An Acoustic Phonetic Study Of The Application Of Underspecification Theory On Iraqi Arabic Vowels

دراسة صوتية فيزيائية لتطبيق نظرية التخصيص التحتي على حروف العلة العراقية

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1- **Introduction**:

Underspecification Theory(henceforth UT) is one of the controversial issues of Lexical Phonology . Ut is concerned with the theory of features and the specification of underlying segments; hovering mainly on the idea that features should be left unspecified if a lexical phonological rule would be capable of filling them in ,i.e. Underspecification pursues the omission of certain features in underlying representation and the specification of underlying segments.

Dinnsen(1998:294) contends that the theory crucially distinguishes between these properties of underlying representations that must be specified and those that must be underspecified ,that is not specified. The underspecified properties, in this case, are filled in by rules of various types that express the predictable value of the property.

Durand(1990:156) argues that there are two views on the specification account:1) a full specification account, and a partial specification account. The former type is concerned with the utterance of a value for each feature into a phonological matrix including the total set of distinctive features as high , low , back, round and voice. The latter approach leaves

out some predictable features; the missing values would be then filled by redundancy rules, with the possibility that the contrast between two phonemes suspends in some contexts leading to the postulation of archiphonemes.

In this case, UT is not just an attempt to achieve formal simplicity at the underlying level. At the basis of this approach lies an interest in a symmetrical segments or feature-values in languages, as it starts from the assumption that underlying specification should be as streamlined as possible and that redundancies should be extracted from underlying entries for distinctive features and all other aspects of phonological representations.

2- **Theoretical Background**:

Two studies handled UT in the treatment of vowel harmony Ringen (1975:55) suggested that:1) feature-filling rules are not obligatory neutralization rules. An illustrative example she gave is that the vowel harmony rules of Turkish could apply root-internally without violating the Alternation condition, provided that root vowels are unspecified for the feature[back] in the output of phonology, and 2) Ringen (ibid) analyzed the tongue-root harmony in the west African languages Igbo and Diola Fongy; arguing that the only feature value[+ ATR] is specified underlyingly, while the complementary value[- ATR] is absent and filled in by a default.

Clements(1976a,b) began to use underspecified representations in his analysis of vowel harmony systems. The starting point was that harmony features have a span or domain that is longer than a single segment, an assumption that is best expressed by placing the feature in question on an autosegmental tier of its own.

3- **Types of Underspecification:**

So far, it was made clear that Underspecification in phonology refers to the representation that make explicit only features not determined by those units adjacent too them; or only those whose values are marked in

that they are not seen as predictable by universal principles(Matthews,1997:420).

In the normal case, it is the marked term that is lexically present, while the unspecified value is filled in by universal default rule. Harris and Lindsey(1995:38-9) assume that the latter operation does not take place until the final stage of derivation, with the result that the unspecified value remains invisible to phonological processes .However, these two items have been dealt with differently in the two approaches of UT.

3-1 Radical UT

This theory centers on the idea that economy is paramount in the evaluation of alternative phonological descriptions. This means that the simpler the description, the more highly valued it will be. This perspective validates what Roca and Johnson(1999:512) postulates in their proposal to leave English[z] lexically underspecified for voice in environments that match the s-voicing rule; this saves on[+voice] entries allowing for exception which will be lexically encoded as [-voice].

Anderson and Ewen(1987:192) expound that the phonological representations are underspecified in the sense that while both voiced and voiceless sonorant will display /o/ phonetically, one member of the opposition lacks the component in phonological representation.

McMahon(2009:1) states that radical Underspecification holds that features should only be underspecified if their values are predictable. To illustrate, all English front vowels /i, I, e, a,a/ are unrounded and so these phonemes do not need to include the distinctive feature[-round], because all[-back] vowels are [-round] vowels. This means that the distinctive feature is not distinctive if we know the vowel to be front.

Roca and Johnson(1999:514)expound that the criterion for the selection of one segment as fully underspecified in the lexicon is grounded in one specific empirical fact: in many(perhaps all) languages, one of the segments in each major class behaves asymmetrically in that it alone

asymmetrically appears in contexts of epenthesis, or it alone triggers, fail to trigger or is persuasive in certain rules.

Structure-building representation of the change in place of articulation from velar to palatal is readily afforded by UT .Coleman(1995;376) affirms that forms which exemplify the velar~palatal alternation could be simply[+dorsal],i.e. not specified further as velar or palatal. In this case, once segment in the relevant class signals itself out by such skewed behavior, its selection as maximally underspecified follows automatically as a matter of theory –internal congruence.

Radical UT assumes that only one value of every distinctive feature is part of the lexical representation, an assumption that is motivated by the desire to free the lexical level of as much information as possible. The choice of unspecified feature is then motivated by:1)universal markedness considerations,2)context-free markedness considerations, and 3) language-specific considerations.

3-2 Contrast-Restricted Underspecification:

This type of Underspecification is based on the tenet that only features that implement lexical contrasts have both their values lexically specified in the relevant environment. In particular, while still favouring lexical economy, the alternative approach gives priority to the explicit expression of lexical contrast over the attainment of radical lexical economy.

Roca and Johnson(1999:522) clarify that the term "contrast-restricted" must be interpreted as restricted to contrastive. feature values are left unspecified in the lexicon if they are predictable from the pattern of distributional neutralization in the language. In this case, the specification of both values of the same feature in the same environment undermines the basic tenet of radical Underspecification that attainment of lexical economy is paramount.

4-Principles of Underspecification Theory:

This theory has its own principles. The first principle is known as "The Eliminate Redundant Feature". This rule as Goldsmith(1990:219) argues is responsible for making reference only to the distinctive features of the language and to none of its redundant or predictable phonological features, such as aspiration of stops in English .Similarly, vowels are not marked for voicing in English since vowels in this language, as in most languages, are non-contrastively voiced.

Features may be left unspecified via using feature filters which could take in more than a single segment. To fill in such predictable feature as voicing, the feature filter will be as follows:

*[voice]

+[sonorant]

This implies that there is no voice specification with sonorants.

Another way of leaving features unspecified underlyingly is to find the feature specification filled in during the course of lexical derivation ,i.e. by the use of a lexical phonological rule. In such cases, to express the naturalness of finding voices non-continuants after nasals, the voicing can be left underlyingly unspecified in such an obstruent to do the work of filling in voicing specification.

Roca and Johnson(1999:508) suggests that the observation that the sounds of the language are ranked on grounds of naturalness has given rise to the theory of markedness which means that some feature combinations, whether paradigmatic(within the same segment) or syntagmatic(across segments) are less natural than others, and therefore less likely to crop up in the world`s languages. The combination [+sonorant,-voice],for instance is marked paradigmatically, and the sequence{coronal}+[labial] or [coronal]+[dorsal] are marked syntagmatically.

Features that are not distinctive in a subpart of the inventory of underlying segments must not be expressed with segments in that subpart in being ruled out by feature filters. Unmarked feature specification can be eliminated from underlying forms in that such non-redundant feature has an unmarked value; only the latter may be explicitly present in underlying forms.

The second principle of UT refers to the view that features should be left unspecified if a lexical phonological rule would be capable of filling them in. In this line of thought ,Goldsmith(1990:219) illustrates the case of tense vowels in English, which typically have an off glide, and that the presence of the Y-glide in[ey],or w-glide in[ow] is obligatory.

Third, there is the principle of structure preservation. In a framework in which segments are fully specified, if any single feature is changed, then the chances are good that the result will not be a permissible underlying segment; phonological systems are rarely so symmetric. For example, if an s becomes not z but r, the [sonorant]will have to be changed as well, if structure preservation is to be maintained, On the other hand, rules that take away feature specification, and rules that add features will also tend more frequently to be structure- preserving especially if they are applying to a highly underspecified segment already.

5-Iraqi Vowels:

There is a kind of controversy concerning Arabic vowels. Arabic linguists assume that classical Arabic(fusha) has three vowel points/I, u, a/ as demonstrated below:

/i/ عِدَّ   /idd/ promise,   /bir/ بِرٌّ Charity

/u/   عُدْ /udd/ comeback,   /bur/ بُرٌّ wheat

/a/   عَدَّ/add/ counted ,   / bar/   بَرٌّ land

 Their counterparts in this case are:

/ ii l   عيد   / iid l Feast   ,   / biir /   بير   well

/ uu /   عود   / uud/ lute , / buur / بور   fallow land

/ aa l عاد l aad l came back ,   l baar l   بار

        Also there is the long vowel l ee l as in qureet (قرأت) and meez (

منضدة)

 In fact these are not just vowel points . Alkalesi(2000:11) assumes that modern Iraqi vowels are nine; four short vowels/I,a,o,u/ and five long vowels/ii,aa,oo,uu,ee/.The following are illustrative examples:

/i/ nisrab (we drink)   sima(sky)

/a/ fann (art)   katab(write)

/o/raadyo (radio)   bannyo(bathing pool)

/u/ luga (language)   rabu(asthma)

/ii/ tiin(figs)   tabiib(doctor)

/aa/ baab(door)   naas(people)

/oo/ mooz(banana)   toom(twins)

/uu/ kuub(cup)   suug(market)

/ee/ meez(table)   zeet(oil)

5:Description of the Experimental Approach Used in This Study

5-1:Procedure and Materials

 In order to obtain a corpus for analysis, a list was compiled of words or phrases. containing Iraqi vowels. The total inventory included 34 individual words .

 The individual words were typed on alphabetized index cards and were assigned a code number. Then two lists were prepared. The first list contained underlined words. The second list was typed without any

indication as to which of the words in the sentence was under study and it was presented to the informants0

Computer program recordings of the text were made in the sound laboratory of the department of English-University of Diyala

5-2:Informants

Four informants were selected from class four of the department of English-University of Diyala. Informants A, B, and C were male and informant D was female

All the speakers recorded first the total set of 34 words. Then they were requested to read the list of words arranged in pairs each with his own tempo, stress and intonation patterns, then they were instructed to use a reasonably uniform tempo and pitch patterns

The above-described corpus was recorded on compact discs in the sound laboratory, using high quality microphone. The recordings were then submitted to a detailed spectrographic analysis using the Pratt sound program.

5-3 :The Spectrographic Analysis of The Data

The acoustic patterns of speech are transformed into visual form via the use of the spectrographic analysis . This research paper uses the following kinds of analyses:

5-3-1:The Broadband Analysis :

This type of analysis displays the formant structure of voiced sounds, the energy concentrations of voiceless sounds, and a time pattern of changes in the frequency dimension. It uses a bandwidth of 300 cps to scan the acoustic spectrum

5-3-2:The Narrow-Band Analysis :

This analysis shows the pitch of the stream of speech using a .bandwidth of 45 cps

5-3-3:The Amplitude Display :

This analysis displays the amplitude variations from one vocal fold cycle to another depending on the overall rectified waveform. Here the duration of the segment is the reciprocal value of the filter bandwidth of 1l60 .seconds

5-4: **The Listening Experiment** :

  The segmentation procedures of Lehiste (1960:16) was adopted in this research. 34items are prepared and recorded as uttered by each of the four informants .

  Thereafter, 30 non-native speakers of English were then chosen from the fourth stage undergraduate students of the department of English. They were ordered to read the words given to them. The listening experiment contained the following pairs of words :

-Table -1

Results of the listening experiment

Words					Correct Identification of The Speaker			
					A	B	C	D
I	nisrab	sima	shuufi	mitkarrir	30	28	26	26
a	fann	katab	marrar	akal	30	29	29	29
o	raddyo	bannyo			28	22		
u	luga	murr	rabu	dazeetu	29	27	24	24
i	teen	tabiib	janiin	daliil	30	28	27	23
a	baab	kaslan	naas	qarran	30	29	27	27
o	mooz	toom	noom	fooz	29	26	26	26
u	kuub	suug	duur	suur	30	29	29	29
ee	meez	zeet	dazeet	quraeet	30	29	28	28

*It is to be noticed that the meaning of the words used in this table are given in the appendix of this research paper.

5-5:The Listening Test :

  This section will discuss the results of the listening test presented in table-1- Two words were chosen from each item. All four speakers were

recorded while pronouncing the words and phrases in the listening experiment.

5-5-1 nisrab – shuufi

Figure a ,b represents the words nisrab and shuufi. This figure contains broadband spectrograms and amplitude displays of the two words uttered by informant A (spectrograms of B and C are not reproduced).
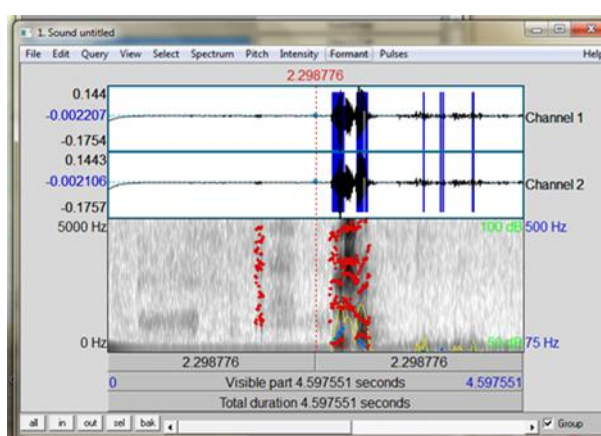

Figure 1.a Broadband spectrograms and amplitude displays of nisrab
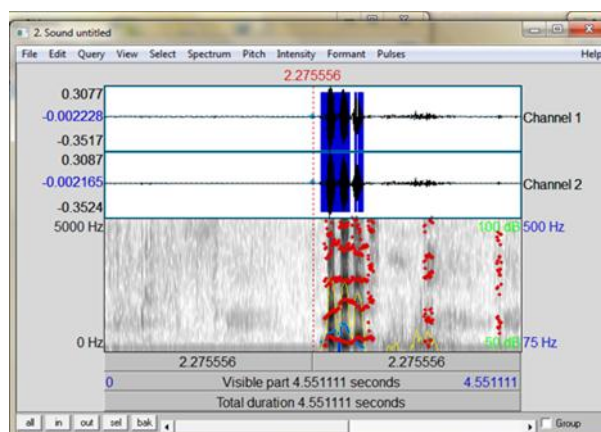
Spoken by informant A

Figure 1.b Broadband spectrograms and amplitude displays of shuufi

Spoken by informant A

Both members of the pair were correctly identified by 30 listeners of informant A and 28 listeners of informant B, and 26 listeners of informants C and D. The segmental duration of nisrab was as follows: the nasal l n l lasted 5 cs for informant A and 3 cs for B and for 1cs C and D. The l i l lasted 9cs and the rest of the sequence was : 7cs for the fricative l l, 5cs for the l r l sound and the vowel l a l that follows and finally 1cs for the dental l b l.

In shuufi, the fricative l l and the l a l that follows lasted 5cs for each.

The fricative l l and the l a l that follows lasted 5cs for each. The long vowel l uu l and the l f l sound lasted 11cs and the short vowel l l l lasted 11 cs. It seems that the duration of the vowel l l l is longer in this word than in nisrab. This is because it occurs at the end of the word. Moreover , l l l in this specific position sounds like its long counterpart l ii l as in ukthee (take it).

5-5-2 fann lmarrar

In figure 2 a,b a spectrogram and amplitude of the above pair are shown as uttered by informant A (spectrograms of B , C and D are not reproduced).
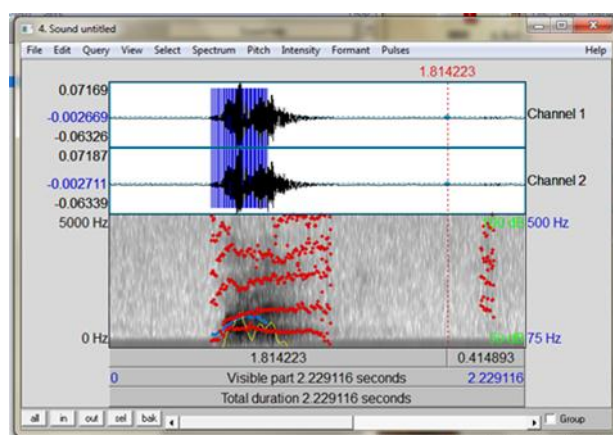
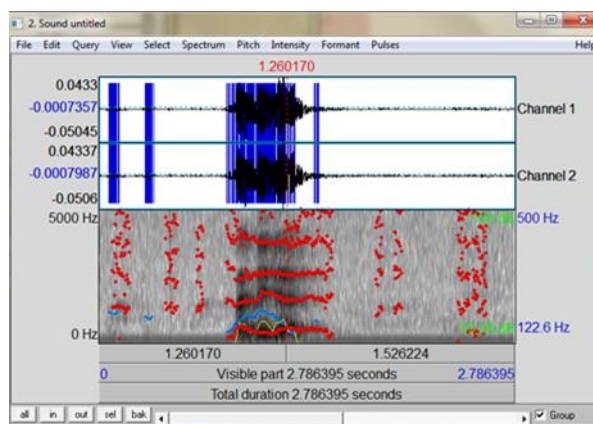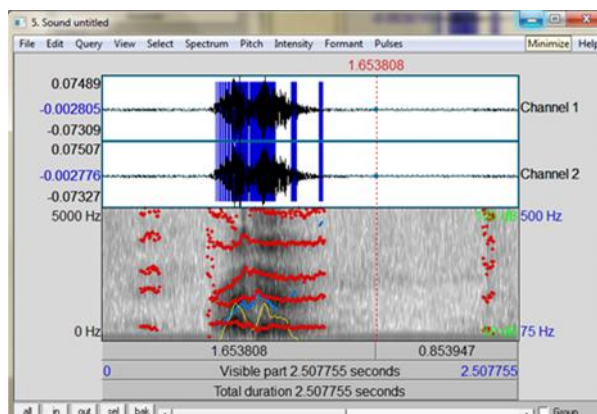Figure 2a Broadband spectrograms and amplitude of fann

Figure 2b Broadband spectrograms and amplitude of marrar

spoken by informant A

Both members of the pair were correctly identified by 30 listeners of informant A and 29 listeners of informants B , C and D. The segmental duration of the word fann was as follows: the voiceless fricative l f l lasted 2 cs. The short vowel l a l lasted 9 cs and the nasal that follows lasted for 16cs.

The segmental duration of marrar was as follows: the nasal l m l lasted for 7 cs, 8cs for l a l , 3cs for the geminated l r l , 9cs for the short vowel l a l and 5 cs for the second l r l . The second l a l in marrar was longer in duration than the first since it occurred between two l r l sounds.

This vowel, depending on the surrounding consonants, has a range of sound qualities, for instance at the mid of the word, it sounds as (e) as in met, (a) asin can or l u l as in cut.

5-5-3 raddyo l bannyo

In figure 3 a,b a spectrogram and amplitude of the above pair are shown as uttered by informant A (spectrograms of B , C and Dare not reproduced).

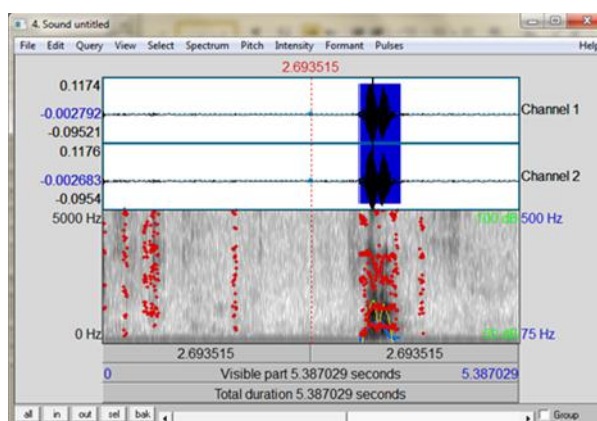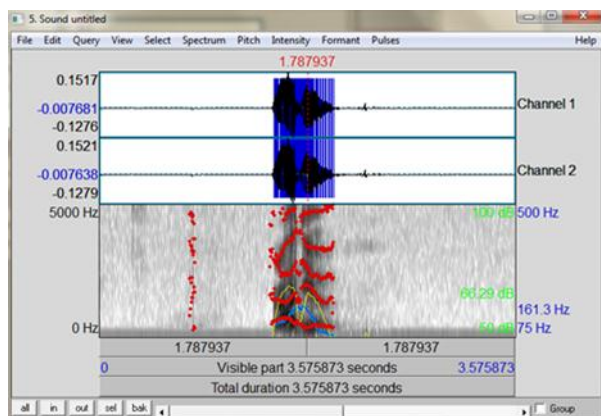Figure 3a Broadband spectrograms and broadband of raddyo

spoken by informant A

Figure 3b Broadband spectrograms and amplitude

of bannyo uttered by informant A

The pair raddyo l bannyo were correctly identified by 28 listeners of informant A, 22 listeners of informants B , C and D. The segmental duration of the short vowel l o lasted 55 cs in raddyo and 29 cs in bannyo .

This short l o l sounds like long l oo l but shorter and it mostly appear in loan words as in the two words under current analysis. But it can also occur at the mid of the word as in basbort.

5-5-4 luga l rabu

Figure 4 a ,b shows the spectrographic analysis of the words luga and rabu. This figure contains broadband spectrograms and amplitude of the two items of the pair uttered by informant A (spectrograms of B , C and D are not reproduced).

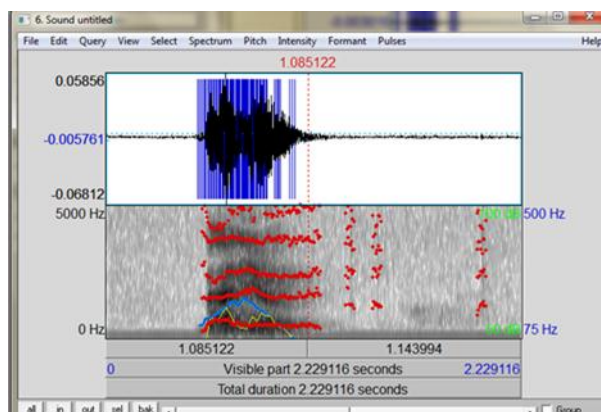Figure 4a Broadband spectrograms and amplitude of luga

Spoken by informant A

Figure 4b Broadband spectrograms and amplitude

Of rabu uttered by informant A

Both members of the pair were correctly identified 29 listeners of informant A, 27 listeners of informant B, and 24 listeners of informant C and D. The segmental duration of luga displays that the alveolar lateral l r l lasted for 5 cs , the short l u l for 7 cs , the l g l for 8 cs and the short l a l for 3 cs.

In rabu, the segmental duration lasted for 2 cs for l r l , 29 cs for l a l, 1 cs for the labial l b l sound, and 16 cs for the short vowel l u l. The spectrographic analysis shows that the short vowel l u l have less sonority than long vowels and that it sounds like its long counterpart l uu l where it occurs at the end of the word as in qireetu (have you studied).

5-5-5 teen l janiin

 Figure 5 a ,b shows the pair teen and janiin . It contains broadband spectrograms and amplitude displays of the two words uttered by A (spectrograms of B , C and Dare not reproduced).

 Both of the wards teen and janiin ware correctly identified by 30 listeners of informant   ;A ,28 listeners of informant B , 27 listeners of informant C and 23 listeners of D .

   The broadband spectrograms shows that there is a clear and straightforward difference in duration between this vowel and its short counterpart as it lasted for , cs in nisrab and /   / cs in shuufi.
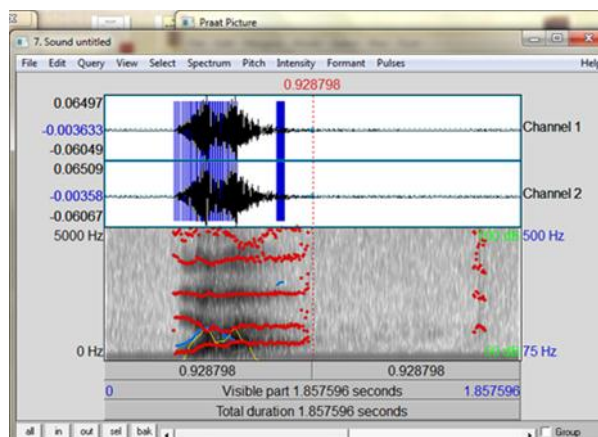

Figure 5a Broadband spectrograms and amplitude of teen
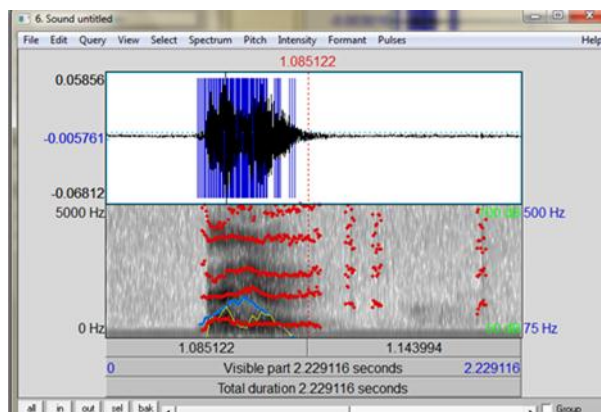
uttered by informant A

Figure 5b Broadband spectrograms and amplitude of janiin

Uttered by informant A

5-5-6 baab/naas

Figure 6a,b displays the spectrographic analysis of baab and naas , It contains a broadband spectrograms and amplitude of these two wards as uttered by informant A (spectrograms for B,C and D are not reproduced) .
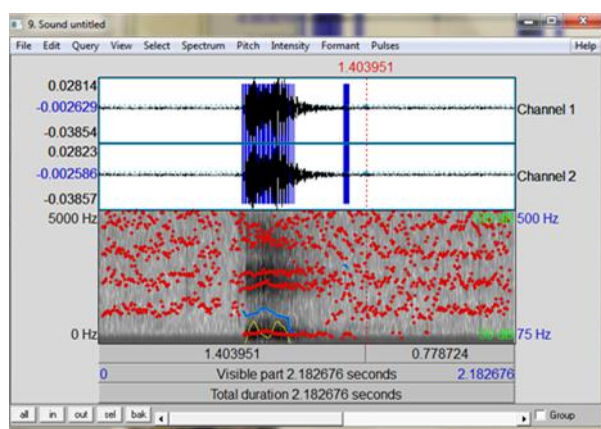

Figure 6-a Broad-band spectrograms and amplitude of baab
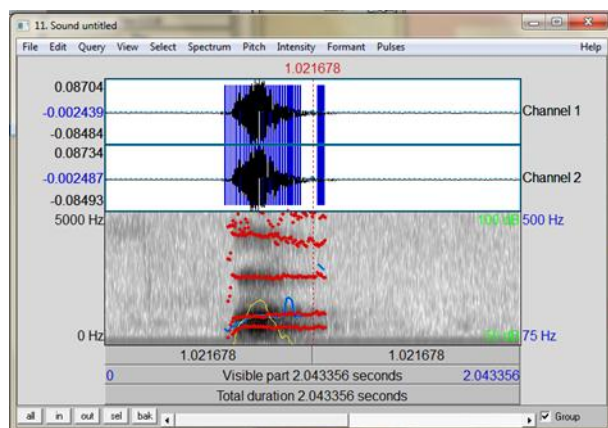
uttered by informant A

Figure 6-b Broad-band spectrograms and amplitude of naas

Uttered by informant A

Both members of the pair were correctly identified by 30 listeners of informant A, 29 listeners of informant B and 27 listeners of informant C and D. The long diphthong l aa l lasted 33 cs in baab and 26 cs in naas.

The spectrographic analysis shows that there is a clear difference between the long l aa l and the short l a l as it lasted for 33 cs and 26 cs in baab and naas; whereas in faan and marrar it lasted for 9 cs only.

5-5-7 mooz l noom

Figure 7 a ,b shows the analysis of the words mooz and noom. It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B , C and D are not reproduced).
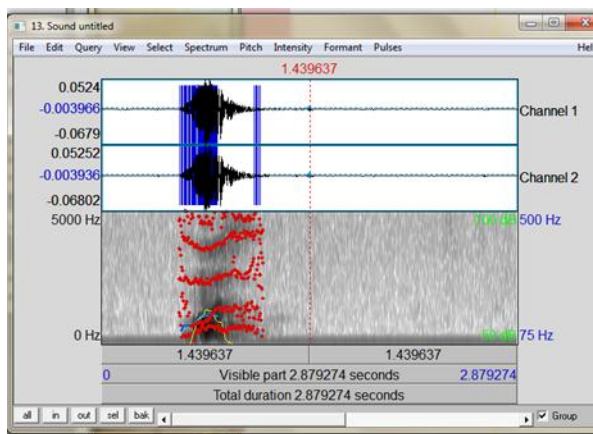
Figure 7a Broadband spectrograms and amplitude of mooz
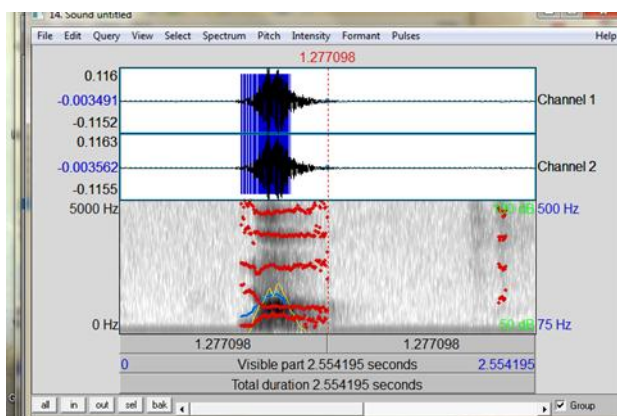
Uttered by informant A

Figure 7b Broadband spectrograms and amplitude of noom

Uttered by informant A

The pair mooz and noom were correctly identified by 29 listeners of informant A, and 26 listeners of informants B , C and D. The segmental durations of the long vowel l oo l lasted for 27 cs in mooz and 41 cs in noom.

In most cases, the long vowel l oo l is regarded as reflexes of diphthongs l ay l and l aw l as in the weak verb yoogaf (to fall down) and yoosal (to arrive).

5-5-8 kuub lduur

Figure 8 a ,b shows the spectrographic analysis of kuub and duur . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B , C and D are not reproduced).
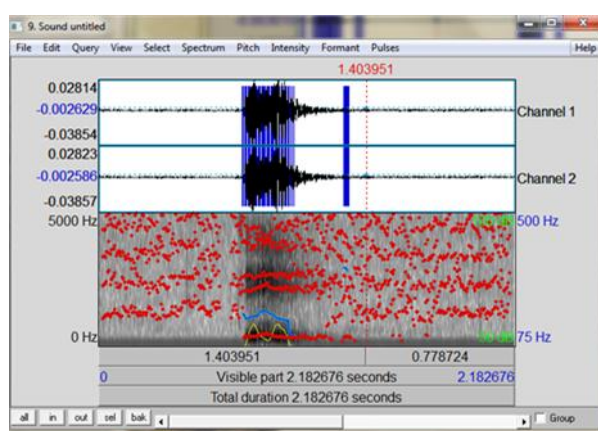

Figure 8a Broadband spectrograms and amplitude of kuub
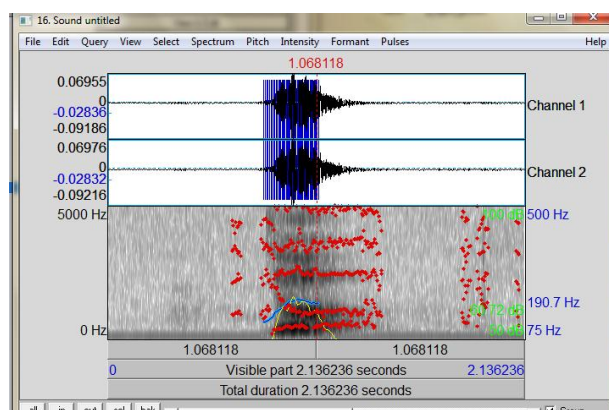
uttered by informant A

Figure 8b Broadband spectrograms and amplitude of duur

Uttered by informant A

Both members of the pair were correctly identified by 30 listeners of informant A and 29 listeners of informants B , C and D. The long vowel l uu l lasted for 26 cs in kuub and 23 cs in duur. The difference is not that great, but it is quite clear with that of the short l u l which lasted for 7 cs in luga and 16 cs in rabu. The short vowels in this case have less sonority than their long counterparts as shown in the spectrograms.

5-5-9 meez l dazeet

The spectrographic analysis of the words meez and dazeet are
shown in figure 9 a ,b . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B , C and D are not reproduced).
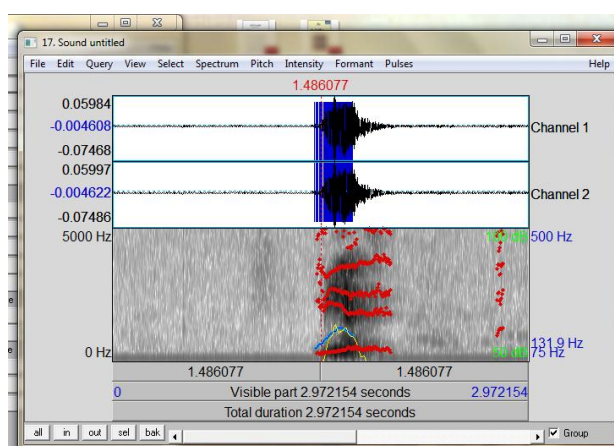

Figure 9a Broadband spectrograms and amplitude of meez
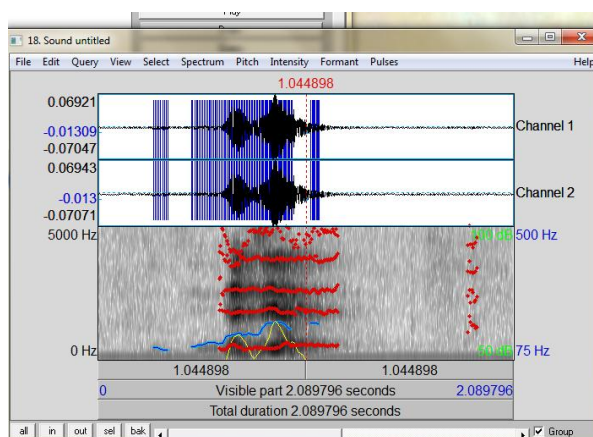
Uttered by informant A

Figure 9b Broad-band spectrograms and amplitude of dazeet

Uttered by informant A

The words meez and dazeet were correctly identified by 30 listeners of informant A , 259 listeners of informants B and 28 listeners of informants C and D.

The segmental duration of the long vowel l ee l lasted for 15 cs in meez and 19 cs in dazeet. The long vowel l ee l is regarded as reflexes of diphthongs l ay l and   l aw l as in heel for hayl which means strength or cardamom.

Appendix -1- Meanings of the Iragi words:

Here is a list of the meanings of words given in table -1- in this research paper:

nisrab	We drink
sima	sky
shuufi	Look up
mitkarrir	repeated
faan	art
katab	He wrote
marrar	He passed
akal	He ate
raddyo	radio
bannyo	Swimming pool
luga	language
murr	bitter
rabu	asthma
dazeetu	You sent
teen	figs
tabiib	doctor
janiin	fetus

daliil	proof
baab	door
kaslan	lazy
naas	people
qaraan	He compared
mooz	bannana
toom	twin
noom	sleeping
fooz	winning
kuub	cup
suug	bizarre
duur	houses
suur	fence
meez	table
zeet	oil
dazeet	I sent
qureet	I read

- **Conclusion** :-

   The theoretical as well as the acoustic approach of this study has reached the following conclusions :

- The power of underspecification theory is greatly increased by allowing supposedly universal markedness convention to be over turned in individual grammars .

-   Underspecification theory is specified in a acknowledging the skewed nature of phonological oppositions . However , it eschews the issue of how the universality of this asymmetry metrics are relative , the favoring of one distinctive term over its language – specific basis .

-Within this theory, the intersection of the two terms of a bivalent feature with the formal operations of spreading, delinking and ordered-blank filling increases the likelihood of more than one analysis being available for a particular harmony system.

-The sound quality of the short vowels are affected by the surrounding emphatic consonants and their position in the word. They also have less sonority than long vowels.

-The short vowel l a l has a range of sound qualities depending on the surrounding consonants, for instance, it may sound as (e) in met, (a) in can and () u) in put. However, its precise quality rarely affects the meaning of the words.

-The vowels l I l and l u l have sounds like that of their long counterparts l ii l and l uu l when they occur at the end of the word as in ukhthii and ukhthuu.

-The vowel l o l seems like long l oo l but somehow shorter. It mostlyappear at the mid and the end of loan words as in bostcart and byanno respectively.

-The long l ee l and l oo l are regarded, in most cases, as reflexes of diphthongs l ay l and l aw l as in the loan words meez and sooda .The long l oo l also occurs in some verbs as in yoosal which means (to arrive).

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