



DURATIONAL VARIATION OF VOWELS AS PRODUCED BY ARAB STUDENTS

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ABSTRACT

The primary objective of this study was to investigate the degree of influence of Arabic vowel duration in 'emphatic' and 'non-emphatic' contexts on the production of English sequences. The specific questions asked were the following:

- (i) What is the average Arabic vowel duration in 'emphatic' and 'non-emphatic' contexts?
- (ii) Is vowel durational variation a function of the complex features of 'emphasis'?

Judging by the spectrographic evidence obtained, it has been established that duration of Arabic vowels as well as of syllables vary according to the complex features of 'emphasis', whose domain is more than one segment in length. Such features are carried over to English.

INTRODUCTION

The most distinctive feature of the Arabic phonological system is perhaps the complex features of 'emphasis' which extend phonetically over the whole or part of the syllable. In general phonetic terms, 'emphasis' has been described as the lateral expansion of the whole body of tongue and the raising of its back in close approximation to the velum, accompanied by a reduction of the pharyngeal cavity (ref1). In phonemic terms, 'emphasis' has been interpreted as follows:

(a) 'emphasis' is mapped as a distinctive feature of the vowel system and as a redundant feature of the consonant system. The consonants which occur before 'emphatic' V are said to be 'emphatic': 'non-emphatic' consonants', on the other hand, always occur before 'non-emphatic' V (ref1).

(b) 'emphasis' may be considered as the property of the consonant system and as a redundant feature of the vowel system.

According to phonemic analysis, the Arabic system of 'emphatic' consonants is generally agreed to consist of four distinctive units (D, T, S, ʔ) in contrast with the corresponding 'non-emphatic' consonants (d, t, s, ʔ) (ref6). Prosodically, both 'emphatic' and 'non-emphatic' syllables are associated with stable complexes within an appropriate domain. Such features including duration may be abstracted from the data and allotted to prosodic categories labelled 'emphasis'/'non-emphasis' (ref4).

The modification of acoustic properties of speech sounds as a function of the immediate phonetic environment similar to those operating in the native language is a phenomenon that has not captured the attention of research workers and a proper understanding of the nature of these rules will improve knowledge about phonological negative transfers, and how these rules interact in the acquisition process of a second language.

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PROCEDURE

Four Jordanian first year university students (two males and two females) were recorded on a tape recorder in the studio of the language laboratory of the University of Jordan. Forty minimal pairs of contrastive forms were pronounced in the real sentence frame

la(a).....wa la(a)
'It's not.....but'

The word list was read twice by all speakers. Analysis was made from the second reading. The collected samples were analysed on a wide band sound spectrogram (Voiceprint 700 spectrograph) at the Institute for Advanced Study of the Communication Processes, University of Florida.

RESULTS

The average vowel duration of each word is given in the Tables below. Each figure represents the average of four tokens.

1. Mean Vowel Durations in milliseconds (ms) per initial 'emphatic'/'non-emphatic' consonant separated by open front and open back vowels

<u>'non-emphatic'</u>		<u>'emphatic'</u>	
da:m	177 ms	D a:m	170 ms
ta:b	215	T a:b	212
sa:m	215	S a:m	182
0a:9	217	0 a:9	175
ra:d	200	r a:D	182
la:t	220	l a:T	190
la:s	182	l a:S	172

2. Average Vowel Duration in ms per final Emphatic /'non-emphatic' Consonant separated by open front and open back vowels

<u>'non-emphatic'</u>		<u>'emphatic'</u>	
fa:d	200 ms	f a:D	188 ms
ba:t	233	b a:T	215
Ha:s	252	H a:S	212
ʃa:θ	230	s a:θ	225
sa:r	240	S a:r	210
da:l	235	D a:l	212

3. Average Vowel Durations of Arabic Short Open Vowels in 'emphatic'/'non-emphatic' Contexts

<u>'non-emphatic'</u>		<u>'emphatic'</u>	
dam	110 ms	D a m	105 ms
tab	122	T a b	85
sam	123	S a m	100
θa9	100	θ a 9	90
rad	130	r a D	117
lat	100	l a T	100
las	98	l a S	95

4. Average Vowel Durations in ms of Arabic short Vowels per final 'emphatic'/'non-emphatic' Consonants.

<u>'non-emphatic'</u>		<u>'emphatic'</u>	
9ad	125 ms	9 a D	100 ms
bat	108	b a T	105
mas	115	m a S	102

fa ^ʔ	107	ms	f a ^ʔ	114	ms
sar	115		S ar	110	
tal	99		T a l	100	
dal	100		d a l	90	

Discussion

Inspection of the spectrograms obtained and the measurement of vowel and syllabic duration of the test words reveal durational differences between 'emphatic and 'non-emphatic' syllables. Durational differences arise from the fact that "emphasis" has an overall shortening effect on the production of the syllables. This shortening effect is apparent in all Arabic syllable-types investigated: CVVC, CVCC and CVV. Within each syllable-type, however, there is considerable variation in length according to the type of consonantal articulation being uttered and the mutual dependency obtaining between successive consonantal articulations within the syllable structure. Thus, syllables of the phonological structure CVVC in which the final C-position is filled by a nasal or voiced pharyngeal approximant are longer in duration than when C - position is filled by a plosive consonant, Cf.

'non-emphatic'			2	'emphatic'		
sa:m	427	ms		S a:m	307	ms
da:m	315			D a:m	290	
ʔa:9	330			ʔ a:9	290	
		::				
ta:b	270			T a:b	225	
la:t	155			l a:T	210	
ra:d	200			r a:D	182	

As the figures indicate, features of consonantal (e.g. nasal and pharyngeal approximants) accompaniment have considerable lengthening effect in both "emphatic" and "non-emphatic" syllables. The occurrence of a compatible plosive consonant has an inverse relationship as far as the duration of the syllable is concerned

The phonetic context in Arabic is not the same as in English. Arabic LONG vowels vary in realisation according to the following important types of environment:

(a) vowels are shorter in duration when an 'emphatic' consonant occurs within its domain. That is, the LONG vowel in ta:b is longer than the long vowel in Ta:b.

(b) Arabic vowels are pronounced longer in the environment of a nasal, lateral or trill consonant, e.g. the long vowel

/i:/ is longer in /ti:n/ than in /Ti:n/.

(c) Formant frequencies of Arabic vowels are considerably affected by DOUBLE ARTICULATION (two places of articulation of equal importance) which is characteristic of all 'emphatic' consonants. Double articulation has therefore an important effect not only on the duration of the vowel but also on its quality. Most formant frequencies are lowered when 'emphatic' consonants are pronounced.

Whereas vowel duration of vowels as produced by native speakers of English is a function of the following

voiced/voiceless consonant (Ref2), English vowels produced

by Jordanian students of English does not vary according to the feature of voice. In point of fact, the difference in duration between vowels followed by a voiced consonant and those followed by a voiceless consonant is quite marginal (except when vowels are followed by a nasal or liquid). What seems to be crucial from the measurements obtained is whether the vowel articulated is an open back or an open front vowel. There exists what seems to be mutual dependency between open back vowels and the feature of shorter duration as opposed to front back vowels and the feature of longer duration. In addition consonantal articulations in the environment of back open vowels are "darker" (i.e. characterised by 'double articulation' than consonantal articulations in the environment of open front vowels.

In Jordanian English, the acoustic realisation of phonetic segments is highly context-sensitive and is largely influenced by Arabic context-sensitive rules. Thus, the realisation of English t as T , d as D , s as S , ʔ as ʔ , l as ɫ and r r̥ is fairly systematic and can be captured by explicit rules:

(i) t becomes T (voiceless alveolar plosive becomes voiceless denti-alveolar plosive) when a back open or half open vowel follows the segment, e.g. /ton/ is realised as /Ton/ . /taim/ is realised as /Taim/ and /botil/ as /boTil/ .

(ii) /s/ becomes /S/ (voiceless denti-alveolar fricative becomes 'emphatic'

'emphatic' denti-alveolar fricative or in acoustic terms the centre of gravity becomes in the lower frequency ranges than in the higher frequency ranges , when the segment occurs in the environment of a back open or half open vowel, e.g. sauce, roast, bus, fuss, sub, socks, loss, boss, Sussex, sausages, are realised as /So:S/, /Ro:ST/, /b S/, /f S/, /S b/, /SOks/, /loS/, /SokS, /loS/, /boS/, /S Siks/, /SoSi3iz/, .

(iii) /ʔ/ becomes /ʔ / when it occurs in the environment of a back open or half open vowel, e.g. mother , father , thus are realised as /m aʔ a r/, /f aʔ a r/, /ʔ a s/ .

(iv) l becomes 'velarised' or 'dark' in the environment of a back open vowel , e.g. luck lot lark are realised as 'dark' ɫ .

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