

An Acoustic Phonetic Study of Close Juncture

دراسة فيزيائية صوتية للوقف المغلق

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المُلخَص

تتضمن الدراسات الحديثة للغة الانكليزية شرحا لظاهرة الوقف الذي يعدّ سؤالا محيرا في علم اللغة على الرغم من الاتفاق العام بأنه ظاهرة موجودة في اللغة الانكليزية . وصمم البحث الحالي - ذو الطبيعة التجريبية - لبحث بشكل تطبيقي الحالات الصوتية للوقف، وتصنيفها ضمن النظام الصوتي للغة الانكليزية مقتصرًا على الوقف المغلق الذي يعزف بأنه الارتباط الطبيعي للأصوات المتعاقبة ضمن الكلمات البسيطة .

- وتنبعث هذه الدراسة من الملاحظة القائمة على انه ليس هناك توافق متكامل بين الكلمات نحويا وتركيب سلسلة الأصوات المنطوقة؛ إذ ان الأخير متعلق ببعض الصفات التي يطلق على معاملتها الصوتية بأنها وقفية.

- ومن هنا فان الشرح الآتي للوقف يعدّ مثاليا من حيث انه يعدّ الوقف فونيمًا متسلسلا وفوق مقطعي، وانه تحديث للصوت على الحدود النحوية . ويعدّ هذا البحث سبرا في المفاتيح الفيزيائية التي تميز تقسيم سلسلة الكلام الى وحدات صغيرة من حيث هناك تحديثات صوتية مشروحة لسلسلة الكلام والحدود للوحدات اللغوية ذات المعنى.

وستوضّح هذه الدراسة المنظمة للوقف المغلق كيفية تحديد ما اذا كانت المفاتيح الفيزيائية قائمة ام لا، وماهية كينونتها لتوضّح حدود المورفيم بطريقة صوتية فيزيائية فيما يخص اللغة الانكليزية .

Abstract

The theoretical and acoustic approach of this research has reached the following conclusions:

- Close juncture has a reality that can be described in physical terms.
- Junctural phenomena are differences in the grouping of phonemes into syllables.
- Juncture is remarkably correlated with word boundaries.
- The correlation of juncture with morpheme boundaries is determined by the coincidence of word boundaries with morpheme boundaries.
- There is a potential juncture at word boundaries which may not be realized when uttering the sequence of sounds.
- When there is no phonetic manifestation present, we can say that there is no juncture.
- A given ordered set of phonemes may constitute a bounded sequence.
- Each bounded sequence starts and ends with a marginal allophone.
- Within the hierarchical phonological structure of the language, the bounded sequence appears as a higher- level unit than the phoneme.
- A distribution of a sequence of segmental phonemes between different bounded sequences is possible when the phoneme sequence in question may occur as final and initial sounds as the

acoustic analysis of the pair night-rate and nitrate shows; where a medial allophone of l t l in night-rate and in nitrate, the medial allophone of l a l is followed by the initial allophone of l tr l.

-The acoustic analysis shows that some pairs like aboard and a broad are not differentiated phonetically, although they are different morphologically and lexically as both contain a sequence of a non- final allophone l l followed by an initial allophone of l b l.

-To determine whether a juncture has occurred, two factors must be taken into consideration; the nature of the segmental allophones and the intensity and duration pattern of phonemes.

-Initial voiced stops are considerably longer than initial voiceless stops and the voicing within the voiced stop decreases before the plosive release.

-Initial allophones of fricatives are longer than medial allophones and the intensity within the production of an initial allophone of a continuant increases and it decreases during a final allophone.

-Initial allophones of nasals are usually longer than medial ones and the length of the final nasal depends on the occurrence of a vowel ,i.e. the nasal is longer after a short vowel.

-Initial l w l is voiced and it is devoiced when it follows an initial stop because of aspiration.

-When l l l occurs medially, it resembles a medial l n l in intensity and duration.

-There is a kind of lengthening concerning final vowels which decays gradually in energy.

An Acoustic phonetic study of close Juncture

1- Introduction:

Most current descriptions of English contain references to the interpretation of junctural phenomena which has long been a perplexing question in linguistics in spite of the fact that there appears a general agreement that such phenomena exist, and are part of the English language.

The present paper ,of an exploratory nature ,is designed to investigate experimentally the phonetic manifestations of juncture and to determine acoustic correlates and to place them into the English phonological system. The investigation is limited to the study of close juncture which is defined as the normal linkage between successive sounds within simple words.

This study stems from an early observation that there is no one-to-one correspondence between grammatical words and the structure of a spoken chain of sounds since the latter is associated with certain features whose phonetic treatment is called junctural. At this point, then, the following interpretation of juncture appears to be current: 1)that close juncture is a segmental phoneme;2)that juncture is a suprasegmental phoneme, and 3)that juncture is a non-phonemic modification of sounds at grammatical boundaries.

The present study, then, is an inquiry into the acoustic cues which signal division of the stream of speech into smaller self-contained units as far as there is a connection between certain phonetically describable modifications of the speech continuum and the boundaries of meaningful linguistic entities, such as morphemes. It seems that a systematic study of close juncture should make it possible to determine whether acoustical clues to morpheme boundaries exist, and if so, what is the character of such clues. This paper deals with an acoustic-phonetic investigation of close juncture in English.

2-The Nature of Juncture:

Matthews (1997:209) defines Juncture as a term referring to the degree of linkage between successive sounds in speech. Brosnahan and Malmberg;1970:129, Trask;1996:189' and Crystal,1996:208 expound that juncture is a phonetic feature whose presence demarcate grammatical units such as morpheme, word or clause. Other linguists(like Chomsky and Halle,1968:12; Botha,1973:221; Gimson,1980:295; Katamba,1989:189 and Gussenhoven and Jacobs,1998:77) prefer to use the term boundary instead to refer to such phonetic features which may be retained in the speech continuum which mark word or morpheme boundaries.

Fischer-Jorgensen(1975:96) views juncture as a phoneme constituted by a class of phonetically highly heterogeneous features. It is in this case a kind of zero phoneme which in itself has no phonetic manifestation but which affects the surrounding sounds in various ways. Harris(1951:81) rejects this idea and suggests instead that junctures must involve phonetic material which can be identified and to attribute the phonetic features to juncture since this results in a simpler phonetic description of the phonemes involved.

Pike-as cited in Fischer-Jorgensen,1975:97- regards juncture as a phonological-grammatical boundary phenomenon which-in this case- seems the most fruitful conception in that it keeps phonology and grammar apart in the description of segmental phonemes. Likewise, Lass(1984:37) considers juncture as segment-like and that it is a methodological ploy for keeping levels separate and have no claim to real independence as non-morphosyntactic,i.e . purely phonological entities.

Chomsky and Halle(1968:13) explain that the rules of syntax generate surface structures then the boundary signal + will be assigned in certain places by a universal principle of interpretation. Thereafter, come the readjustment rules that will modify the surface structure in various ad hoc ways, demarcating it into phonological phrases which will then be converted by the phonological component into a phonetic representation.

Davenport and Hannahs(2005:77) proceed to assume that to determine the location of the boundary, one must appeal to the principle of Onset Maximization ,i.e. consonants should be syllabified in onsets rather than codas, and that this division generally corresponds to native speakers` intuitions about where the boundary should lie. So, in the word Parrot lpa r tl ,for example, the boundary comes before the lrl whih thus forms the onset of the second syllable.

Trubetzkoy(1969:294-7) claims that there are two types of languages: those which signal morpheme boundaries and those which signal word boundaries, and that phonological boundaries are expressly admitted and expected at morphological boundaries. He further(ibid) assumes that the existence of phonological boundaries that do not coincide with morphological boundaries appears to be left out of consideration, and that the determining influence appears to proceed from the grammatical hierarchy to the phonological hierarchy.

Moreover, Clark and Yallop (1995:106) recognize that the ascending hierarchy of units suh as: syllable, phonological word, tone group and breath group have their own boundaries and that the boundaries of these units do not necessarily coincide with grammatical boundaries. They give the example of the English article plus a noun which form a single phonological word, even though there are two distinct grammatical elements written as two words.

3-The Types of Juncture:

Trager and Bloch (1941:225) define open juncture as “the totality of phonetic features which characterize the segmental and suprasegmental phonemes and the beginning and end of an isolated utterance”. A more clear definition is that given by Crystal(1997:208) and Matthews(2007:277) as “the degree of linkage between successive words”. As such ,in the words seal in lseal inl, there is an open juncture between ll and the following ll. The same relation seems to apply to ll and the preceding li:l in see Lyn lsi: llnl.

Fischer-Jorgensen(1975:95) and Trask (1996:189) expound that open juncture is of two types:1)internal open juncture which refers to boundaries within words as in the difference between night-rate lnait reItl and dry-trade ldraI treIdl, and 2) external

open juncture which refers to utterance boundaries, i.e. phonetic features which are found initially and finally in sentences, as in:

-The waiter cut itl weit -t k t Itl

Where leI is reduced. And

-The way to cut it l weI- t k t Itl

Where leII is long.

Close juncture, on the other hand, is defined as the normal linkage between successive sounds within simple words. So, if we take the two word my turn lmal tu3:nl, the relationship between lml and laII, between Itl and I3:l and between I3:l and Inl is said to be one of close juncture.

Fischer-Jorgensen(1975:205-6) gives the following types of juncture (depending on "SPE,1965:371):

1-Formative boundary: This is the most elementary boundary symbolized by + and it indicates the point at which a given formative begins and ends. It occurs between the final segment of one formative and the initial segment of a following formative ,e.g. tele+graph. In this respect, the formative boundary does not need, like other boundaries, to be introduced by means of special universal and language-specific rules.

2-A boundary symbolized by = which is inserted in the syntactic surface structure on both sides of the strings. It appears in the phonological surface structure primarily as the result of a general convention that it is automatically inserted at the beginning and end of every string dominated by a major category ,i.e. by one of the lexical categories "noun", "verb", "adjective" or by categories dominating a lexical category, like "noun phrase", "verb phrase" and "sentence", as in blackboard lbla k b udl.

The boundary = plays a role in defining the notion "word", which is crucial for phonology since it constitutes the domain of application of the noncyclic rules. Besides, the occurrence of = accounts for: 1)the syllabicity of l r l in differ = ing, 2)the deletion of final l g l in ring = ing, 3) the shift of stress to the first syllable in meta = language, and 4)the fact that the affix does not move stress to the penultimate syllable as in establish = ment.

3-A boundary symbolized by = which is an ad hoc boundary with the purpose of preventing the application of certain rules. In a verb like per=mit, for example, it bars a rule which would otherwise shift the accent to the first syllable. This boundary is necessary in the phonology of English in order to account for stress placement and s-voicing.

To recapitulate, the three junctures function differently in rules. Unless the opposite is expressly pointed out, a formative boundary does not count in phonological rules ,i.e. a rule which is stated as being applicable before a vowel, for example, applies both to cases with and without + before the vowel.

4-The Importance of Juncture:

Many phoneticians (e.g. Fischer-Jorgensen,1975;96; Lass,1984:189; Katamba, 1989: 189; Clark and Yallop,1995:106 and Davenport and Hannahs,2005:76) assume that juncture has many advantageous points summarized as follows:

1-The great importance of juncture lies in the fact that they can be so placed as to indicate various morphological boundaries.

2-When modifiable sounds happen to occur at the borders of such units, the juncture becomes phonologically recognizable. If no modifiable sounds happen to occur at a grammatical boundary, the boundary is not phonetically perceptible but is nonetheless present and just as important in the total structure of the language.

3-While the sonority hierarchy is useful in deciding the internal organization of syllables, it is less helpful when it comes to deciding where one syllable ends and another begins and here starts the role of juncture.

4-Some structuralists, confronted with the problem of (apparent) morphological conditioning of allophonic rules, attempted to retain the principle of separation of levels by shifting the problem onto the phonological plane with the use of juncture.

5-A proper account of phonology, including intonation, stress and assimilatory process as well as phonemic contrasts requires reference to units at various levels and to the way of separating these units using juncture.

6-Boundaries may have a conditioning or inhibiting effects. Some phonological processes only take place when a certain boundary is present or absent. For instance, in English, voiceless stops are aspirated only if two conditions are satisfied; they must be in a stressed syllable, and in addition they must be immediately preceded by a syllable boundary as in pen lp enl.

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 close juncture. The total inventory included 22 words and phrases.

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 informants.

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

5-2 Informants:

Three informants were selected from class four of the department of English-University of Diyala. Informants A, B, are male and informant c is female.

All the speakers recorded first the total set of 40 words and phrases. 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 the computer 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 spectrographic analysis of speech transforms the acoustic patterns of speech into visual form. This research paper uses the following four kinds of analyses.

5-3-1 The Broadband Analysis:

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

5-3-3 The Amplitude Display:

Depending on the overall rectified waveform, the amplitude variations from one vocal fold cycle to another can be observed. If the amplitude sections are clearly observed, they will show the intensity of each harmonic. Here the duration of the segment is the reciprocal value of the filter bandwidth of 1160 seconds.

5-4 The Listening Experiment:

This test depends on the way of analysis using the segmentation procedures of Lehiste (1960:16) and Hoard(1966:97). 40 items are prepared, uttered by each of the three informants and then copied.

The test was then given to 30 non-native speakers of English. All of them were fourth stage undergraduate students of the department of English. They were ordered to read the words and phrases given to them. The listening experiment contained the following pairs of words and phrases:

Table -1-
Results of the listening experiment

Pair	Correct identification of the speakes		
	A	B	C
Night-rate l nitrate	20	17	17
An ice man l a nice man	30	29	29
That`s ink l that sinks	30	29	29
A name l an aim	30	30	30
A tower l at hour	30	30	30

Beef eater l bee feeder	29	25	23
It swings l it`s wings	28	25	27
It sprays l it`s praise	15	16	17
Nude eel l New Deal	28	25	24
Plump eye l plum pie	29	27	27
See lying l seal eyeing	28	25	25
See the meat l see them eat	16	12	12
The sun`s rays meet l the sons raise me	18	12	12
Twenty-six ones l twenty sick swans	18	12	11
White shoes l why choose	27	25	25
Home-acre l hoe-maker	24	23	22
Wholly -holy	28	25	24
Get aboard l get a broad	10	10	10
Grade A l grey day	30	30	30
Tulips l two lips	30	30	30

5-5 The Listening Test:

This section will discuss the results of the listening test presented in table-1- in a more detailed way. All three speakers were recorded while pronouncing the words and phrases in the listening experiment.

5-5-1 night-rate – nitrate

Figure a ,b represents the pair night-rate and nitrate. This figure contains broadband spectrograms and amplitude of the two items of the pair uttered by informant A (spectrograms of B and C are not reproduced).

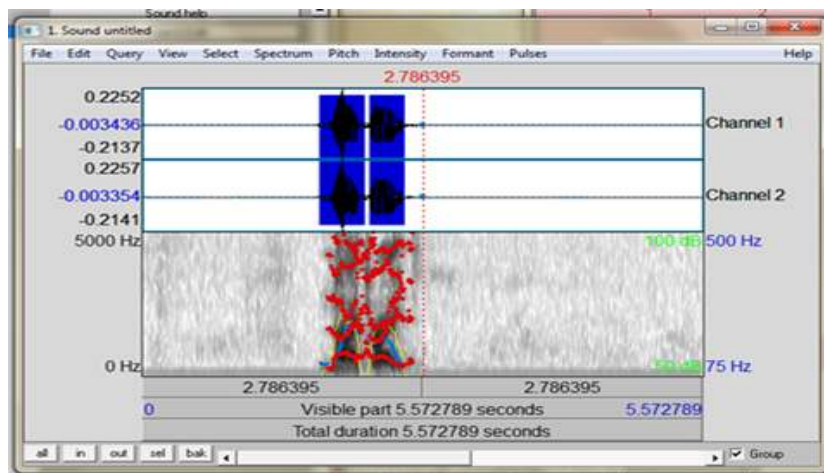


Figure 1.a Broadband spectrograms and amplitude displays of night-rate Spoken by informant A

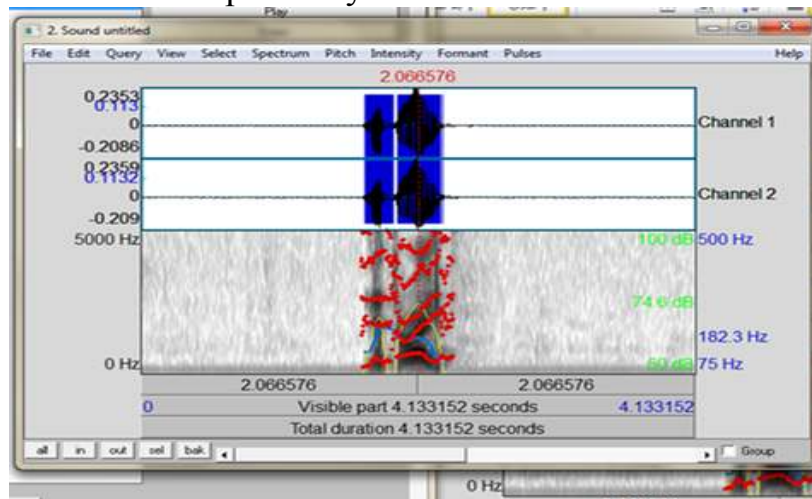


Figure 1.b Broadband spectrograms and amplitude displays of nitrate Spoken by informant A

Both members of the pair were correctly identified by 20 listeners of informant A and 17 listeners of informants B and C. The duration of l a l in night-rate was 7 cs for A and 5 cs for B and C. The duration of l t l was 2cs and the release phase that follows l t l lasted 7 cs for A, B and C.

In nitrate, l a l had the duration of 4 cs for A and 2 cs for B and C. The period of aspiration that followed l t l lasted 5 cs for A and 3 cs for B and C.

The juncture in night-rate is preceded by a final allophone og l t l ; whereas in nitrate a non- final allophone of l a l is followed by what is phonetically an initial allophone of l t l.

5-5-2 that's ink l that sinks

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

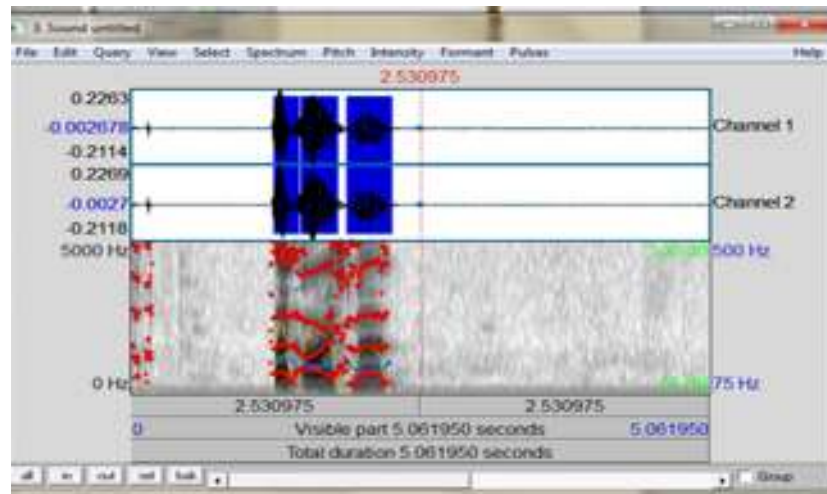


Figure 2a Broadband spectrograms and amplitude of that's ink spoken by informant A

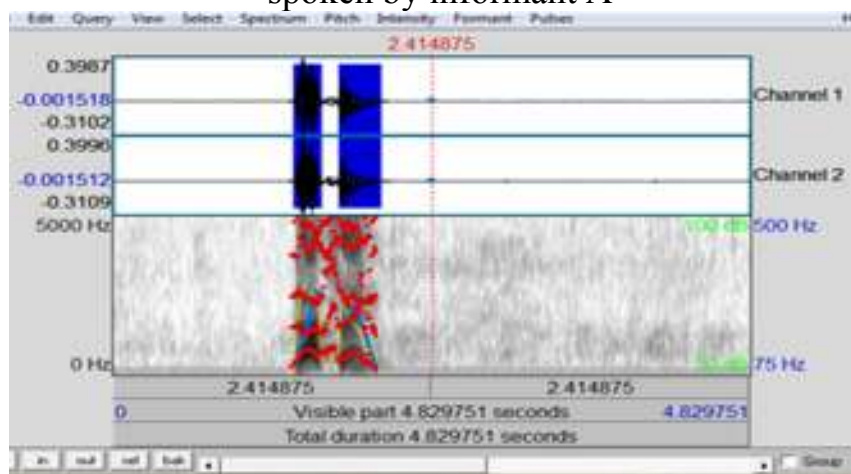


Figure 2b Broadband spectrograms and amplitude of that sink spoken by informant A

Both members of the pair were correctly identified by 30 listeners of informant A and 29 listeners of informants B and C. The duration of l a l is 6 cs for A and 4 cs for B and C. The release following l t l lasted 5 cs for A and 2 cs for B and C. The duration of the fricative l s l lasted 6 cs for A and 5 cs for B and C. And the duration of the nasal l l lasted 5 cs for A and 4 cs for B and C.

Taking the phrase that sink into consideration, the duration of l l lasted 8 cs for A and 6 cs for B and C. The duration of l t l lasted 2 cs for A and the aspiration period lasted 9 cs for A. The duration of l l lasted 5 cs for A.

5-5-3 a tower l at hour

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

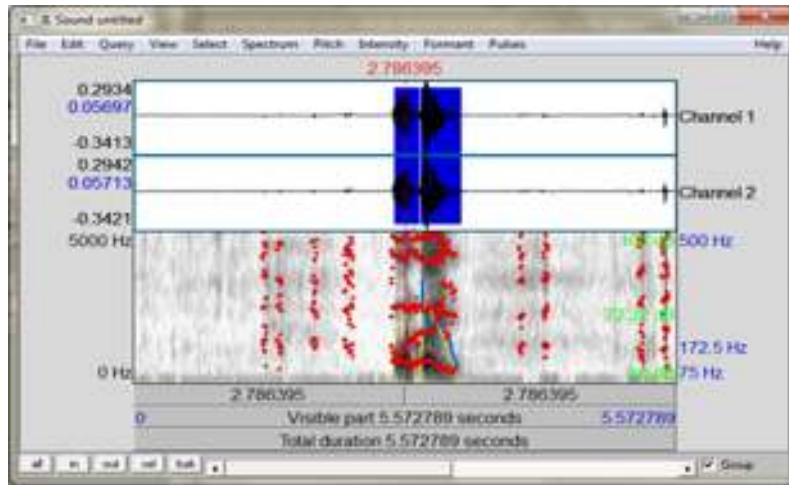


Figure 3a Broadband spectrograms and broadband of a tower spoken by informant A

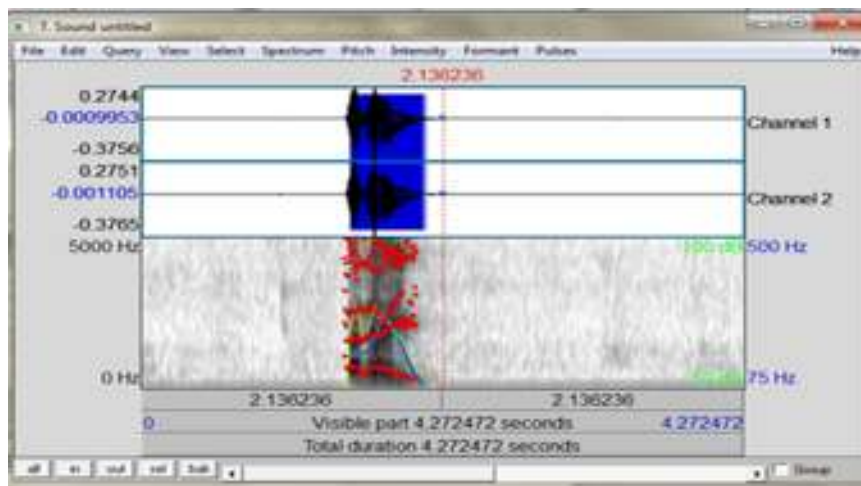


Figure 3b Broadband spectrograms and amplitude of at hour uttered by informant A

The pair a tower l at hour were correctly identified by 30 listeners of the three informants. The l t l sound lasted 5 cs in its production, and the aspiration that followed 7 cs. The triphthong l au l took the duration of 7 cs.

At hour had the following durations: 2 cs for l a l, 7 cs for l t l, 4 cs for the aspiration that follows and 7 cs for the triphthong l au l. The acoustic pattern of l t l shows that it is very similar to that of the flapped l r l.

5-5-4 It swings l it's wings

Figure 4 a ,b represents the pair it swings and its wings. This figure contains broadband spectrograms and amplitude of the two items of the pair uttered by informant A (spectrograms of B and C are not reproduced

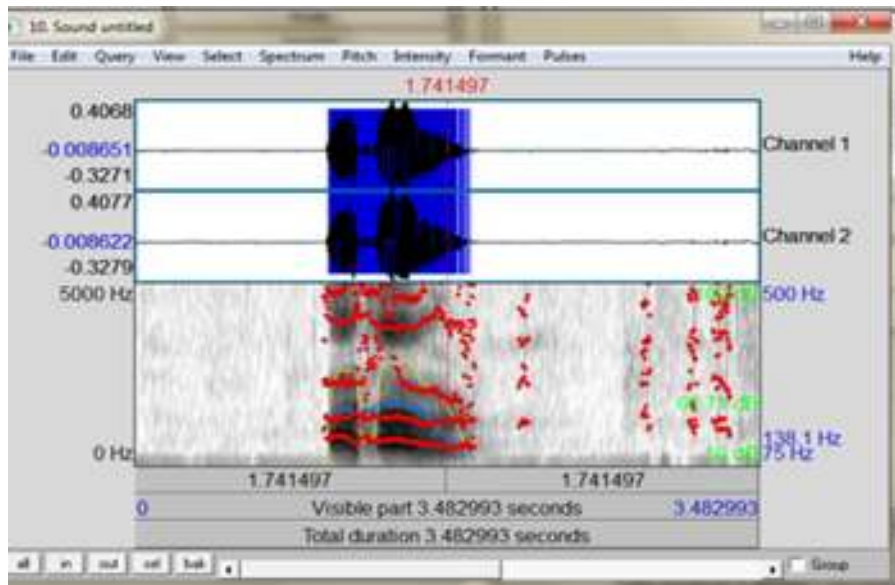


Figure 4a Broadband spectrograms and amplitude of it swings Spoken by informant A

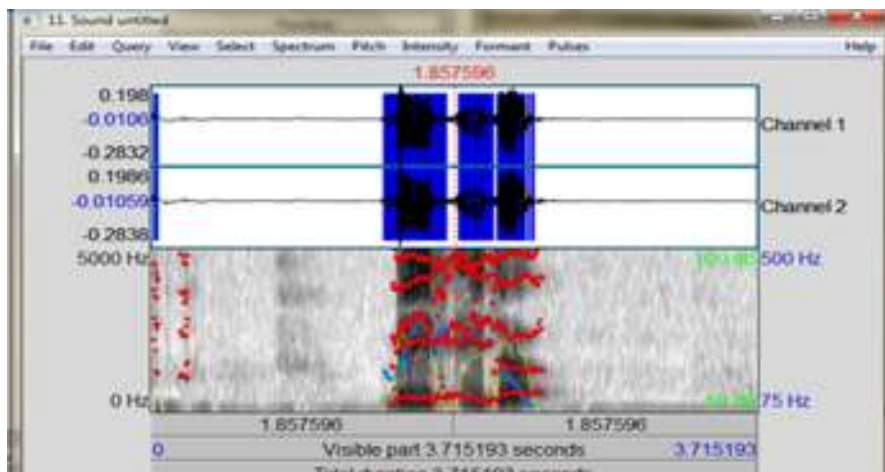


Figure 4b Broadband spectrograms and amplitude Of its wings uttered by informant A

Both members of the pair were correctly identified 28 listeners of informant A, 25 listeners of informant B, and 27 listeners of informant C. The segmental duration of it swings was as follows: l t l lasted 4 cs for A, 2 cs for B and 3 cs for C. The aspiration that follows l t l lasted 8 cs and the fricative lasted 2 cs.

In its wings, the duration of l t l lasted 7 cs for A , 4 cs for B and 6 cs for C. Then follows the fricative l s l which lasted 1 cs only. The reason behind this difference in the duration of l t l in the given pair is that in it swings it was followed by a period of aspiration; whereas in its wings, the aspiration disappears because of the immediate production of l s l sound.

5-5-5 nude –eel 1 New Deal

Figure 5 a ,b shows the pair nude- eel 1 New Deal. It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

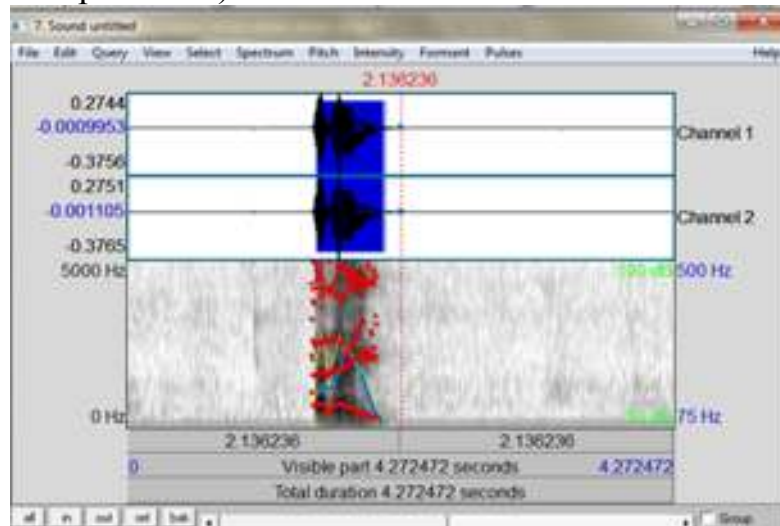


Figure 5a Broadband spectrograms and amplitude of nude –eel uttered by informant A

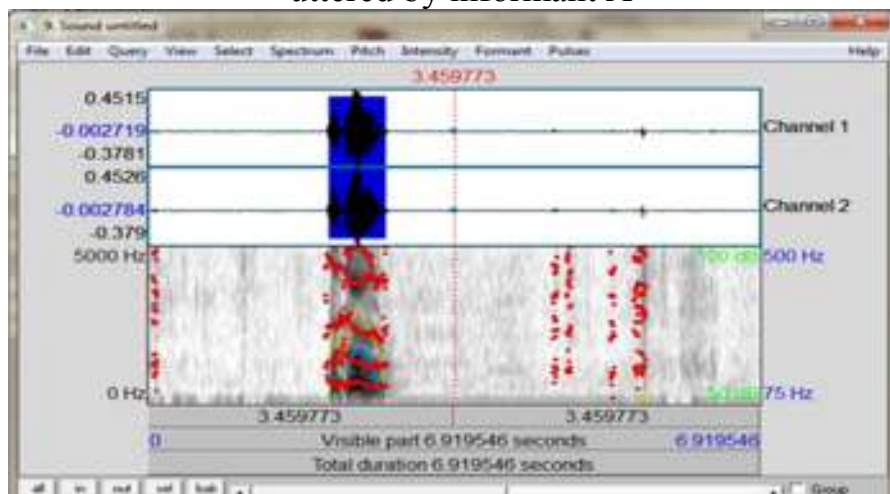


Figure 5b Broadband spectrograms and amplitude of New Deal Uttered by informant A

Both members of the pair were correctly identified by 28 listeners of informant A, 25 listeners of informant B and 24 listeners of informant C.

The segmental duration of the sequence l u:d l in nude- eel was 24 cs for informant A; whereas the same sequence lasted 54 cs for New Deal. It seems that the medial allophone of l d l was more frequently a brief voiced stop in the first phrase of the given pair.

5-5-6 See lying l Seal eyeing

Figure 6 a ,b shows the pair see lying l seal eyeing. It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

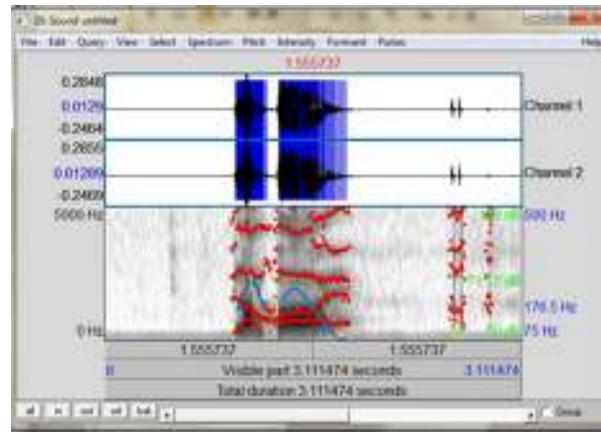


Figure 6a Broadband spectrograms and amplitude of see- lying Uttered by informant A

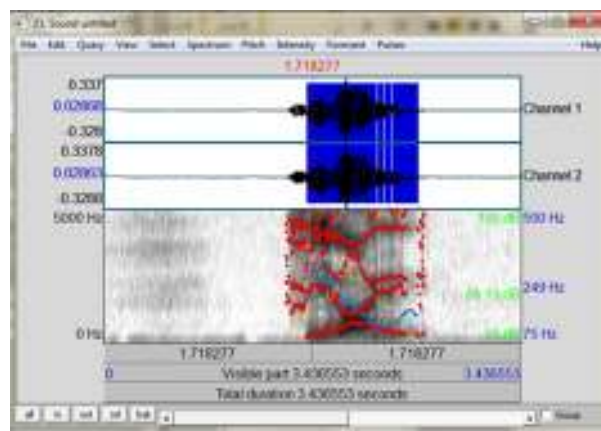


Figure 6b Broadband spectrograms and amplitude of seal eyeing Uttered by informant A

The pair see lying l seal eyeing were correctly identified by 27 listeners of informant A, and 25 listeners of both B and C. The segmental durations were as follows . In see lying, l i l lasted 11 cs for informant A and 9 cs for B and C. The duration of l l l lasted 14 cs for informant A, and 12 cs for informants B and C.

The corresponding durations for seal eyeing were as follows. l i : l lasted 43 cs for informant A and 65 cs for B and C. The intensity pattern of this figure clearly shows that l l l has more energy than l i l ,i.e. it is accompanied by an abrupt rise in intensity. The intensity pattern also shows a type of secondary articulation termed Laryngealization which is the addition of back tongue raising to the velum. It lasted 5 cs for informant A and 3 cs for informants B and C.

5-5-7 The sun`s rays meet l the sons raise meat

Figure 7 a ,b shows the pair the sun`s rays meet l the sons raise meat . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

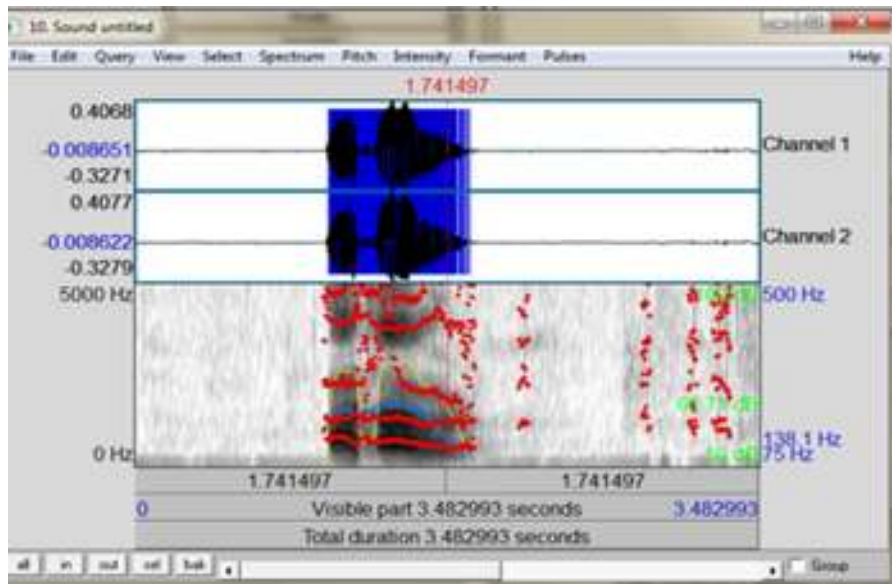


Figure 7a Broadband spectrograms and amplitude of the sun`s rays meet uttered by informant A

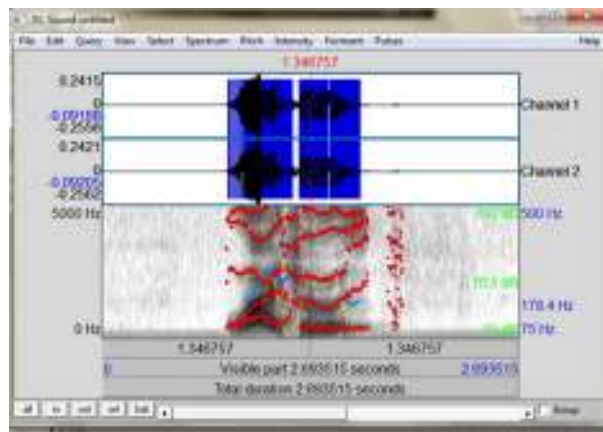


Figure 7b Broadband spectrograms and amplitude of the sons raise meat Uttered by informant A

Both members of the pair were correctly identified by 18 listeners of informant A and 12 listeners of informants B and C. The segmental duration of the phrase the sun`s rays meet shows that the sun`s lasted 48 cs for informant A and the word rays lasted for 29 cs for the same informant.

In the sons raise meat, the duration of the sons lasted 60 cs and the word raise lasted 35 cs. The distinction between the two phrases of the pair seems to have been effected primarily by the durational difference of the Initial and final allophones of l

n l and l r l which occurred in all instances of the three informants without exception.

5-5-8 White shoes l why choose

Figure 8 a ,b shows the pair the white shoes l why choose . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

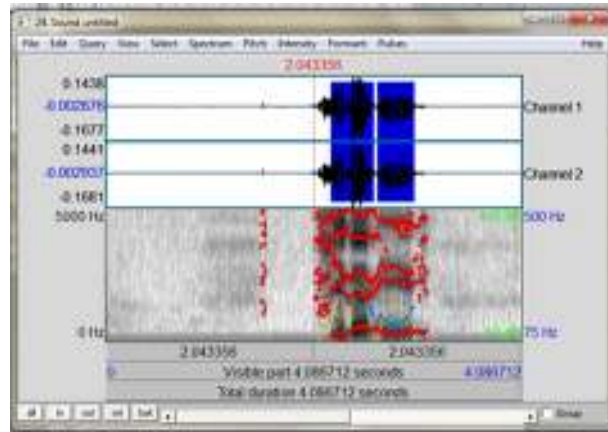


Figure 8a Broadband spectrograms and amplitude of white shoes Uttered by informant A

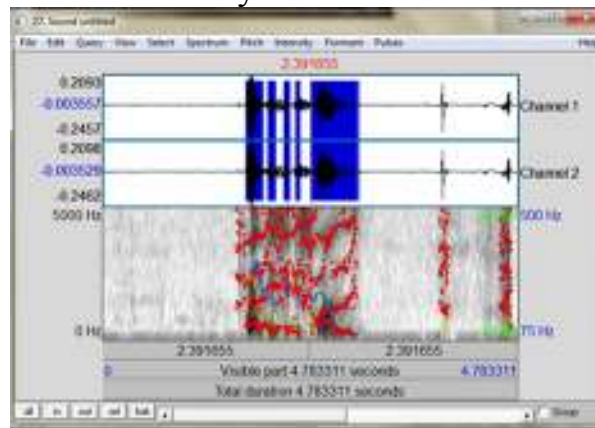


Figure 8b Broadband spectrograms and amplitude of why choose Uttered by informant A

The contrastive pair white shoes l why choose was correctly identified by 27 listeners of informant A and 25 listeners of informants B and C.

The segmental duration of white shoes was as follows. The sequence l wa l l lasted 88 cs for informant A and 72 cs for informants B and C. The duration of l t l lasted 6 cs for A and 5 cs for B and C. And the aspiration that follows l t l lasted 7 cs for A and 5 cs for B and C. The l l sound lasted 1 cs for A, B and c.

The sequence l wa l in why choose lasted 78 cs for A and the affricate l t l lasted 83 cs for A. The intensity of the sequence l wa l seems different in the given pair. In white shoes, it lasted 88 cs; whereas in why choose it lasted 78 cs.

5-5-9 Wholly l Holy

Figure 9 a ,b shows the pair the wholly l holy . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

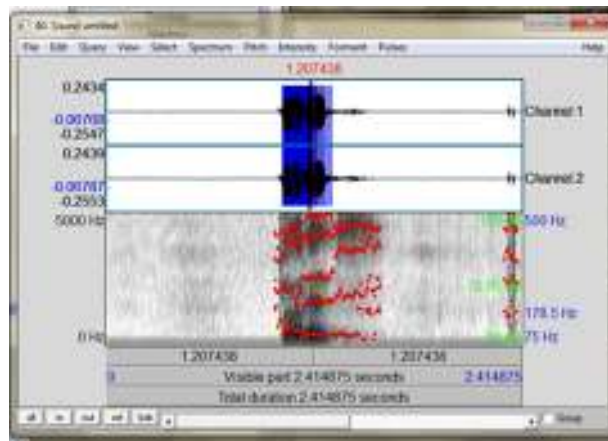


Figure 9a Broadband spectrograms and amplitude of wholly Uttered by informant A

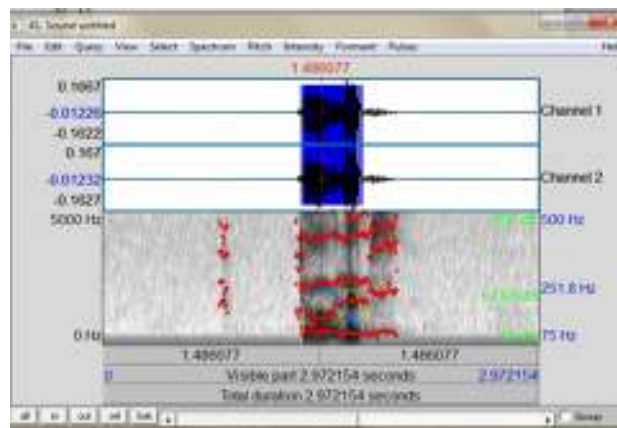


Figure 9b Broadband spectrograms and amplitude of why choose Uttered by informant A

Both members of the pair were correctly identified by 28 listeners of informant A and 25 listeners of informants B and 42 listeners of informant C. The segmental duration of the sequence l h u l lasted 41 cs for informant A, 33 cs for informant B and 30 cs for informant C.

In holy, the sequence l h u l lasted 97 cs for informant A ,88 cs for informant B and 80 cs for informant C. The difference in duration of l h u l in the two pairs suggests that the informants are more acquainted with the word holy as it was uttered with a longer duration than that of wholly.

5-5-10 Grade A l grey day

Figure 10 a ,b shows the pair grade A l grey day . It contains broadband spectrograms and amplitude displays of the two phrases uttered by A (spectrograms of B and C are not reproduced).

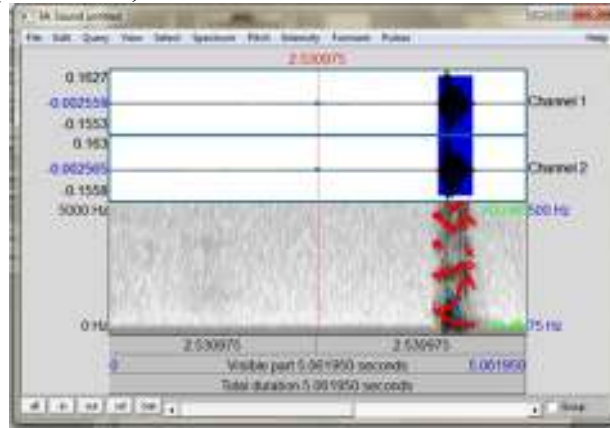


Figure 10a Broadband spectrograms and amplitude of grade A Uttered by informant A

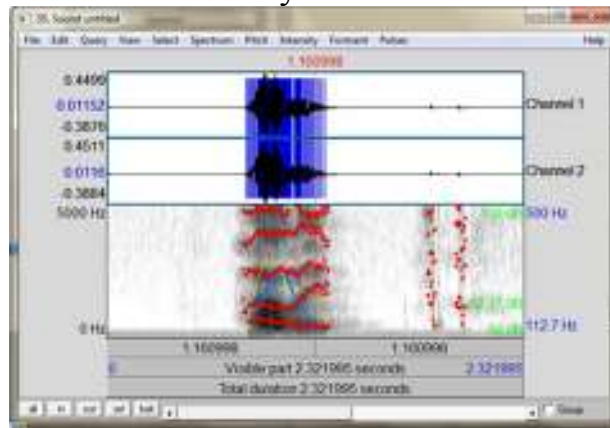


Figure 10b Broadband spectrograms and amplitude of grey day Uttered by informant A

The members of the pair were correctly identified by 30 listeners for informants A, B and C. The segmental duration was as follows. In grade A , the duration of the sequence l re l l was 61 cs for a, B and C and A lasted 21 cs for the same informants in grey day.

In grade A , the duration of l d l was 9 cs for all informants and it was also of the same duration for grey day. This l d l sound was followed by a glocal stop of 5 cs in grade A and 9 cs in day.

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