

# **Phonetic analysis of lexical stress in Sindhi**

by

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# Certificate of Approval

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## **Declaration**

I hereby declare that this work has not been submitted in support of another degree or qualification at this or any other university/institute.

**Abdul Malik Abbasi**

## **Abstract**

This dissertation investigates the syllable structure and stress patterns of Sindhi words through the analysis of behavioral data from speech judgment experiments, and of acoustic data from speech production experiments, conducted with native speakers of Sindhi. There were three basic queries, the first of which was: What is the syllable structure? For this, a syllable judgment study was designed to explore syllable structure in Sindhi indigenous words and English loanwords. Syllable counts and syllabification judgments were elicited from native speakers for words presented in written format. This syllable judgment study sought to determine native speakers' intuitions about the syllabification of Sindhi words in terms of the major principles: Sonority Sequencing Principle (SSP) and Maximal Onset Principle (MOP) of syllabification, and phonotactic constraints of the language, referencing to consonant clusters syllable-initially, -medially, and -finally. On the basis of the data, the study devised an algorithm for syllabification that illustrates how a Sindhi word is syllabified.

Secondly, it investigates the word-level stress patterns in Sindhi and identifies the phonological factors that determine stress location in polysyllabic words. This study also examines the intuition of native speakers by eliciting their judgments about the location of lexical stress in words of two, three, four and five syllables from 150 selected words.

The findings from the stress judgment study shows that native speakers have a preference for identifying stress on a heavy syllable. This pattern is strongest in words that have a single heavy syllable. In words with multiple heavy syllables the pattern is less clear. In tri-syllabic words there appears to be a preference for stress on the leftmost heavy syllable, while four-syllable words do

not show this pattern as clearly. However, five-syllable words, show a preference for lexical stress on the penultimate syllable, which does not seem to depend on syllable weight. From these data the study concludes that Sindhi is not a fixed stress language. The location of stress varies in words according to the weight of the syllables in the word. This study concludes that Sindhi is a weak quantity-sensitive language and it is not a fixed stress language.

Third question investigated here is what are the acoustic correlates of word level stress in Sindhi?

This work collects and examines quantitative acoustic data (2000 voice samples of Sindhi speech) from ten native speakers. From the physical examination of stressed and unstressed vocalic sounds, the study found strong evidence that several phonetic properties are altered by word-level stress in Sindhi. The speech materials used in the acoustic analysis are ten minimal stress pairs of words that differ primarily in the location of stress (first vs. second syllable). The test words were all highly familiar words selected and chosen to minimize segmental variation among the words. The acoustic analysis of productions of these 20 words is based on measures of fundamental frequency (F0), vowel formants (F1 and F2) as a measure of vowel quality and vowel duration. In addition, the stop closure duration of the word-initial onset consonant for stressed and unstressed syllables was also measured. The results show strong evidence that stressed syllables have higher F0, F1 and F2, and greater duration values as compared to unstressed syllables.

In addition, the study undertook another experiment of preliminary intonational aspects of Sindhi in order to investigate the role of pitch between stress and intonation of contrastive focus accentual phrase in Sindhi, F0 of vowel pitch contours were analyzed for evidence that the location of the beginning of the pitch rise, or the pitch peak varies in relation to the location of the stressed syllable

in the word. Sindhi pitch accent rises from the first syllable in disyllable words, irrespective of syllable weight, and the rise is followed by a fall at end of the word. Thus, it was observed, there was a rise and fall in intonation of contrastive focus accentual phrase. A peak occurs on the second or third syllable and may span over two syllables in longer words.

## **Acknowledgements**

The author owes a great debt of gratitude to Professor Jennifer Cole for her guidance, advice, and encouragement on this project. She is considered to be an authority in the prosody of speech production in the world of phonology. I felt elevated and honored to work with her at the University of Illinois at Urbana-Champaign (UIUC), USA. I am also grateful to Professor Cole for serving as the co-advisor on my doctoral thesis and also for her detailed email responses regarding the phonetic analysis of stress and syllable structure in Sindhi before I left for the States to further enrich my doctoral project. I found her really to be an inspiring woman with an un-quenchable thirst for phonetic and phonological research. I learnt a great deal from her, in particular how to think critically as a researcher. Professor Cole is a generous, intelligent and inspiring researcher, who sincerely cares about her advisees. I am very lucky indeed to have had her as a co-advisor in the journey of phonetic doctoral research, which really made my journey more robust and easier.

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level and in interacting with international researchers in my field; where, I presented my research before world-renowned professors and received feedback.

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This dissertation was written in accordance with American Psychological Association (APA) sixth edition (2010) rules and typed in office 2013 (registered version) and throughout this document IPA phonetic symbols were used from SIL (Summer Institute of Linguistics) International website on my laptop *Acer Travel Mate* Core i3 system. All errors and omissions are my own. No amount of thanks can be paid to Allah Almighty, since no work is possible merely with His Help.

**Abdul Malik Abbasi**

## **Dedication**

to my parents and family

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## Table of Abbreviations

|                 |                                                       |
|-----------------|-------------------------------------------------------|
| APA .....       | American Psychological Association                    |
| CV.....         | Consonant and Vowel                                   |
| CC .....        | Consonant Cluster                                     |
| DELL.....       | Department of English Language and Literature         |
| <i>df</i> ..... | Degrees of Freedom                                    |
| EGIDS .....     | Expanded Graded Intergenerational Disruption Scale    |
| ELT.....        | English Language Teaching                             |
| ESL.....        | English as Second Language                            |
| F0.....         | Fundamental Frequency                                 |
| F1.....         | First Formant Frequency                               |
| F2.....         | Second Formant Frequency                              |
| HEC.....        | Higher Education Commission                           |
| HH.....         | Heavy Heavy                                           |
| HL.....         | Heavy Light                                           |
| HS .....        | Heavy Super Heavy                                     |
| Hz.....         | Hertz                                                 |
| IRSIP.....      | International Research Scholarship Initiative Project |
| IPA.....        | International Phonetics Association                   |
| IPC.....        | Information Processing Center                         |
| LS .....        | Light Super Heavy                                     |
| <i>p</i> .....  | Probability-Level of Significance                     |
| MOP.....        | Maximal Onset Principle                               |

|                |       |                                                  |
|----------------|-------|--------------------------------------------------|
| ms.....        | ..... | Millisecond                                      |
| NIA .....      | ..... | New Indo-Aryan                                   |
| NS.....        | ..... | Native Speaker                                   |
| OC.....        | ..... | Onset Cluster                                    |
| SIL.....       | ..... | Summer Institute of Linguistics                  |
| SNS.....       | ..... | Sindhi Native Speaker                            |
| SPE .....      | ..... | Sound Pattern of English                         |
| SPSS.....      | ..... | Statistical Package for the Social Sciences      |
| SSP.....       | ..... | Sonority Sequencing Principle                    |
| <i>t</i> ..... | ..... | the Sample Value of the <i>t</i> -Test Statistic |
| TTS.....       | ..... | Text to Speech                                   |
| UET .....      | ..... | University of Engineering and Technology Lahore  |
| UMT.....       | ..... | University of Management and Technology Lahore   |
| UIUC .....     | ..... | University of Illinois Urbana-Champaign          |
| V.....         | ..... | Short Vowel                                      |
| VV.....        | ..... | Long Vowel                                       |

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# **Chapter 1**

## **Introduction**

### **Introduction**

Very limited research has been carried out on phonetics and phonology with special reference to Acoustic phonetics in Pakistan. The purpose of the study is to explore and develop the awareness of lexical stress among the native speakers. The key purpose of the study is to document phonetic-acoustic exponents of lexical stress through phonetic and phonological examinations in Sindhi speech. Acoustic phonetics comes under the head of speech science, also known as experimental phonetics; this field also includes physiological phonetics. It is the scientific study of human speech sounds, whereas physiological phonetics defines how the nervous system, muscles, and other organs are operated during speech. This science of speech explains how these sounds are made acoustically (Pickett, 1999, p. 5). Acoustics examines the physical properties of speech sounds with reference to linguistic related acoustic realizations of speech sounds (Davenport & Hannas, 1998, p. 156).

The study also investigates the phonological variations particularly syllable structure of native Sindhi and English loanwords. It investigates the factors of syllable structure and its different syllable templates. The study further investigates syllabification by devising an algorithm, syllable inventory, and epenthesis phenomenon in consonant clusters of English loanwords and indigenous words in Sindhi. The chapter first examines what possible syllable structures are licensed in Sindhi. The phonetic analysis of stress is very important where native speakers do not have strong intuition regarding which syllables have primary, secondary, and tertiary stresses at the lexical level