

Cross-linguistic Comparison of Phonotactic Development

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ABSTRACT

The acquisition of phonotactics has not been studied as commonly as other aspects of children's development. A study was carried out on normally developing Maltese speaking children to collate a phonological development profile. One objective of this project was to identify trends of stages of the development of syllabic structure and to compare them cross-linguistically. Twenty-one children were recorded in their natural settings at four different stages between ages 2;0 and 3;6. As predicted, a change was observed in canonical syllabic structures used by the subjects as they grew older. A more complex structure seemed to become increasingly common among the children and their syllabic structures were progressively matching more with the corresponding adult ones. Most children mastered their phonotactics by the time they reached 3;6 years of age, irrespective of whether these involved multisyllabic words or words with syllabic complexity. Cross-linguistic comparison indicates that the phonotactic developmental profile for Maltese fits in with current theories highlighting universal phonotactic developmental trends. Some behaviour, specifically related to the structure of Maltese phonology, is also observed. Various implications for impairment and intervention are inferred. Findings in this study call for further cross-linguistic research in this area.

KEY WORDS: phonotactic development, phonological development, cross-linguistic comparison, Maltese.

INTRODUCTION

Descriptive studies of child language in the past few decades have assisted in the assessment of child phonology and identification of disordered patterns. Descriptive characterisation of child phonology, in particular data related to early segmental acquisition, has become increasingly available for a variety of languages. This information is required by clinicians that need to know what constitutes normal from delayed and/or deviant phonology. Such data would also act as a guideline to monitor progress if phonological therapy is recommended. Stoel-Gammon (1987) suggests that child phonology norms, especially for children below three years of age, should be broad-based. Rather than focussing on 'correct' phoneme production, the data should be collected on several aspects of child phonology and their relationship with the adult system. Identification of the typical word and syllable shapes¹ would contribute to the attainment of the composite picture of the phonological system of children. The canonical shape of children's early words has attracted fewer researchers' interests, even though there exist indications that words used by children tend to be constrained regarding word shapes and other phonological characteristics (Dobrich & Scarborough, 1992).

Data concerning child phonology are considered essential for clinical purposes and have broader linguistic application. It is also considered to be a useful tool in contributing to scientific knowledge on theories of phonology. It is meant to direct researchers who focus on explanations for linguistic phenomena, especially in relation to the growing interest on phonological acquisition. The issue of whether or not children develop phonology along a universal path has been hotly debated in current theories and various studies indicate that there is not a simple answer to it. The 'universalist' theories such as those of Jakobson (1968), Locke (1983) and Stampe (1969) propose that the phonological acquisition process is universal or near-universal. Jakobson claimed that there exists a universal tendency for the use of certain syllabic structures in the early stages of phonological development. Studies such as those by Ingram (1976) and Stoel-Gammon (1987) supported this claim.

Goodluck (1991) argues that children use syllable types reflecting the relative frequency of occurrence of syllable types in languages of the world. She reports CV as being the most common type of syllable universally and that initially children frequently delete consonant clusters or break up clusters to conform to a CV pattern. Lleo & Prinz (1996) report evidence of a common syllabic structure acquisition hierarchy in their study of monolingual Spanish

¹ Although there is not yet agreement on the constituent structure of the syllable, no one denies that it plays an important role in phonological description (Yavas, 1998). The syllable is seen as the constituent phonological unit by some researchers (e.g.; Goldsmith, 1990), because prosodic phenomena are claimed to be described better in terms of this. Goldsmith sees the word as composed of syllabic sequences with a specific internal structure which is more or less constant and definable for a specific language. In any language, the syllable is composed of (zero or more consonants) + sonorous peak + (zero or more consonants).

and German children at ages from 0;9 to 2;1 respectively. Meanwhile, cross-linguistic variation in the syllabic shapes used by children has also been recorded. Other theories that are cognitively based, such as those proposed by Ferguson (1978) and supported in Macken and Ferguson (1983), Stemberger (1992) and Waterson (1971), suggest that children play an active role in the acquisition process by formulating and testing hypotheses regarding the sound system being acquired. Hence, individual variation would be more the rule than the exception. Researchers such as Fee (1995) indicate the existence of intra-language variation in connection with the use of word shapes by children.

It is important to note that methodological shortcomings and variations exist in these studies which may have had an influence when comparing results and postulating similarities and differences. A clear example is observed in Goad and Ingram (1987). In this article, the authors discuss their disagreement of the analysis and conclusions made by Stoel-Gammon and Cooper (1984) when they studied the phonological acquisition of three English speaking children. Goad and Ingram claimed that the type of analysis carried out by Stoel-Gammon and Cooper brings out variation as a result of environmental and genetic influence (rate and style of learning), more than the actual possible linguistic commonalities/variations that could exist. The former researchers proceeded to re-analyse the data in a different way with the result that it gave opposite indications to the ones suggested by Stoel-Gammon and Cooper, in that they concluded that patterns of similarities did exist among the children's utterances.

Given the data available (with all the shortcomings), it is obvious that the issue is not a question of 'either/or'. Phonological development is based on a combination of universal or near-universal and idiosyncratic patterns posed by each child. Stoel-Gammon (1992) reported that only cross-linguistic data could provide further information regarding which aspects of acquisition are universal and which are due to language-specific characteristics. Until recently, data on phonological acquisition were reported almost exclusively on the acquisition of English. Most researchers of child phonology have not studied the area of phonotactic development (not even for English). The development of phonotactics is a neglected area in most assessment protocols that help clinicians in describing and analysing their clients' speech. Data from Maltese speaking children could help in identifying the extent, order of acquisition and by what age children develop certain complex phonological structures.

Maltese is a language with complex morphophonemics and phonotactics; the study of the phonotactic development of this language is likely to reveal phenomena that contribute to the scientific knowledge in this area of child language. Maltese is a derivative of Arabic introduced in Malta and Gozo sometime between AD 870 and 1090. Maltese has developed independently ever since the end of the Arab occupation of the Maltese Islands in 1090 AD. The Maltese grammar is Semitic with influences of other languages amalgamated with it. The lexical impact gives rise to a mixed vocabulary including English and Italian influence. This progressive meshing of other languages onto the original Arabic dialect has made it a unique independent language, which is today neither fully Semitic nor fully Romance. Although most of it has been standardised, there are still some areas such as intonation and syntax that require further study (Borg and Azzopardi-Alexander,

1997). How this language stands today is significantly of great interest to linguists and researchers in child language. Specifically, it has meshed into a very complex language; some additional 'meshing' is still going on, since new loan words from English are still being added leaving an impact on its morphophonemics in particular.

The sound system of Maltese derived by Azzopardi-Alexander (1981) includes twenty-two consonantal phonemes (three of which are affricates), eleven monophthongs and seven diphthongs. All consonants can occur singly in syllable initial word initial position. Single consonants could be geminated. There is a distinctive length contrast for nasals, fricatives, stops, affricates and liquids. /j, w/ do not contrast distinctively in length; however they both occur geminated in word medial position but as single units in word-initial and word-final position. /m,n,l,r/ can occur as syllabics in word initial position and when this occurs, they do not contrast distinctively. There are five distinctive sets of short and long vowels. Vowels are longest in monosyllables. Their duration depends on the number of syllables in the word. Long vowels never occur in unstressed syllables.

The syllable in Maltese can have the following structure in the case of monosyllabic words: (C) (C) (C) V (C) (C). The syllable nucleus in a Maltese syllable almost always consists of a vowel. The nasals /m/, /n/, lateral /l/ and /r/ may be syllabic when they occur word initially. Azzopardi-Alexander reports that vowel length and stress are not in any way clues to syllable division. The number of possible syllables in words in Maltese may be more than one but usually not more than five. Syllable division has preferences. If consonants occur intervocalically the preferred pattern for occurrence is syllable initially of the second syllable, i.e., V-CV (syllable initial within the word). When two intervocalic consonants or geminated consonants occur there is a preference for these to split up as consonant sequences to allow a closed syllable to precede a consonant released syllable (Azzopardi-Alexander, 1981: 74). The order of preference for division is: C-C (always in geminated; preferable position with two intervocalic consonants, rather than V-CCV OR VCC-V). CC combinations can therefore occur as clusters word-initially and word-finally and are usually dismissed from qualifying as clusters within a multisyllabic word because they are bound by syllabic division. In the circumstances they become consonantal sequences. There are only few restrictions for CC sequence combinations across syllabic boundaries. With a three consonant sequence intervocalically, the tendency is for the following order of preference:

C - CC

CC - C

but never - CCC or CCC -

If the medial consonant is /m/ or /w/ the latter may constitute a separate syllable or CC - C option is used in analysis. As a rule CC - C is opted for when C2 and C3 cannot occur as syllable initial clusters but are possible as final clusters. Syllable division does not restrain assimilation of voicing, place of articulation and lip movement.

The author carried out a longitudinal study with the purpose of describing aspects of the normally developing Maltese speaking child's sponetics and phonology. One objective of this project was to identify trends of stages of

the development of syllabic structure and to compare this cross-linguistically. This paper reports this aspect of the overall findings and forms part of a broader database regarding Maltese child phonology. Data obtained are meant to become a help to clinicians. This study is the first major contribution to develop 'norms' for the Maltese child population regarding the development of phonology. Since no research has been carried out yet on Maltese child phonology, such a study was considered to be essential in view of the fact that speech therapists in clinics have been needing the data for the past two decades when the speech therapy service was launched in Malta. Allied professions such as psychologists, child psychiatrists, paediatricians and educators would also benefit from such data once they become accessible.

This study also aimed at contributing to scientific knowledge on theories of phonology. "Language-specific differences across fully developed languages have constituted the principal source of variation for linguistic theorising" (Dinnsen, 1992, p191). Complex theories of language are still being resolved in view of the fact that data are still being collected especially in the area of phonological acquisition. The findings of cross-linguistic studies have led researchers to awareness that questions cannot be answered from one single language. The distinctiveness of Maltese is highlighted mainly by the following characteristics:

- the situation of bilinguality which has to be considered when transcribing child speech;
- the phonotactic complexity of Maltese (particularly reflecting on the number of possible syllables in a word and the complexity that a monosyllabic word may have);
- the effect of English loan-words which do not seem to leave a great impact on its phonology (e.g., English /θ, ð/ do not usually surface in Maltese speakers when they utter English words with such phonemes embedded in them);
- its morphophonemics; in some cases a slight phonetic (even prosodic) change alters the meaning of a whole word/sentence;
- the distinctive degrees of length in vowels and consonants;
- the glottal stop as a Maltese phoneme (which is relevant particularly in pathology and intervention; e.g., voice disorders; effect on cleft palate);
- the number of affricates as phonemes.

In view of such unique characteristics of Maltese it is expected that this project will be able to contribute to the database that already exists in search of the theory of phonological acquisition.

METHODOLOGY

This paper presents data from an observational longitudinal investigation of some aspects of phonological development of 21 normally developing Maltese speaking children. Data from the Maltese children were collected over a period of eighteen months. The children were video- and audio-recorded in their homes when they were 2;0, 2;5, 3;0 and 3;6 years old respectively. Each recording session took a reasonable length of time not exceeding forty-five minutes, with the purpose of collecting a sufficient speech sample. The longitudinal method allowed the researcher to observe changes of phonological production, which were dependent

on age. This period between 2;0 and 3;6 years of age was chosen specifically to include the "crucial" years for phonological development. The fact that the child's phonological system changes considerably between two and three years of age is well-recorded in the literature. The types of syllable and word shapes are among the reported changes (Stoel-Gammon, 1991). The subjects were also studied cross-sectionally to look into the possibility of generalising data at one point in time (specific developmental stage). It was expected, as from other research findings (e.g., Grunwell, 1985 and Ingram, 1989), that changes in a child's phonology would become less apparent after three years of age. The fourth recording period provided the researcher with the possibility of noting any further changes which occur after three years of age. By this period the main progress in phonology was expected to have been reached.

The issue of sample size was difficult to resolve in view of the nature of the project. A large sample would increase generalisability but the large amount of data generated from recording child speech limits the amount possible. A random sample of 40 children who had to be 2;0 years old at the onset of data collection, was drawn up from the list recorded at the public registry, after eliminating children who did not fulfil the following selection criteria: Apgar scores at birth greater than 3 (McCormick, 1992); child not admitted to special care baby neonatal unit; child not born with congenital abnormalities; child not illegitimate and both parents living together at birth; both parents spoke fluent Maltese. The first three criteria eliminated a high proportion of those children who would have been at greater risk of having hearing acuity problems and/or having difficulties with cognitive functioning. The last two mentioned criteria were included to reduce variables pertaining to emotional stability of children and reduce variability in linguistic input respectively. The selected subjects were further scrutinised to ensure that the children were following a 'normal' pattern of linguistic development and were not at risk of developing complications later on. This was made possible by interviewing parents in their homes and asking them to complete a questionnaire with the help of the researcher. Questions dealt with the general developmental milestones, the hearing acuity and overall health of the child, family history of language impairment and the linguistic input, that had to be primarily Maltese.

During the same session the respective children went through a language screening test, employed by the researcher, that gave a broad view of the verbal comprehension and expression abilities as well as the hearing acuity of the child. Those children whose score was \pm three standard deviations were eliminated from the sample population. It was not possible to predict a phonological disorder in a child aged 2;0 other than by identifying the known associated factors and eliminating those children who had them. Since a baseline for phonological acquisition was not yet established for Maltese, it was difficult to conclude that a specific child was delayed/deviant phonologically. During the same interview, the children were also shown a set of picture cards that was constructed specifically to use in subsequent sessions for data collection. This was to check whether the respective words were within the lexicon of the child. Spontaneous continuous speech was also noted and analysed for a subjective opinion regarding deviancy. The examiner, a speech therapist, evaluated related areas such as psychosocial, neuromotor and

cognitive/linguistic abilities; oro-facial structure and functions; the child's perceptual abilities; and rate, fluency, voice and suprasegmentals. Furthermore, the investigator had to be cautious of any signs of acquired difficulties during the period of recording that could consider elimination of any subject/s from the study at a later stage. Although factors such as gender, position in the family and multiple births seem to influence phonological acquisition, these factors were not controlled in this study so that variation of the 'norm' could be picked up without getting a skewed picture of development.

The research tools were selected and devised to enable the researcher to obtain an *exhaustive* speech sample that included all the child's pronunciation patterns; hence, spontaneous speech sampling as well as picture naming were employed, with criteria for transcript size being established prior to recording sessions. The speech sample had to be *replicable*; conventions for transcription and analysis were clearly defined, so that two analyses of the same data sample by two different analysts provided 91.2-100% agreement on consonantal place and manner features, consonantal count in pre- and post-vocalic position and vocalisation length in syllables. The sample needed to reflect reliably the *typical* pronunciation patterns of the speaker; hence spontaneous speech sampling was collected in the natural environment. The children were recorded during free play sessions while interacting with their mothers in the home, as well as during the administration of the picture-naming test with the help of the researcher. Each session was audio-recorded as well as video-recorded to enable the collection of relevant information such as situational context, direction of the child's attention, gestures and accompanying vocalisations. Lip to microphone distance was maintained at 15-30 CMS. This was made possible by using a wireless microphone with a small transmitter (Connevens, Type CRM -T200) attached to the child's pocket or trousers and the receiver (Connevens, Type CRM -R200) connected directly to the audio-cassette. The frequency response of the radio microphone equipment used was 90HZ-5.5 kHz. The microphone (BT 1754 Electret) used was AGC controlled. The audio-cassette (Nokia recorder type, SL 837 AV stereo) being a stereo recorder with a built in condenser microphone (mono) and built in slide signal generator, a 2 channel sound mixer plus tone control availability. The video camera (Panasonic NV-MS4E) was also supplied with a 'gun' microphone. The signal to noise ratio was more than 47 dB. This procedure yielded excellent quality tapes in which, as reported by Shriberg, Kwiatkowski and Hoffman (1984), consonant allophone features such as aspiration were clearly audible, and vowels were not distorted. Thirty children completed all recording sessions.

The data were analysed using the *Phonological Assessment of Child Speech* (PACS), Grunwell (1985), which was modified for Maltese with authorisation. Transcription was sub-divided into four groupings: namely, single words (from spontaneous/elicited picture naming or conversation; connected speech (produced through picture naming task or during conversation); modelled single words; modelled connected speech. Analysis proceeded for spontaneous/elicited single word utterances due to the vastness of data that were collected. These included utterances from picture naming and conversation since it was assumed that internal representations were present in both instances. The researcher was unable to proceed with the analysis of 9 of

the 30 children because:

- transcript size was only acceptable for 23 children for all recording sessions;
- one child, who had passed selection criteria and whose transcript size was acceptable, had more English than Maltese words in her transcript for spontaneous single words;
- one child refused to talk in front of researcher and cameraman; recordings for all sessions proceeded with only the mother present in the room. Although transcript size was acceptable, the subject's recordings were not considered for analysis as these were not consistent with other children's recordings.

The data were organised for each child and for every recorded session so that the phone inventory, phonemic inventory, consonantal cluster realisations, developmental phonological processes and syllabic structures used by each child were identified. Following this comprehensive analysis for each child, the next step was to collate all the children's inventories and look at the trend and level of these occurrences across time. Results were organised for the group for each recording session; these were then summarised to give the developmental profile for the group. Finally, cross-linguistic comparison was carried out. This paper highlights and discusses results related to the syllabic structures produced by the children.

RESULTS

Data about the canonical structures of the children were tabulated at different developmental stages. This was an important aspect to consider, checking whether such canonical structures were common amongst the children at a particular age and whether they changed between one recording session and another. Since a wide range of syllabic structures exists, the data were summarised depending on syllabic size rather than type of the word (see Table 1). Multisyllabic² words are not tabulated due to the high degree of structural variation that existed. However more comprehensive data sheets are available for each session per child should these need to be retrieved. In some cases a child may have had more than one canonical structure constituting a particular size of syllable; e.g., subject 04 had the disyllabic canonical structure represented equally by 15 tokens as CVC,CV and CVC,CVC at one recording stage. When this occurred both possibilities were recorded in Table 1.

The next step was to compare the children's syllabic structures with the adult system. When the children's structures were matched with the corresponding adult forms, all the occurrences were considered and not merely those that dominate the child's range of syllabic possibilities. Figures 1-4 provide details regarding the percentage of syllabic matches for each child, for mono-, di-, and multisyllabic words respectively.

As indicated above, cross-linguistic data on syllables and shapes of early words are scarce. The few studies that are available vary in methodology and the type and depth of analysis. Table 2 provides a comparison of the Maltese data with English and Arabic data for children between 2;0 and 3;0 years of age. In one of the studies data are available for monosyllables up to 2;0 years of age only.

DISCUSSION

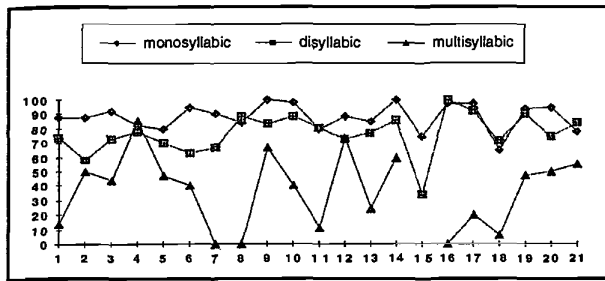


FIGURE 1. Percentage of syllabic matches at age 2;0 for each child.

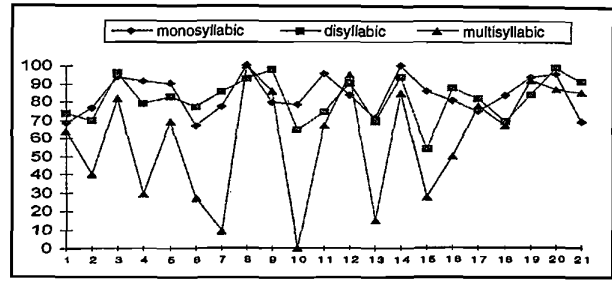


FIGURE 2. Percentage of syllabic matches at age 2;5 for each child.

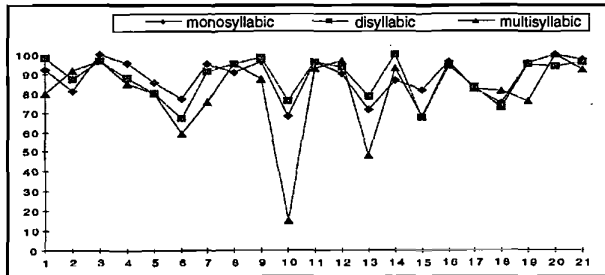


FIGURE 3. Percentage of syllabic matches at age 3;0 for each child.

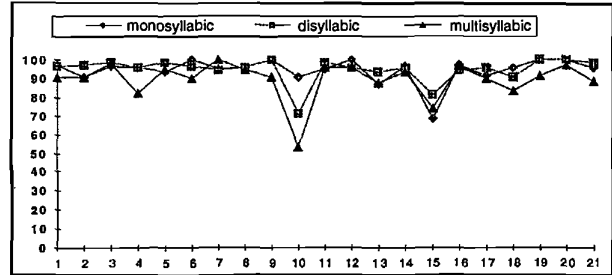


FIGURE 4. Percentage of syllabic matches at age 3;6 for each child.

TABLE 1. Canonical Structures of the Maltese Children

Syllabic structures	Canonical structures	Percentage of children
C = non-syllabic segment V = syllabic segment MONOSYLLABLES	AGE 2;0	
	CV	66.6
	CVC	23.8
	AGE 2;5	CVC
AGE 3;0	CVC	100
AGE 3;6	CVC	100
DISYLLABIC	AGE 2;0	
	CV,CV	61.9
	V,CV	19.05
	CVC,CV	14.29
	AGE 2;5	
	CVC,CV	33.3
	CV,CV	28.5
	V,CV	
AGE 3;0		
CV,CV	28.57	
CVC,CVC	23.8	
AGE 3;6		
CVC,CVC	38.1	
CV,CVC	23.8	
CVC,CV	9.52	

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A DESCRIPTION OF THE MALTESE CHILDREN'S SYLLABIC STRUCTURES

Monosyllabic words

Canonical structures for monosyllabic words did not vary a lot within subjects or throughout the recording period. Two thirds of the group had the open syllable CV as a canonical structure at age 2;0, while about one fourth of

the group had the closed syllable CVC. A few children had a different type of structure as the canonical one at this stage.

Canonical structures at age 2;5 were dominated by the closed syllable CVC. At age 3;0, all the subjects had a common closed syllable as their canonical form, namely CVC. This persevered, so that at age 3;6, the most common monosyllable was the same one for all the children.

Disyllabic words

TABLE 2. Cross-linguistic Comparison of Syllabic Structure Development

	Most prevalent word shapes recorded	Age	Maltese % of children using word shape canonically (Grech, 1998)	English % of occurrence of word shape (Watson & Scukanec, 1997)	Arabic % of occurrence of word shape (Dyson & Amayreh, 1999)
Number of subjects			21	12	13 (age ranging between 1;2-2;0)
Monosyllabic	CV	2;0	66.6	27.0	62.7
		2;5-2;6	not recorded ³	18.9	not studied ⁴
		3;0	not recorded	13.8	not studied
	VC	2;0	not recorded	7.5	not recorded
		2;5-2;6		6.8	
		3;0		7.4	
	CVC	2;0	23.8	28.7	34.7
		2;5-2;6	95.2	37.6	not studied
		3;0	100	35.1	not studied
	CCV	2;0	not recorded	not recorded	1.0
		2;5-2;6			not studied
		3;0			not studied
	CCVC	2;0	not recorded	1.6	0.3
		2;5-2;6		2.2	not studied
		3;0		2.3	not studied
	CVCC	2;0	not recorded	3.1	1.4
		2;5-2;6		5.8	not studied
		3;0		9.3	not studied
Disyllabic	CV,CV	2;0	61.9	12.3	not studied
		2;5-2;6	28.5	8.9	
		3;0	28.6	7.4	
	V,CV	2;0	19.1	2.4	not studied
		2;5-2;6	23.8	1.6	
		3;0	not recorded	0.9	
	CVC,CV	2;0	14.3	not recorded	not studied
		2;5-2;6	33.3		
		3;0	not recorded		
	CVC,CVC	2;0	not recorded	not recorded	not studied
		2;5-2;6	not recorded		
		3;0	23.8		
	CC(C)VCC	2;0	not recorded	0.0	not studied
		2;5-2;6		0.73	
		3;0		0.67	

Disyllables varied a lot in type. However, Table 1 indicates a trend for the subjects' canonical form at age 2;0. In fact, 61.9% shared CV, CV as their most common disyllabic structure. About one fifth of the group used the disyllabic V, CV structure more commonly; whereas fewer children used mostly the structure form CVC, CV. The latter form was used more commonly five months later. In fact CVC, CV was the most common canonical disyllabic structure at age 2;5. At 3;0, about one third used the form CV, CV most commonly, while another 23.8% of the group had CVC, CVC more frequent in their transcripts. By age 3;6 the structure CVC, CVC was becoming the most commonly used disyllable for more than a third of the group, while another closed structure, i.e., CV, CVC was catching up in use as it was the canonical form for about one fourth of the group.

Multisyllabic words

Although multisyllabicity was not presented in Table 1 for reasons given above yet it merits being included in this section. 90% of the 2;0 year olds in this study had three syllabic word structures in their repertoires. This percentage went up to 95% among the 2;5 year olds. By age 3;0 all the children used three syllabic words and 95% of them used four syllabic word structures also. At age 3;6 nearly all of them included three and four syllabic words in their utterances. 19% of them had also five syllabic single words in their transcripts.

COMPARISON OF THE CHILDREN'S STRUCTURES WITH ADULT FORMS

A more complex syllabic structure seems to become common among the subjects as they grew older. However, were these matching with corresponding adult ones? Figure 1 indicates a high degree of matching of monosyllables even at age 2;0. An average of 88% monosyllabic matches was produced at this age. With regard to disyllabic matches, this averaged to 76.4% for this age group, whereas production of multisyllabic words was matched for structure 35% of the time. The trend for matches increased progressively, so that by age 3;6, matches for monosyllabic words were 94.4%; disyllabic words: 95% and multisyllabic words: 89.4%. It is reported that by three years of age children tend to have relatively few persistent mismatches when compared with the adult system in terms of syllable shape (e.g., Stoel-Gammon, 1991; Haelsig and Madison, 1986). The main mismatch lies in the production of sequences of consonants as recorded by the relatively high proportion of the cluster reduction process applied in their speech. Most of the Maltese children mastered their phonotactics by the time they reached 3;6 years of age, irrespective of whether these include multisyllabic words or words with syllabic complexity. This is an interesting finding especially when it is compared with results obtained for the same subjects regarding their phone/phoneme systems. Data indicate that for the Maltese subjects', syllabic structure development precedes segmental development.

THE FINDINGS IN RELATION TO OTHER ASPECTS OF MALTESE

The impact of the findings in relation to other sub-components of the Maltese language is particularly evident regarding lexical and morphological acquisition. Maltese

words can be composed of a series of morphemes; for example, possession, the feminine and some plural forms may be expressed through a suffix. Hence, lexical expansion may be indicated by an increase in the number of morphemes attached to or merged in a word. Consequently, syllabic complexity and the number of syllables in the word increase, as more morphemes are included in the word. Therefore, progress in lexical and morphological development puts demands on Maltese child phonology. For example, the early use of consonantal clusters ties in with morpho-syntactic advancement. In some cases, pluralisation in Maltese is signified by the substitution of a syllable initial consonantal cluster for a syllable initial singleton. The fact that more syllable initial clusters were recorded when the children were older could have been influenced by the advancement of such aspects as morphological development. Similarly, in Maltese, verb forms are derived from the same verb base. More clusters were produced in syllable initial position for all recording stages. This could be due to the fact that some verb forms signifying past tense (which may involve the introduction of syllable final clusters in a word) may take longer to develop, than other morpho-syntactic aspects such as pluralisation.

CROSS-LINGUISTIC COMPARISON OF SYLLABIC STRUCTURE DEVELOPMENT

Although the acquisition of phonotactics has not been studied as commonly as other aspects of children's development, some data are available for cross-linguistic comparison. For example, Lleo and Prinz (1996) provide data on German and Spanish monolingual speakers that provide evidence for the following hierarchy of acquisition: CV > CVC > CVCC > CCVCC. Results for Maltese children highlight an agreement to the above profile of development as it is clear that the closed syllable develops later than the open syllable and that this is soon followed by the addition of consonantal clusters to the structure. Dobrich and Scarborough (1992) sought to examine aspects of the phonotactics of 12 normally developing children (age 2;0-5;0). Overall the group of children, like adults, favoured monosyllabic words and attempted more words with final than initial consonant clusters. The data in the Maltese study also showed a group trend for favouring canonical structures even though the number of possible structures is numerous for Maltese. Stoel-Gammon (1987) produced a profile of phonological skills of English speaking 2;0-year-olds and includes information about their phonotactics. She reports that CV and CVC monosyllables were present in the samples of most subjects and that CV, CV and CV, CVC were present in >50% of the children. Watson & Scukanec (1997) report the mean percentage of the most prevalent word shapes used by the 12 English speaking subjects in their study (see Table 2). These results compare well with those of Stoel-Gammon. In fact, CV and CVC were the most prevalent syllabic shapes at age 2;0. At the same age, the Maltese structures CV and CVC were used canonically by 66.6% and 23.3% of subjects respectively. CV seems to be the most common monosyllabic word shape at 2;0 years of age for the Arabic speaking children also, as reported by Dyson and Amayreh (1999), while CVC is the next most common monosyllabic shape used by the same subjects. Unfortunately, these authors do not report data on the use of multisyllabic words or on older children. However, comparison of the Maltese data with that of the English

speaking children (Watson & Scukanec, 1997) indicate that CV, CV was the most commonly used disyllabic structure at age 2;0 in both studies; this word shape was used less often as the children grew older. V, CV was another word shape used commonly by both the English and Maltese subjects at age 2;0. Reported data for older children's word shape use are less common cross-linguistically. This could perhaps be the result of the expansion of lexicon size that would include more specific language syllabic structures.

CONCLUSION

The limited phonological forms of children's early speech seem to be universal. The observed phenomena could be scrutinised further as information could be revealed related to the various explanatory claims posed by researchers. For example, Johnson, Lewis and Hogan (1997) claim that maturational limitations could be reflective of word and later sentence production whereas other researchers, such as Echols and Newport (1992), suggest that these limitations result from extraction biases young children use to segment the input speech stream.

Meanwhile, the fact that canonical form in the early stages of phonological development seems to be universally limited to monosyllables and bisyllables but that the content of the syllable differs, suggests that children employ different production strategies to compensate for this limitation probably influenced by specific language constraints. In the introduction it was mentioned that Maltese can have monosyllabic words as complex as C3VC₂ and that words can frequently have up to five syllables. Perhaps this high proportion of structural matching with the adult system could be the influence of the structure of the language in question. To date few studies have concentrated on phonotactic development in older children. Findings in this study call for further cross-linguistic research in this area.

Various specific implications for intervention can be drawn out from the data revealed in this study regarding Maltese phonotactic development. These are discussed below.

- Language specific profiles may be different from universal ones; now that developmental phonological profiles for Maltese are available, clinicians treating Maltese speaking children are in a better situation as they can follow these profiles specific to this population when devising treatment strategies.
- Assessment should proceed for both simple and complex syllabic structures; this also applies to intervention. However, this needs to be planned carefully. It has been observed that complex structures develop early in Maltese. This may influence intelligibility of the phonologically impaired. As the phonotactic structure develops, more and more developmental processes affecting the segmental level may be involved which renders speech more difficult to understand. Perhaps if clinicians consider this in prioritising strategies for intervention, it may help intelligibility to be achieved earlier. For example, if 'systemic' processes are targeted in simpler syllabic structures, the impaired child may receive more positive feedback when self-evaluating.
- It is now 'widely accepted' that developmental verbal dyspraxia may be characterised by inconsistent patterns. The complexity of Maltese phonotactics and the

numerous possible combinations of consonantal clusters, make this statement very difficult to apply in the Maltese context. One would expect inconsistent patterns even in a 'normal' Maltese child, especially if processes are studied from a limited speech sample. This suggests that clinicians need to be very cautious and make sure that analysis is based on a large enough transcript that incorporates as many phonotactic varieties as possible.

- It has been found that contrastive clusters take longer to be mastered even though they may surface early. Clinicians need to be cautious of intervening too early when full mastery may not yet be complete. The introduction of new strategies in intervention before the establishment of earlier targeted ones may leave repercussions on speech intelligibility.
- Intervention for phonological impairment needs to be planned in parallel with the development of other sub-components of the language. Morpho-syntactic complexity, in Maltese, is often marked by the introduction of syllabic complexity in a word. This is because pluralisation, verb forms and adjectives may be derivations of a noun/verb; the derived forms often introduce consonantal clusters in the lexeme; hence intervention would have to consider the influence that the language sub-components have on each other.
- Prosodic development needs to be tackled prior to segmental development if there occur difficulties in both (Bernhardt, 1990). The Maltese findings support this claim since syllabic structure development proceeds segmental development.

The implications of the findings of this study for intervention could be more exhaustive than the brief that has been given above. However, this is not the main scope of this investigation. The contribution of the data in this study regarding norms for Maltese (output) phonological development sets the scene for clinical application and for encouraging future related research that could address the number of clinical questions that this study has uncovered.

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