

# Duration as a Cue to Stress and Accent in Tunisian Arabic, Native English, and L2 English

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## Abstract

This paper investigates the role of duration in signaling stress and accent in Southern British English (SBE), Tunisian Arabic (TA), and English as produced by Tunisian speakers (L2 English). Results show that unlike English, where duration is a robust correlate of both stress and accent, Tunisian Arabic has shown a lack of durational involvement in lexical stress. Duration, in this language, was found to be a cue to accent only. This fact did not affect the production of English lexical stress by Tunisian speakers who produced significant durational contrasts between stressed and unstressed constituents. In addition, these speakers seem to have internalized the positive interaction existing between syllable position and focus related lengthening in English and successfully mimicked it. Their production of English segments and words were, however, consistently longer than native production, which may reveal their non-nativeness.

## 1. Introduction

Before the influential work of Sluijter [1] on the phonetic correlates of stress and accent, most of the studies on these prosodic features suffered from covariation of stress with accent, which has led to confounding their acoustic correlates as well. These two distinct suprasegmental features are important in speech in general, and in second language learning, in particular. Correct prosody is, in fact, known to conduct the flow of speech in ways that facilitate comprehension, while failure in producing correct speech rhythm and suprasegmental features in the target language indicates non-nativeness and can affect intelligibility ([2] and [3]). The present paper reports results on duration as cue to stress and accent in Southern British English (SBE), Tunisian Arabic (TA), and English as produced by Tunisian speakers (L2 English, hereafter) in an attempt to explore these features cross-linguistically and to have more insight into their importance in the learning of L2 prosody.

## 2. The role of duration in signaling stress and accent

Duration is reported to be a robust acoustic correlate of both stress and accent in many languages of the world. English is a language where prosodic contrasts are signaled mainly on the suprasegmental domain. Duration in this language is reported to be a robust cue to both, lexical and phrasal stress ([4]; [5] & [6]). In addition, research on focus related lengthening [7] and [8] in English has shown that focus lengthens stressed syllables wherever their position is (initial or final), while there is a positive interaction between focus related lengthening and syllable position for unstressed syllables. Tunisian Arabic, just like Modern Standard Arabic and most other dialects of Arabic, is a quantity sensitive language, where length is phonemic and durational differences can change the meaning of words. Berinstein [9] hypothesized that languages that use length

phonemically do not use duration to signal stress.

This study investigates the role of duration in cuing stress and accent in SBE and TA, tries to find out whether Tunisian speakers, whose mother tongue is said to use length phonemically, use duration as a cue to lexical stress in English the way native speakers do. It also tries to see whether focus-related lengthening in TA is conditioned by syllable position like in SBE, and attempts to assess the effect of the similarities or differences between SBE and TA on the production of accentual lengthening in L2 English.

The results reported in this paper on the role of duration in signaling stress and accent in SBE, TA, and L2 English constitute a part of a larger work that explores the acoustic correlates of stress and accent, independently in these languages and language varieties.

## 3. Method

### 3.1. Test material

Three experiments were designed to measure the acoustic correlates of stress and accent (including duration) in SBE, TA, and L2 English. Twelve minimal pairs of the kind “‘permit’/‘per'mit’”, were used as test words for SBE and L2 speech. In this way, the durational measurements made on the first syllable of 'permit (noun) are compared to the same measures made on the first syllable of per'mit (verb). The word pairs ( 'permit/per'mit; 'pervert/per'vert, 'record/re'cord/, 'combine/com'bine, 'conduct/cond'uct; 'content/content, 'contrast/cont'rast, 'contract/cont'ract, 'object/ob'ject, 'subject/sub'ject, 'project/pro'ject, 'digest/'digest) were placed in a focused and a non-focused condition in order to assess the impact that focus may have over stress and the interaction between them. Special sentences that guide the pitch accent to the target word and others that place it elsewhere were constructed to measure the acoustic correlates of stress and accent, independently. The frame sentences in which the target words were placed were the same and were designed, first to naturally elicit from the speakers the desired prosodic contour, and second to aid in segmentation.

Examples:

\*[+Focus] condition (Lexical stress+ phrasal stress)

Say LICENCE again

Say PERMIT again

\*[-Focus] condition (lexical stress only, the phrasal stress is

placed on word in bold)

A permit is another word for licence

**WRITE** permit again

**SAY** permit again

For TA, ten near minimal pairs of the kind /'bɛddɛl / /bɛd'dɛlt/ were used. These pairs include {'fakkar/fak'kart (he thought/ I thought); 'bɛddɛl/bɛd'dɛlt (he changed/ I changed); 'χafit/χaf'tin; (she feared/they're quiet); 'kɪsbɪt/kɪs'buh (she owned/ they owned it); 'χatʔat/χat'taʔt ( he planned/ I planned); 'fɛtɪt/fɛ'tuh ( she moved ahead/ they left him behind); 'hutɪt /hu'tæt ( the fish of/ fish (pl)); 'biʔit/bi'ʔæt ( the selling of/ sales); 'kɛmmɛl/kɛm'mlɛt ( he finished/ I finished) ; 'mʊχ[ɪr/mʊχ'tar (dangerous/ “a male name in Arabic”)}.

Thus, the acoustic measurements made on the first syllable of /'bɛddɛl / “he changed” are compared with the same measures made on the fist syllable of /bɛd'dɛlt/ “I changed”. The word pairs were placed in two focus conditions. The content of the frame sentences was as such that it depicts a semantic relationship between the target word in the experimental sentence, and a foil word in the sentence before. When no semantic relationship between the words could be found, a word that rimes with the test word is chosen instead. The way to signal which word was prominent each time, was to write it in bold bigger letters, in Arabic script of course. Examples of the carrier sentences and focus conditions:

\*[+Focus] condition (Lexical Stress+ Phrasal Stress)

/ qul **χammam** martin/ “say **consider** twice”  
/ qul **fakkar** martin / “say **think** twice”

\*[-Focus] condition (lexical stress only, the phrasal stress is placed on word in bold)

/fakkar kilma sehle / “Think is an easy word”  
/ **qul** fakkar martin / “**Say** think twice”  
/ **ʔawid** fakkar martin / “**Repeat** think twice”

### 3.2 Subjects and recordings

The subjects for the English experiment were five male and one female speakers of SBE with no known hearing or speaking disorders. They were between the age of 26 and 55, and were all either studying or working at the University of Edinburgh at the time of the recording. The recordings took place in one of the recording studios in the department of theoretical and applied linguistics (TAAL) in Edinburgh, UK. They were made in a soundproof room using an AKG hypercardioid microphone.

For Tunisian Arabic, the informants were three male and three female Tunisian students of English. Care was taken in the choice of these subjects so that they were all perfect native speakers of Tunisian Arabic, thus, no one had a parent who was not Tunisian.

This meant to avoid the risk that another dialect of Arabic or another language influences the subjects' speech. They had been learning English, in Tunisia, for at least seven years.

These same subjects produced the English test words used to assess the use of duration as a cue to stress and/or accent in L2 English. The recordings took place in a soundproof room using a professional microphone. They were recorded directly onto a computer at a frequency response of 44.1 kHz, than down sampled to 16 kHz mono. Both English and Tunisian informants were instructed to emphasize the words written in bold and not to pause between words. The subjects read the cards presented to them three times for each block of cards. The subjects were asked to repeat sentences that were incorrectly read either in terms of lexical content or in terms of prosodic realization.

### 3.3 Segmentation criteria and data analysis

The measurements taken from the disyllabic test words in the three experiments were obtained for initial vowels, initial syllables, and final syllables in both stress and focus conditions. The total duration of the word was also measured in the two focus conditions. The aim from this was to examine the effects that stress, focus, and syllable position in the word (initial vs. final) have on duration in the three languages, as well as the interaction between these factors. The segmentation criteria followed were based on the spectral characteristics most identifiable in spectrograms with the aid of waveform displays that are helpful in showing dips and rises in amplitude, often corresponding to onsets of constrictions and their releases. Duration of specified constituents was calculated automatically through a script (used within Praat) that sends output to an Excel file for later analysis.

The terms [+Focus], [-Focus] and their abbreviations [+F] and [-F] are used throughout the present paper to indicate the focus condition.

## 4. Results and interpretation

### 4.1. Duration results for SBE

The results of experiment1 showed that when no pitch accent is realized on the word in SBE, stressed vowels and syllables were significantly longer than their unstressed counterparts in the same focus condition. These results were statistically checked through paired sample tests that provided significant values for both initial vowels and syllables, ( $t=7.44$ , and  $t=13.87$ ;  $df =17$ ;  $p < .001$ , respectively). When the word receives the pitch accent, the results also revealed very significant durational differences between stressed and unstressed vowels and syllables ( $t=30.25$  for vowels and  $17.96$  for syllables, with  $df =17$ ;  $p < .001$ ). Experiment 1 compared between stressed constituents in the two focus conditions, too, and found that focus in SBE lengthens the duration of stressed syllables both initial and final, and unstressed syllables only when they are in final positions. These results were verified though two-way ANOVA tests for stressed and unstressed syllables, separately. In this two-way ANOVA tests, focus and syllable position in the word were used as fixed effects, repetition as a repeated measure, and subject as a random factor. For stressed syllables, the factor focus was found to be highly significant ( $F(1, 5) = 61.78$ ;  $p < .001$ ), the factor syllable position was also found to be highly significant ( $F(1, 5) = 56.18$  and  $p < .001$ ). The interaction between them is non-significant. For unstressed syllables, however, the factor syllable position was highly significant ( $F(1, 5) = 88.05$ ;  $p = .000$ ), the factor focus is

also significant ( $F(1, 5) = 14.47$ ;  $p = .001$ ), and the interaction between them was significant, too. Figure 1 illustrates this finding.

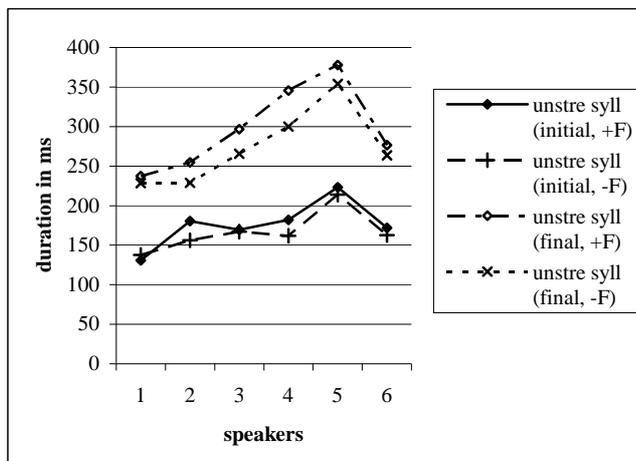


Figure 1: Initial and final unstressed English syllables in the [+F] and [-F] conditions.

The results of experiment 1 confirm earlier findings by [7] and [8] concerning focus-related lengthening in English. Experiment 1 has also shown that focus lengthens the whole duration of the word, whether the word is initially or finally stressed.

#### 4.2. Duration results for TA

Unlike English, when no focus is placed on the target word in TA, stressed and unstressed vowels and syllables were not significantly different ( $t = 2.82$ , n.s.,  $df = 17$ ;  $p > .05$ ). However, when the target word is focused, stressed vowels and syllables significantly differed from their unstressed counterparts ( $t = 6.52$ ,  $df = 17$ ;  $p < .001$ ). This lack of durational involvement of TA in lexical stress could be explained by the fact that when a prosodic parameter is used to encode a certain contrast in the phonological system of a language, its importance as a stress cue may be diminished. Duration is phonemic in TA; hence, its role in cuing lexical stress is not significant. Figure 2 below provides a visual display of these findings.

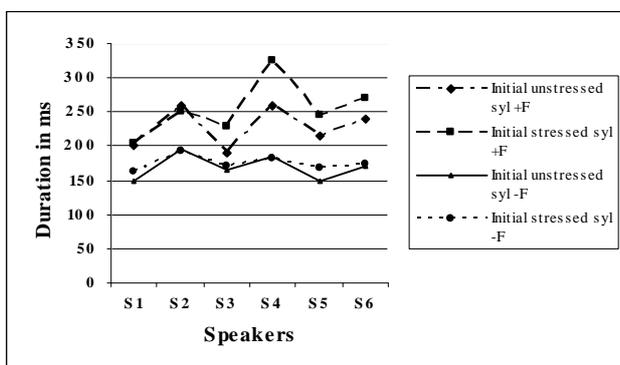


Figure 2: The mean duration of initial syllables in TA across focus and stress.

Focus in TA was found to lengthen both stressed and unstressed syllables. However, ANOVA tests run for stressed and unstressed syllables, independently, showed that unlike English, no

significant interaction exists between focus and syllable position for unstressed vowels. In this two-way ANOVA tests, focus and syllable position in the word were used as fixed effects, repetition as a repeated measure, and subject as a random factor. The results show that syllable position has a significant main effect on the duration of stressed syllables in TA ( $F(1, 5) = 89.1$ ;  $p < .001$ ). Focus is also found to be highly significant ( $F(1, 5) = 21.86$ ;  $p < .001$ ). The two-way interaction between focus and syllable position is found to be significant ( $F(1, 5) = 7.94$ ;  $p < .05$ ), showing that the effect of focus on stressed syllables depends on their position. For unstressed syllables, the results of the ANOVA test revealed that syllable position has no significant main effect on duration ( $F(1, 5) = 2.26$ ;  $p > .05$ ). Focus is found to be highly significant ( $F(1, 5) = 59.76$ ;  $p < .001$ ), and the two-way interaction between focus and syllable position is non-significant ( $F(1, 5) = 5.36$ ;  $p > .05$ ). Focus lengthened initial and final unstressed TA syllables in a similar way. In this behavior, TA seems to be much more like Dutch than English [10]. The total duration of words in TA was also affected by their presence under a pitch accent. Focused words (both initially and finally stressed) lengthened significantly ( $t = 9.42$ ,  $df = 17$ ;  $p < .001$ ).

Lengthening various constituents under focus, in TA, seems to have a linguistic communicational function that consists in drawing the listener's attention to what the speaker wants to highlight.

#### 4.3. Duration results for L2 English

Experiment 3 on the use of duration as a cue to stress and accent in L2 English showed that despite the lack of durational involvement in lexical stress in TA, Tunisian speakers produced significant durational contrasts between stressed and unstressed vowels and syllables even when no focus is realized on the word in English ( $t = 5.91$ ,  $df = 17$ ;  $p < .001$ ). Their productions also showed significant durational differences between stressed constituents and their unstressed counterparts in the presence of a pitch accent on the word ( $t = 8.71$ ,  $df = 17$ ;  $p < .001$ ). More interestingly, these speakers seem to have internalized the positive interaction existing between focus and syllable position for unstressed syllables in English and produced native-like interactions for both stressed and unstressed syllables. Two-way ANOVA tests were run for stressed and unstressed L2 syllables, separately. For stressed syllables, the results show that both factors of syllable position and focus are significant ( $F(1, 5) = 185$ ;  $p < .001$  for syllable position and  $F(1, 5) = 21.63$ ;  $p < .05$  for focus). The interaction between the two factors is, however, non-significant. For unstressed syllables, the results show that both syllable position and focus are significant with  $F(1, 5) = 64.55$ ;  $p < .001$  and  $F(1, 5) = 12.17$ ;  $p < .05$ , respectively. The interaction between syllable position and focus is also significant ( $F(1, 5) = 6.78$ ;  $p < .05$ ).

The duration of the whole word in the production of L2 speakers is also considerably longer in the [+F] condition. However, a comparison between the length of their L2 segments and syllables and those of native speakers showed that they consistently produced longer durations. Figure 3 below provides a visual display of the difference in vowel duration between native English, L2 English, and TA in different stress and focus conditions.

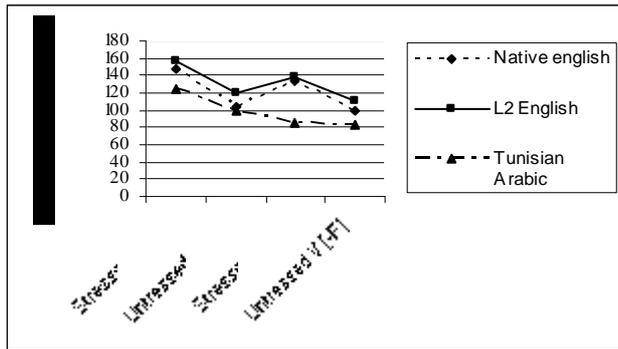


Figure3: Mean duration (in ms) of native English, L2 English and TA vowels across stress and focus conditions.

It can be noticed from the figure above that TA has the shortest vowel duration in all stress and focus conditions. L2 English, however, has the longest vowel duration. These longer productions indicate the care and slowness non-native speakers, generally, exhibit when speaking a foreign language and may be used by native listeners as an indicator of the non-nativeness and accentedness of these speakers. Further research is, however, needed to provide more experimental evidence for this claim.

## 5. Conclusions

The present study showed a similarity between the languages and language varieties explored regarding the use of duration as a cue to accent, while a noticeable difference could be observed in the use of duration as a cue to lexical stress between English and TA. This could be explained by the nature of the difference between stress and accent themselves. While stress is a structural linguistic property of the word that is determined by language system, accent is a property of the whole utterance that exists in every language and is rather determined by language behavior.

## 6. References

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