.12	94.74
sˤ	100	97.37	100

ʃ	96.49	94.74	89.47
X	100	92.11	100
ɣ	94.74	100	68.42
H	97.37	100	100
ʕ	100	100	100
H	100	100	78.95
dʒ	91	78.95	87
M	100	100	100
N	100	100	100
L	100	100	100
R	90.79	98.25	97.37
W	100	100	100
J	100	100	100

Appendix 3 Participant Information Sheet

City University London

Name of the researcher: Husen Owaida

Title of the research: Ages of acquisition of speech sounds in Syrian Arabic speaking children.

Aim of the project: to determine the ages of speech sound acquisition in Syrian children.

This research project addresses the problem of speech sound acquisition in children who are native speakers of the Syrian variety of Arabic. At the moment, no scientific information is available about the ages of speech sound acquisition and this information is very important in the assessment of speech disorders or atypical development. Furthermore, this kind of information will enable speech and language therapists to set realistic treatment targets. Therefore, this study will benefit children with articulation difficulties.

For the purpose of this research 120 children from two kindergartens in Damascus will be recruited. Each child will participate in an articulation test, which consists of 65 pictures of daily objects which have to be named by each child. The speech delivery of the children will be recorded on audio tape. At a later stage, these recordings will be transcribed phonetically by the investigator by means of the International Phonetic Alphabet and accuracy in pronunciation of each sound of Syrian Arabic will be recorded and analysed by the investigator.

It is important to emphasize that participation is voluntary and participants have full liberty to withdraw from testing at any time.

The results of the test application will be published as part of a doctoral thesis at City University London and in scientific journals regarding speech and language therapy. In all instances, the anonymity of the participants will be guaranteed.

Annexed to this information is a card containing the name and address of research in Arabic and English, any written complaints can be sent to the address shown on the card.

Should you have any complaints about the application of the test, you can address this complaint to City University which has established procedures in dealing with such complaints. Complaints can be addressed to the following address:

Anna Ramberg

Secretary to senate Research Ethics Committee

CRIDO

City University

Northampton Square

London EC1V0HB

Email anna.ramberg.1@city.ac.uk

Appendix 3

Participant Consent Form

Project Title: The ages of acquisition of speech sounds in Syrian speaking children.

I agree that my child/person …… (Full name of child/person) for whom I am a guardian may take part in the above City University research project. The project has been explained to .....……..…….. And to me, and I have read the Explanatory Statement, which I may keep for my records. I understand that agreeing to take part means that I am willing to allow ..... to:

- *Be interviewed by the researcher*
- *Allow the interview to be videotaped/audiotaped*
- *Make her/himself available for a further interview should that be required*
- *allow the researchers to have access to his/her medical/academic records*

I understand that any information …….. (Full name of child/person) provides is confidential, and that no information that could lead to the identification of any individual will be disclosed in any reports on the project, or to any other party. No identifiable personal data will be published. The identifiable data will not be shared with any other organisation.

I also understand that ……'s (full name of child/person)

participation is voluntary, that s/he can choose not to participate in part or all of the project, and that s/he or I can withdraw at any stage of the project without being penalised or disadvantaged in any way.

Signature …….. ..... Date……
……

Participant's Name: ..... (Please print)

Participant's Age...

Parent's/Guardian's Name.....

Your relationship to participant:
.....

If appropriate, reason(s) why s/he cannot give written consent.....

Signature of Parent/Guardian:
.....Date.....

Appendix 4: Questionnaire

Dear judge:

This questionnaire is designed to judge the content validity of an articulation test which has been developed to assess speech sounds in Arabic Syrian children. Would you please add any notes that you may have regarding the questionnaire's items? The questionnaire has been established to examine three factors relating to the articulation test:

-The appropriateness of the types of words included, from items 1 to 4.

-The compl eteness of words sampled, items 5 to 10.

-The way in which the items assess the content, items 11 to 16.

Dear Sir/Madam;

This questionnaire is developed to judge an articulation test that designed to assess the speech sounds of Syrian children aged between 2:6- 6:5(year: month).Accompanying this questionnaire is a list of words that will be in the articulation test. Please read the list then in the boxes below, give your opinion about the words.

	The item	Agree	Don't know	Neutral	Disagree	Give example
1	The words are very simple(names of objects) so it is appropriate for the children's ages					
2	The test's words are familiar to the children.					
3	Some of The t words are complicated so the child cannot pronounce them.					
4	Some of the words are not common in					

	the children's environment.					
5	The words cover all Arabic speech sounds.					
6	Every speech sound in Arabic will be assessed in three sounds positions (initial, medial, final)					
7	The appearance of some speech sounds more than three times will enable the examiner to assess the sound correctly.					
8	Naming a picture is a simple tool that the child cans easily respond to.					
9	There are some Arabic speech Sounds that do not appear in the words.					
10	Most of the test's words are names (animal, fruit, etc) this helps the child to spontaneously respond.					
11	Using colour pictures attracts the child's attention until the					

	end test					
12	Giving cues to the child helps him / her to know the target words.					
13	Putting three pictures in the same sheet break s up the child's attention.					
14	Using of the examiner hands to point towards and touch the target picture helps a child to focus on picture.					
15	Indirect imitation helps the examiner to determine whether or not the sound exists in the child's inventory.					
16	Using words in modern Arabic standard helps to assess any Syrian dialect.					