

A quantitative Analysis of Word Stress in LSA

Dr. Buthaina Shaheen *

(Received 31 / 8 / 2022. Accepted 2 / 1 / 2023)

□ ABSTRACT □

Two different views are advanced with regards to the treatment of stress, the first contends that stress is a purely linguistic phenomenon. The second view goes to the other extreme where it assumes that stress is actually measurable. This study attempts to qualitatively analyze stress in Latakian Syrian Arabic. Conducting a statistical analysis to investigating stress in LSA may either yield results in support of the claim that stress can be measured, or it may give support to the treatment of stress from a linguistic view.

Three acoustic correlates: duration, pitch, and intensity were investigated to answer questions related to acoustic correlates, the effect of the position and type of heavy syllables on stress, and the difference between heavy and light syllables.

This quantitative phonetic study revealed interesting insights into this phenomenon, in particular there is a difference between heavy and light syllables, weight plays a role in stress, and not all correlates have a significant effect.

Keywords: quantitative analysis, stress correlates, heavy syllables, duration, intensity, pitch

Copyright



:Tishreen University journal-Syria, The authors retain the copyright under a CC BY-NC-SA 04

* Assistant professor, Department of English, Tishreen University, Latakia, Syria.

تحليل كمي لنبر الكلمة في اللهجة اللاذقية

د. بثينة شاهين*

(تاريخ الإيداع 31 / 8 / 2022. قبل للنشر في 2 / 1 / 2023)

□ ملخص □

تم تقديم وجهتي نظر مختلفتين بخصوص النبر، الأولى تزعم أن النبر هو ظاهرة لغوية صرفه. أما وجهة النظر الثانية تطرقت حيث تزعم ان النبر يمكن بحقيقة الأمر قياسه. تحاول هذه الدراسة أن تقوم بتحليل النبر نوعيا في اللهجة اللاذقية. ان القيام بتحليل احصائي للنبر في اللهجة اللاذقية يعطي نتائج قد تدعم الرأي القائل ان النبر يمكن قياسه أو قد تدعم التعامل مع النبر من ناحية لغوية. تمت دراسة ثلاث ارتباطات صوتية: المدة وطبقة الصوت والكثافة للإجابة عن أسئلة متعلقة بالارتباطات الصوتية، وتأثير موقع ونوع المقطع الصوتي على النبر، والفرق بين المقاطع الصوتية الثقيلة والخفيفة. أظهرت هذه الدراسة نتائج ذات أهمية فيما يخص هذه الظاهرة، بالتحديد أن هناك فرق بين المقاطع الصوتية الثقيلة والخفيفة، وأن الثقل يلعب دورا مهما في النبر، وأن الارتباطات الصوتيات لا تلعب جميعها دورا أساسيا.

الكلمات المفتاحية: تحليل كمي، ارتباطات النبر، المقاطع الصوتية الثقيلة، المدة، الكثافة، طبقة الصوت

حقوق النشر : مجلة جامعة تشرين- سورية، يحتفظ المؤلفون بحقوق النشر بموجب الترخيص



CC BY-NC-SA 04

* أستاذ مساعد - قسم اللغة الإنكليزية - كلية الآداب والعلوم الإنسانية - جامعة تشرين - اللاذقية - سورية.

Introduction

Two different views are advanced with regards to the treatment of stress, the first contends that stress is a purely linguistic phenomenon. Hayes (1995), for example, proposes the metrical theory that regards stress a linguistic entity, and hence cannot be measured in speech. The second view goes to the other extreme where it assumes that stress is actually measurable. For proponents of the second view, word stress is usually manifested by a number of acoustic dimensions such as duration, fundamental frequency, intensity, and spectral characteristics (Gordon and Roettger, 2017).

A large body of literature has been devoted to the investigation of acoustic correlates of word stress in languages such as English (see Fry (1955), (1958), Lehiste (1970) Beckman (1986), Goffman and Malin (1999) among others). This is not the case of Lattakian Syria Arabic (LSA). While there are few studies devoted to the examination of linguistic stress in LSA (see Melhem (2016) which depended on the researcher's intuition about stress), there is a paucity (may be no) quantitative analysis of stress in this dialect.

The quantitative phonetic study of stress in LSA carried out in this study revealed interesting insights into stress acoustic correlates, the effect of the position and type of heavy syllables on stress, and the difference between heavy and light syllables.

The paper is structured as follows. The next section presents background on the studies conducted on stress in some Arabic dialects. In section 3, the author highlights the importance of the study. This is followed by an illustration of the methodological details of the study. In section 5, the data collected is analyzed, and section 6 discusses the significance of the findings. Some concluding remarks follow in section 7.

Background on Arabic quantitative stress

There are studies on Arabic stress which highlighted the quantitative aspect of stress. The differences between the statistical studies conducted on different Arabic dialects mainly revolve around i) the position of the stressed syllable (the ultimate, penultimate, and antepenultimate), ii) the phonetic correlates held responsible for stress, iii) whether the correlates report word-level stress or phrase-level stress, and iv) the method used for investigating stressed syllables. Below are examples of such studies:

Zahid (1997, 1998) conducted a study on Arabic¹, his study showed that the main phonetic correlates of stress is fundamental frequency, while duration is not affected by stress. In his study of Egyptian Arabic, Abdalla (1960:18) showed that fundamental frequency and duration are inseparable. Mitchell (1975: 94) reported that the correlates are "less noticeable" in the dialects of Syria and kwait. In Lebanese Arabic, as discussed in Chahal (2001) prominent syllables showed higher fundamental frequency and/or higher RMS values, and/or longer duration, and more peripheral F1 and F2 vowel formant characteristics than the lower level. Her study differentiates word stress and phrasal stress. In De Jong & Zawaydeh (1999), focus was on the durational, spectral, and fundamental frequency correlates of stress and word-final juncture in Jordanian Arabic. There was final lengthening associated with higher first formants and less penultimate lengthening. The lengthening is sensitive to higher level prosodic juncture.

The method adopted varied according to the dialect under study. For example, Hellmuth (2006) in her study of Egyptian Arabic, reproduced Keane (2004) which compared parallel syllables in different locations in words. (As there are no stressed minimal pairs in Egyptian that would lead to any lexical differences, Hellmuth did not compare such pairs).

¹ Zahid did not specify the dialect under study.

Chahal (2001) compared parallel accented vs. unaccented examples of parallel words taken from a large corpus. This is because she identified three levels of prominence: lexically stressed but unaccented syllables, lexically stressed and accented syllables, and nuclear accents.

Importance of the study

Conducting a statistical analysis to investigating stress in LSA may either yield results in support of the claim that stress can be measured, or it may give support to the treatment of stress from a linguistic view.

The importance of the present study emanates as well from investigating the phonetic correlates of stress in this dialect, checking how stressed syllables are phonetically different from unstressed syllables, and checking how stressed syllables are phonetically different from each other.

Method of research

On a recorder, data was collected from 4 male native speakers of LSA. The recorder was positioned at a similar distance from all speakers' mouths throughout the recording sessions in order to permit extraction of reliable measurements.

The speakers were asked to read 21 words. Each of the words contained a target syllable selected for its position. They were from different categories: nouns, verbs, adjectives.

- i. 3 words with heavy ultimate syllable (/maktu:b/ 'written', /khatı:r/ 'dangerous', /mafıru:ʃ/ 'project')
- ii. 3 words with heavy penult syllable (/maktab/ 'office', /zamʃa/ 'university', /tana:zer/ 'pots')
- iii. 3 words with heavy antepenult syllable (/muʃaɖara/ 'lecture', /sa:mafıta/ 'I forgave her', /maktabı/ 'bookshop')
- iv. 3 words with no heavy syllable (/qaʃad/ 'sat', /rasama/ 'he painted it', /daʃasa/ 'he stepped on it')
- v. 3 words with heavy ultimate and CVV heavy penult or antepenult syllable (/sa:tu:r/ 'cleaver', /mafıru:ʃ/ 'projects', /ʃa:bu:n/ 'soap')
- vi. 3 words with heavy ultimate and CVG heavy penult or antepenult syllable (/zazza:r/ 'butcher', /fazzaʃu/ 'he frightened him', /derrasna:h/ 'we taught him')
- vii. 3 words with heavy ultimate and CVC heavy penult or antepenult syllable (maktabkı:n 'your office', /mafıku:m/ 'sentenced', /nafıla:t/ 'bees')

The results of the production experiment followed a practice session to ensure that participants had understood the instructions; to read out the words as carefully and naturally as possible. The recorded material was then transferred to a computer. The analysis of the data was completed using the Praat software and SPSS software.

Statistical Analysis

Turning to the statistical examination of stress in LSA, the first question to address here is the relevant correlates of stress in this dialect. In this study, only some² acoustic dimensions (duration, pitch, intensity) will be investigated to check if they are correlates of stress in this dialect. The second question has to do with the effect of the position of heavy syllables. The third question is related to whether there is a difference between heavy and light syllables in terms of duration, pitch and intensity.

² Only some acoustic correlates were investigated because of the limitations of space.

What are the correlates of stress in LSA?

In order to determine which factor affects stress in this dialect, a Regression Test was carried out. The results are shown in table (1)

Table (1) parameters affecting heavy ultimates

duration	pitch	intensity	Anova
.000	.840	.028	.000

Parameters affecting heavy penultimates

duration	pitch	intensity	Anova
.169	.066	.044	.024

Parameters affecting heavy antepenultimates

duration	pitch	intensity	Anova
.460	.090	.355	.359

Parameters affecting penultimates when there is no heavy syllable

duration	pitch	intensity	Anova
.000	.030	.764	.000

The table shows that there is a significant effect of one or more of the correlates on stress in all cases except in the case of heavy antepenultimates as Anova results show. In particular, duration is a crucial factor in the case of heavy ultimates and in the absence of heavy syllables. Intensity seems to play a role only in the case of heavy ultimates and heavy penultimates. Pitch affects the penultimate when there is no heavy syllable.

Is there a correlation between duration, pitch, and intensity?

A Bivariate T-Test was conducted to investigate whether the three dimensions all together affect the heavy syllables or not. The results are displayed in table (2):

Table (2) Correlation between parameters in heavy ultimates

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
-.371	.236	.526	.079	-.180	.576

Correlation between parameters in heavy penultimates

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
-.180	.576	.249	.435	-.682*	.015

Correlation between parameters in heavy antepenultimates

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
.371	.365	-.073	.864	.411	.312

Correlation between parameters when no heavy syllable

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
.375	.229	-.089	.783	-.363	.247

What is noticeable is the negative correlation in the majority of cases. Although there is no correlation between the three dimensions in any of the cases, there are cases where two dimensions correlate:

- There is a correlation between duration and intensity in the case of ultimate and penultimate syllables.
- There is a correlation between duration and pitch in the case of heavy antepenultimate and penultimate when there is no heavy syllable.
- There is a correlation between pitch and intensity in the case of heavy antepenultimates.

Is there a difference between the stressed and unstressed syllables?

Results of One-way Anova shows the difference between stressed and unstressed syllables. See table (3):

Table (3) Difference between heavy ultimates and other syllables		
duration	pitch	intensity
.000	.312	.691
Difference between heavy penultimate and other syllables		
duration	pitch	intensity
.913	.127	.268
Difference between heavy antepenultimate and other syllables		
duration	pitch	intensity
.037	.290	.787
Difference between syllables when no heavy syllable		
duration	pitch	intensity
.454	.358	.353

There is a significant difference in duration in some cases; final heavy ultimate and other syllables in the word, and heavy antepenultimate and other syllables.

1.1. The effect of the type of heavy penultimates/antepenultimates

The question of whether the type of heavy penultimates/antepenultimates (CVV, CVC, CVG) affects stress placement when the ultimate is heavy is addressed here.

Table (4) reveals the results of One-way Anova. The only difference between ultimate and antepenultimate/penultimate syllables lies in the duration of CVC heavy penultimates/antepenultimates. Pitch and intensity did not play a role in distinguishing the syllables.

Table (4) Difference between heavy CVV penultimate or antepenultimate and heavy ultimate

duration	pitch	intensity
.221	.372	.120

Difference between heavy CVG penultimate or antepenultimate and other syllables

duration	pitch	intensity
.334	.182	.235

Difference between heavy CVC penultimate or antepenultimate and other syllables

duration	pitch	intensity
.001	.479	.620

Table (5) reveals results of a Regression test which shows the factor that affects stress. Only duration significantly affects CVV and CVC penultimate and antepenultimate syllables.

Table (5) parameters affecting penultimate and antepenultimate CVV

duration	pitch	intensity	Anova
.034	.614	.280	.119
parameters affecting penultimate and antepenultimate CVG			
duration	pitch	intensity	Anova
.357	.071	.732	.179
parameters affecting penultimate and antepenultimate CVC			
duration	pitch	intensity	Anova
.002	.455	.093	.011

Table (6) shows the results of a Bivariate T-Test conducted to check the correlation between the investigated parameters. Duration correlates with pitch, pitch correlates with intensity in the case of CVV and CVG syllable. Duration and intensity are the only correlates in the case of heavy CVC.

Table (6) Correlation between parameters in heavy CVV

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
.066	.839	-.477	.117	.020	.950

Correlation between parameters in heavy CVG

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
.017	.958	-.241	.450	.485	.110

Correlation between parameters in heavy CVC

Duration & pitch		Duration & intensity		Pitch & intensity	
correlation	sig	correlation	sig	correlation	Sig
-.062	.857	.000	.999	-.709*	.015

Discussion

Based on the results, it seems that similar to Mitchell's claim (1975), the parameters (duration, pitch, intensity) are not noticeable in this dialect. The effect of duration was clear only in some cases but not all.

The results also show that the weight of the syllable was not the determinant factor for attracting stress. For example, this is evident in the fact that there is no difference between heavy and light syllables in the majority of cases (with duration being an exception sometimes). In the case where there was more than one heavy syllable, namely heavy final and heavy penultimate/antepenultimate, stress was not sensitive to the type of penultimate/antepenultimate.

Conclusion

The present work employed measurements for the phonological analysis. This is to eliminate any impressionistic judgments about stress and to check the possibility of measuring stress.

A host of parameters were measured: duration, pitch, intensity. Results showed that not all the correlates were effective, i.e. only duration is sometimes a crucial factor in stress. More quantitative studies are recommended with more participants and more material to give support to this conclusion.

References

- ABDALLA, A.G. *An Instrumental Study of the Intonation of Egyptian Colloquial Arabic*. University of Michigan, thesis/Dissertation, 1960.
- ABDELHAMID Z. *Al Tahleel Al-Akoustiki Lnabr Lkalima fi Llughati Alarabia*, Al-lisaan al-Arabi. The Arab League Education, Culture and Science Organization. The Arabization Coordination Bureau, 46, 1998.
- ABDELHAMID Z. *Nabr L-Kalima wa Qawa'idh fi Al-Llughha L-Arabia*, Al-lisaan Al-Arabi. The Arab League Education, Culture and Science Organization. The Arabization Coordination Bureau, 44, 1997.
- BECKMAN, M. *Stress and Non-stress Accent*. Dordrecht: Foris, 1986.
- CHAHAL, D. *Modeling the intonation of Lebanese Arabic using the autosegmental metrical framework: a comparison with English*. University of Melbourne. Thesis/Dissertation, 2001.
- DE JONG, K.J. & B.A. ZAWAYDEH, *Stress, Duration, and Intonation in Arabic Word-level Prosody*, Journal of Phonetics, 27, 1999, 3 – 22.
- FRY, D. B. *Duration and Intensity as Physical Correlates of Linguistic Stress*. Journal of the Acoustical Society of America 27, 1955, 765-8.
- FRY, D. B. *Experiments in the Perception of Stress*. Language and Speech 1, 1958, 126–152.
- GOFFMAN, L., & MALIN, C. *Metrical Effects on Speech Movements in Children and Adults*. Journal of Speech, Language, and Hearing Research 42, 1999, 1003-1015.
- GORDON, M. & ROETTGER T. *Acoustic Correlates of Word Stress: A Crosslinguistic Survey*. Linguistics Vanguard, 2017.
- HAYES, B., *Metrical Stress Theory: Principles and Case Studies*. Chicago: University of Chicago Press, 1995.
- HELLMUTH S. *Intonational Pitch Accent Distribution in Egyptian Arabic*, PhD thesis, SOAS, 2006.
- LEHISTE, I. *Suprasegmentals*. Cambridge, Massachusetts & London, UK. United States: MIT Press, 1970.
- MELHEM, W., *Investigating Variability in the Acquisition of English Functional Categories by L1 speakers of Latakian Syrian Arabic and L1 speakers of Mandarin Chinese*. PhD thesis. Essex University, 2016.
- MITCHELL, T.F., *Prominence and Syllabification in Arabic*. [Reprinted in Mitchell (1975:75-98)]. Bulletin of the School of Oriental and African Studies, 23, 1960., 269.