

Stress Patterns in Pakistani Standard English



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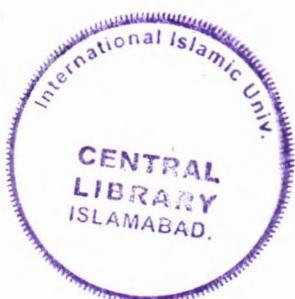
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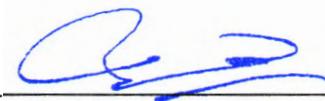
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Dedication

This work is dedicated to my best friend **Arooj** and my kids: **Anas, Barra** and **Nawal**, who showed their full patience without complaining when sometimes they had to miss their mother because of her research work.

Abstract

English, as a non native variety, in Pakistan has acquired its own form most pronounced on the phonological level. The few attempts to study its structures treated phonology as marginalized part of lexical or syntactic descriptions. And even when phonological descriptions are carried out, the focus was segmental features only. Consequently, the present study aims to explore supra-segmental features exclusively which make significant differences in pronunciation and cause problem of unintelligibility. Among many sub-varieties of Pakistani English (PE), the variety of English news media which is considered to be Pakistani Standard English (PSE) is investigated through auditory and acoustic phonetics. For acoustic analysis, Praat software is used to get the waveform and spectrographs of word structures. Later, these prosodic structures are discussed in detail. Moreover, syllable structures and prosody of PSE are analysed in the optimality theory framework. First, the constraints on the syllable and word stress patterns were ranked to form a grammar of these phonological features by forming violation Tableaus to understand interaction of these constraints. Further more, a new way of doing OT is introduced in this thesis, that is violation computing method (VCM). This method addresses the most complicated issue of OT analysis- ranking of constraints. The VCM is applied by ranking constraints of two phonological processes in PSE- syllable structure and word stress patterns. It is further tested and verified by re-analysing constraints interaction with the method suggested by Prince & Smolensky (1993/2004). It is concluded that among many other differences, PSE forms 'iambic' foot pattern; unlike native varieties of English which make 'trochaic' foot pattern.

Index of Constraints

Faithfulness constraints

Dep (C): epenthesis or addition of consonants }

DEP- IO: input-output correspondence

Faith C: no epenthesis or deletion of consonants

Faith V: no epenthesis or deletion of vowels

FILL: no insertion of any segment

Max (V): vowel deletion

Parse: no deletion

Parse- μ : mora should be parsed into syllable

Parse- σ : foot should be parsed into syllable

Markedness constraints

*Complex: no cluster in any position of syllable

Complex-Onset (Comp-Ons): no cluster in onset position

Complex-Coda (Comp-Coda): no cluster in coda position

CCC σ : cluster of three consonants in the onset position

σ CCC: cluster of three consonants in the coda position

Foot Binarity (FT-Bin): foot must contain either two moras or two syllables

*Hiatus: No immediate adjacent peaks as vowels in a syllable

No-coda: syllable without coda

NONFINALITY (NONFIN, NONFINAL) or Non-finality (F; σ): no prosodic head of the

prosodic word in the final position

Onset: consonant before nucleus is required

Peak or Nucleus: syllable must have nucleus

Rhythmic Harmony (Rh Hrm) or no clash: no two adjacent foot heads

Rhythm Type (Rh Type: I/T): foot type either iambic or trochaic

RhType = I(ambic): right headed iambic foot

Sonority-Sequencing (Son-Seq): consonants cluster should follow sonority sequencing generalization

Strict Layer Hypothesis (SLH): Lower level component is dominated by higher level element

Weight to Stress Principle (WSP): heavy syllable is stressed

Alignment constraints

ALIGN-HEAD/ Align-L (ALIGN-LEFT: feet are formed from right to left

Edge-most (Edge-L/R): position of head foot in the Left or Right edge of prosodic word

Lx≈Pr: every lexical word must be stressed

List of Symbols

Acute accent (') Main stress

Grave accent (`) Stress with secondary prominence

<> = Delimit an extrametrical prosodic constituent, i.e. syllable

() = Delimit a foot

= Word boundary

[] = Phonetic transcription

// = underlying representation

σ = syllable

μ = mora

* = constraint violation

** = double violation

! = fatal violation

Σ = foot

<> = unparsed.

σ_w = weak syllable

σ_s = strong syllable

(.) = separating syllables

(!) = Forceful production

(:) = long vowel

» = dominated

(σ) = stressed syllable

(.) = syllabic

Note : This list is prepared by keeping in view the following works:

Chomsky & Halle (1968); Selkirk (1980); Prince & Smolensky (1993/2004); Burzio (1994); Dobrovolski & Katamba (1996); Davenport & Hannahs (1998); Kager (1999); McCarthy (2002 & 2008).

Abbreviation

Am E = American English

BSE = British Standard English

C = Consonant

CON = constraints

CR = Ranking of constraints

db = decibel

F = foot

EVAL = Evaluator

GEN = Generator

GvP= Government Phonology

H = Heavy syllable

L = Light syllable

L1= first language

LP= Liberman and Prince

MOP= Maximum Onset Principle

ms = millisecond

OT = Optimality Theory

PE= Pakistani English

PSE = Pakistani Standard English

RP = Received Pronunciation

SSG= Sonority Sequencing Generalization

SV= Sonority Value

S = Syllable

VCM = Violations Computing Method

V= Vowel

v = Violation

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CHAPTER 1

INTRODUCTION

English is spoken in many countries as a native, official, second and a foreign language. Generally, English language is classified into two main varieties: native English varieties and non-native English varieties. As a native variety, it is further divided into different sub-varieties spoken by different sociological groups, geographical areas and professions. There are different varieties of English spoken in England. For example, British Standard English and Cockney. Similarly, there are sub-varieties of non-native varieties of English detail of which are provided in section 2.1 below.

Other than six countries, where English is spoken as a native variety, in the rest of the countries, English is spoken as a non-native variety. Like many other south-Asian countries, English language is also used in Pakistan as a non-native English variety. Within Pakistan, English is not spoken as a single variety, but is spoken with variations on the basis of the following differences: difference of schooling, exposure to the English language, demand of workplace, English language training opportunities etc. Most of these differences depend on the social class of Pakistani English speakers. People from high or high-middle social class get educated from such schools where their exposure to English language is more. They get jobs in multi-national companies and they often visit or study English countries; so, the way they speak English is different from the way people of lower-middle class and lower class speak. Within those varieties of Pakistani English, there are differences at different linguistic levels.

On the basis of differences at different levels of linguistics, Svartvik and Leech (2006, p. 226) present a conceptual model of world Englishes in a form of wheel, where 'Distance on the spokes of the wheel actually represents a continuum of variation.' In this wheel there are four circles, the hub is small that shows less diverse 'World Standard English' that is a variety closer to the 'standard' native English varieties. On the other hand, at the rim of the wheel, the inner most circle shows supra-national regional standards (e.g. South Asian English) "There is one group in India, Pakistan, Bangladesh, and Sri Lanka, often collectively called South Asian English" (Crystal 1997, p.133). The central circle of the rim presents national and more localized regional varieties (e.g. Pakistani English) and the outer most circle is for the most localized and nativized varieties such as dialects, local vernaculars, creoles, pidgins (detail of these terms can be seen in section 2.1 below).

According to this categorization of English varieties, the present study is about the national variety of English, which fits in the middle circle of the rim. It means that this variety is different from supra-national variety of English, i.e. South-Asian English and any other most localized variety of English spoken within Pakistan such as English spoken by Punjabi or Pashto speakers.

Other than socio-economical classes, non-native variety of English language spoken in Pakistan can also be classified into different sub-varieties based on multiple factors. One factor is first language (L1) background differences. For example, English varieties spoken by native Urdu, Pashto, Sindhi, Balouchi, Saraiki speakers. Another factor is professional or academic differences, i.e. the variety spoken by English language teachers, English news media and university students.

Different varieties of English can vary at the level of Phonetics and Phonology, Morphology, Syntax, and Semantics. In spoken English the most noticeable variations are Phonological. Barber (1993) explains three main ways, in which phonological system of English varieties can differ. First, the inventory of phonemes; secondly, pronunciation of the same phoneme can be different that is allophonic difference; and thirdly, the distribution of phonemes, which includes the differences of prosodic features such as stress and intonation.

1.1 Introduction of the Study

This section presents the overall introduction of the study that includes rationale, purpose, research statement, delimitation, objectives and methodology. The rationale of the study is given in section 1.1.1 which highlights the need of this study. Then in section 1.1.2, the purpose of the study is stated followed by the research statement which is given in section 1.1.3; delimitation of the study is presented in section 1.1.4 that gives the complete focus of this research. Different objectives of the study are outlined in 1.1.5. In the end, research methodology is briefly explained which includes a general overview of research methods, data collection and analysis (1.1.6).

1.1.1 Rationale of the Study

Learning English has become essential in Pakistan in terms of education and professional life like in many other developing countries. In this regard, Leith (1983, p. 156) asserts 'the educational system everywhere was instrumental in the spread of standard English'. It is essential for Pakistanis, who want to study abroad; and those who wish to move to English speaking countries, to qualify for the International English Language Testing System (IELTS) or Test of English as a Foreign Language (TOEFL). In both tests, students are examined for their competence in all four language skills including

speaking. Speaking English language is a pre-requisite for getting high value jobs and social status. English is included in the syllabi right from the primary up to the University level. So Pakistani educated people speak English language in different settings, for example, English as a medium of instruction is mandatory in many private schools and universities.

English language is not only a mode of communication but also a sign of speakers' identity, as it is spoken differently all over the world in terms of its linguistic features. Various reasons for these differences can be; individual accent, social class, geographical situation, educational background and the influence of the first language. According to Coffin and O'Halloran (2010) a speaker's accent provides useful information about their social class and geographical origin. Similarly according to Freeborn, French and Langford (1993), variation in accents is not only geographical but also related to social class. Similarly, English is also spoken with different accents in Pakistan according to differences in speakers' social class, education, region, and mother tongue. These are differences in the sub-varieties of English in Pakistan which are beyond the scope of the present study.

Being non-native speakers of English language, Pakistanis speak English that is coloured by their native language(s) influence. The interference of their mother tongue can be seen at segmental and supra-segmental levels which is sound differences that extend over many segments (phonemes) or beyond the level of a segment (Roach, 2009). Among the supra-segmental features, stress is a very important feature for describing variations in different varieties of English. According to Katamba, word-stress occurs when "a particular syllable of a word is pronounced in a way that makes it more prominent than the rest" (1989, p.222) and phrasal stress pattern of English language brings change in the

pronunciation and accent of English words and phrases which can be accounted for phonological description of any English variety. However, as Barber (1993, p. 249.) asserts 'English as a second language is very often syllable-timed instead of stress-timed'.

Considering the importance of stress patterns in different varieties of English, the present study is aimed at exploring and describing lexical stress patterns in Pakistani Standard English (PSE). A standard variety of any language is usually a variety of educated and upper social class. According to Rhys (2007, p. 190) "a standard language is the selection of an existing variety as basis, and that the variety selected is usually that of the most powerful or socially influential social or ethnic group." The description of the stress patterns of PSE can be helpful for a better understanding of this variety at phonological level and can also be informative for teaching of pronunciation skills and teachers' training, about whom Afsar (2007) claims that English teachers in Pakistan are not confident to teach pronunciation because of lack of training and knowledge about the English phonology.

Lado (1957, cited in Pennington and Richard 1986, p.212,) while discussing the influence of the First language in the learning of pronunciation of second language, state that 'Language transfer has always been recognized as basic to any theory of second language phonological development.' Many researches, such as MacCarthy (1978) discuss the stress-timing of English language as a problem for speakers of other languages to correctly pronounce English. English is a stress-time language and Pakistani native languages are syllable-time languages; therefore, Pakistani speakers show different stress patterns. According to Pennington and Richard (1986, p. 219), 'There is a need for basic research into the nature, learning, and teaching of pronunciation in a second or foreign language'.

Many studies have been conducted to compare the different phonological features of Standard varieties of English with other non-native varieties to highlight the differences which can cause problem of unintelligibility. As Kenworthy (1987, p.14) asserts 'features like word and sentence stress, rhythm, and intonation are very important in highlighting the important bits of a message.' Yet, many studies have found difficulties faced by ESL or EFL speakers, for example Collins and Mees (2003) discuss the English word stress errors of French and West African speakers.

In this case, there is a need of such descriptive study about PSE variety so that English language teachers in Pakistan can also focus on pronunciation problems of English learners by knowing how this variety is different in its suprasegmental features. Moreover, this study constitutes a commendable academic endeavour in its own right and is of interest to linguists who would like to understand how PSE works as a system and what major suprasegmental features; such as syllable structures, word stress and foot patterns; it exhibits.

1.1.2 Purpose of the Study

Having taught English language to Pakistani advanced level learners, the researcher has observed differences in the stress patterns of PE. Pakistani speakers, whose native language is not English, speak English with stress patterns which are hybridized with the influence of their native language(s). Most of the time, either they produce no stress or different stress patterns from that of any other variety of English. As Dickerson (1992, p. 111) states "word stress in English, which is neither marked in standard orthography nor uniformly located on words, often poses a serious problem for learners." Pakistani speakers also face difficulty learning stress patterns of native English, which is in the intuition of native speakers of English, and it causes differences in the spoken English varieties.

Studies have been done on the non-native varieties of English. For example, Bansal (1990) studied the vowel system of Indian English, Kachru (1959, 1965, 1966, 1969 & 1975) described Indian English at different linguistic levels and Rahman (2010) explored all linguistic features of four social classes of PE (detailed discussion on previous work on PE is presented in section 2.5 below). However, the description of the stress patterns of PE variety (Pinglish) is yet unexplored. Stress, tone, and intonation form the prosody of a language and prosodic features of a language cannot be predicted from the intrinsic properties of its consonantal and vowel phonemes. This study serves to bridge this research gap. There are phonological theories explaining word stress patterns of English and different rules about word stress patterns of English, which are unconsciously followed by native speakers of English language. But Pakistani English speakers do not follow the same rules, because of their L1 influence and as English is spoken as a different, non-native variety in Pakistan. So, in PSE word stress patterns may be different from any other native or non-native variety of English.

Knowing the fact that stress is not an isolated phenomenon rather it is interlinked with other phonological processes such as syllable structure, number of syllables and the morphology of word. Stress on poly-syllable words can be analyzed by identifying the syllable structure of the word to perceive the difference of the level of prominence of the syllable, which forms primary and secondary stress (discussed in section 2.2.2).

Similarly, the presence of bound and free morphemes in the structure of words also affects stress phenomenon. It is often discussed in English stress rules that some suffixes carry stress while others do not. Hence, for a thorough study of word stress patterns, the relationship between morphology and phonology cannot be ignored (detail is presented in section 2.4 below).

Prosody is an important issue for both phoneticians and phonologists. Phoneticians explore measurable properties of prosodic features, whereas phonologists traditionally focus prosody on an abstract basis. They have often ignored each other's work. So, the purpose of this study is to describe the stress and foot patterns of PSE at word level (simple, complex and compound words), which form word structures and foot patterns, by exploring the acoustic properties of lexical stress patterns of PSE with the help of spectrographic analysis. In addition, these patterns are also discussed in the light of different phonological perspectives most importantly by applying Optimality theory (OT).

OT has been used in many recent works as a tool to describe different linguistic as well as phonological processes (detail is presented in section 2.7 below). Although this theory was first proposed by Prince & Smolensky (1993) for describing the syllable structure of a language but soon it spread in other linguistic areas because of its wide application in all fields of linguistics. According to Gussenhoven & Jacobs:

Optimality theory phonology is thought of as a universal set of constraints which are hierarchically ranked on a language- specific basis. The relation between input and output is accounted for by respectively generating for each input all possible outputs and evaluating these outputs so as to select the optimal one. (1998, p. 233)

The use of OT for the explanation of stress and foot patterns of different languages is very common (see section 2.7 below). The present study also exhibits OT analysis of the syllable and prosodic word structures formed in PSE (see chapter 6 below) after presenting the description of prosody of PSE in phonological theory with special emphasis on syllable and stress theories (see chapter 5 below).

1.1.3 Research Statement

This study describes the syllable structures, stress patterns of words and formation of word structures with foot patterns in Pakistani Standard English (PSE). After discussing

these phonological features in the light of phonological theories, finally, for the description of prosody of PSE Optimality theory (OT) is used as a model for analysis.

1.1.4. Delimitations of the Study

Different varieties of English vary from each other, mostly in their phonetic and phonological features both at segmental and supersegmental levels. These dissimilarities are at first noticed when speakers of different varieties contact with each other in oral contexts. Many of the sound features of the varieties of English seem to be influenced by local languages or dialects. However, there are some phonological features of these varieties that are not influenced by the local languages, specially when those features are common in both languages. Some of these features are shared across different varieties of English, while others are more localized. The current study focuses on some of the phonological features of PSE.

Pakistani English is not a single variety of English, but rather includes a number of sub-varieties. Many of the differences in Pakistani English are based on the 'local languages' spoken in Pakistan as a mother tongue. However, regardless of these variations, there are also a number of similarities across Pakistani English, since all educated people also speak one national language, i.e. Urdu (mostly as a second language). Moreover, almost all local languages of Pakistan such as Pashto, Panjabi, Sindhi, Saraiki belong to the same family. According to Prasad (2012, p. 200) Urdu, Punjabi, Sindhi are descendants of 'Indo-Iranian' group of Indo-European family. About Urdu, Masica (1991) stated that its stress is predictable as it is syllable or mora-timed which means that a weight of the syllable is based on the number of moras in a syllable. Nelson (1982) also claimed that South-Asian languages are syllable-timed. Hence, almost all these local Pakistani languages have common rhythmic pattern, i.e. syllable-timed.

Although there are different varieties of English spoken in different areas of Pakistan which can be described at different linguistic levels, the present study is delimited to PSE variety, i.e. the accent of English news casters, at the level of phonetics and phonology. English Phonology describes language at a segmental (at the level of phoneme) and supra-segmental level, in which latter deals with different prosodic features, i.e. stress, intonation and tone. This study focuses on prosody by exploring stress patterns which form a foot patterns and word structures. According to the prosodic structure theory, in any language sentences are organized into a structure whose different categories are drawn from the set defined in the Prosodic Hierarchy. Selkirk (1980) presents the following 'Prosodic Hierarchy':

Utterance

Intonational Phrase

Phonological Phrase

Prosodic Word

Foot

Syllable (σ)

As shown above, stress can be analyzed at five different levels in the prosodic hierarchy. The study is further delimited to describe prosody only at the lower three levels, i.e. syllable, foot and prosodic word.

In this study, stress is not only analyzed phonologically by highlighting all stress related phenomenon in phonological theory but also phonetically by exploring the phonetic correlates of lexical stress in PSE with the help of spectrographs. There are different levels of stress: primary, secondary and tertiary stress, but this study focuses on primary and

secondary stress only. The emergent structures of words with different stress and foot patterns are analyzed with optimality theoretic framework.

1.1.5 Objectives

The objectives of the research are to:

- Identify the supra-segmental features, i.e prosody of PSE which includes syllable structure, word stress and foot patterns.
- Find the stress patterns at word level of PSE through spectrographic analyses
- Discuss prosody on the basis of syllable structures, stress and foot patterns in phonological theory
- Apply Optimality Theory to explain the syllable structure, word stress and foot patterns of PSE.
- Suggest some improvements to address issues in optimality theoretic analysis such as constraints ranking.

1.1.6 Methodology

In the following study, Qualitative and Quantitative methods are integrated which will help to conduct an in-depth investigation of the PSE. For the quantitative data (different words) in the form of recordings from Pakistan Television (PTV) and Pakistan Radio English News were taken. The data includes the English news of PTV and radio Pakistan of year 2012. The spectrographic analysis of word stress patterns of recorded data were analysed by making waveforms and spectrographs taken with the help of PRAAT software (spectrographic analysis of word stress patterns of PSE demonstrated in chapter 4 below). With the waveforms and spectrographs, the researcher got the visible picture of stressed syllable produced by the Pakistani speakers and described the stress patterns of words and

foot patterns in PSE. The emerging stress patterns of words were first discussed using different phonological theories of syllable and stress; and then it was comprehensively described with the help of OT analysis. The researcher found out the hierarchical set of constraints in the syllable structure and derived word stress patterns. In OT, constraints may be violated, depending on the ranking of other constraints; and the most higher-ranked constraint will be the one which is never or least violated. According to Archangeli (1997, p.12) 'the optimal candidate is the one with the fewest lowest violation.' For every type of multi-syllabic words; bi-syllable, tri-syllable, tetra-syllable etc one optimal candidate is used as an input and its relation with the output is shown in the Tableau with the hierarchical set of constraints from left to right column in the Tableau (detail of important terms of OT is given in section 2.7 below).

OT is applied as a model to describe the syllable structure and stress patterns of a word in PSE because the most important argument in favour of OT given by Archangeli (1997) is that the stress based phenomena in different languages are best treated in terms of constraints, rather than rules.

1.2 Significance of the Study

The present study will be an important contribution to the field of research with some theoretical and practical benefits. Theoretically, it can provide the knowledge about word stress patterns of PSE variety, which will lead to better understanding of the variety.

Different researchers have described phonological and phonetic features of PE and its sub-varieties at segmental and supra-segmental level by using different models and methods by comparing them with some other standard variety of English. In previous studies on PE it is only labelled as syllable-timed but its stress patterns are not explained. So, the

present research is significant because it is the first comprehensive study on syllable, stress and foot patterns of PSE.

This is also the first study on the 'prosody of PSE' in which application of OT is discussed by introducing new method. This study discusses the comprehensive practical method of ranking of constraints and selection of candidates as an input which is simple, easy-to-do, elaborated method in comparison to other constraints hierarchy learning algorithm and some softwares to assist the constraints ranking algorithm given in the literature on OT before. But this study proposes some simple detailed procedure (See section 3.4 below). This suggested method can be used later for OT analysis of other linguistic processes of any language.

Practically, the present study describes the stress patterns of PSE and can help to determine the pronunciation problems caused by variations in the syllable, stress and foot patterns. In language classrooms, students struggle with pronunciation to promote proficiency and listening comprehension. There have not been enough research to explore the pronunciation problems of Pakistani English learners. There have been several researches regarding problems faced by Language learners, who learn English as a second or foreign language in general but none of them focuses on Pakistani English speakers which leaves the Pakistani English pronunciation problems unattended and neglected. Pakistani learners of English face difficulties in pronunciation because of the typical patterns of stress and intonation in English, which make the overall rhythm or melody of the language, are different from those in Pakistani languages (i.e., syllable-timed vs. stress-timed and pitch accent vs. stress accent). Moreover, flexible placement of stress in English is also exploited for grammatical purposes (Strang, 1970).

This study does not claim that the finding on specific pronunciation differences at supra-segmental level for Pakistani learners of English will necessarily lead to the improvement of their accent and pronunciation, but rather the result of this study can assist teachers in creating and devising teaching materials and activities. As Haycraft (1978) suggests that in the first six months of teaching English, basic rules and reasons for stress in the word and sentence should be taught to enhance learners' pronunciation skills. In other words, this study can prove to play significant role in English pronunciation teaching in Pakistan, which can become effective by utilizing such knowledge in designing the teaching materials or activities that facilitate students become aware of the variations between native English and Pakistani English and improve their pronunciation by practicing themselves. Moreover, findings from the study can help students in overcoming the problems of unintelligibility, and hesitation in speaking and listening comprehension.

1.3 Summary

PE as a nativized variety is spoken widely in Pakistan. It has been described at different linguistic levels such as phonological, morphological, syntactical and lexical. Only a few phonological features of PE have been studied. Its rhythmic pattern is labelled as 'syllable timed'; but no one explored its lexical stress and foot patterns nor were its syllable structures discussed. This study focused on the prosody of PE to fill this gap. For this purpose, data was recorded from Pakistani English news media. To find the stress patterns, spectrographic analysis of the polysyllable words was done with the help of Praat software. For the description of prosody of PE, the overview of various phonological theories is given but detailed analysis is presented in the light of OT. Moreover, a new method for application of OT is suggested.

1.4 Thesis Structure

In this chapter, the overall introduction of the topic and study is given. It also highlights the rationale and significance of this research. In Chapter 2 below, a review of the literature is discussed. In this chapter, there are different sections which present explanations and reconsiderations of fundamental concepts such as supersegental features such as syllable, stress, foot, prosody and rhythm; stress patterns of other English varieties (native and non-native); previous research in PE; Urdu Phonology with emphasis on stress patterns of Urdu language; Morphology-Phonology interaction; some terms used in acoustic phonetics to understand spectrographic Analysis; and theoretical concepts of OT and its application in metrical phonology by illustrating OT grammar of syllable and stress systems of various languages.

Research methodology employed in this study is discussed in Chapter 3 which includes: research methods, data collection tools, size of data, tools of analysis, model of analysis and research procedure.

The next three chapters are analyses of PSE. Spectrographic analyses of the words forming different word structures on the basis of stress patterns are offered. This chapter also discusses the phonetic correlates of stress in PSE. Phonetic transcription of twenty words from each word structure is shown in the form of a Table. Waveforms and spectrograph of one word from each word structure is shown as a visible illustration of stressed syllable in poly-syllable words.

Chapter 5 presents the description of prosody of PSE by discussing various phonological theories of syllable structure, stress patterns and foot patterns. Different

theories in metrical phonology and syllabic phonology are explained. It also compares the syllable structure, stress patterns and foot patterns of PSE with English (native variety).

In Chapter 6, OT analyses of syllables and word structures of PSE are presented. All constraints relevant to syllable and stress are first explained. Then, the procedure of ranking of those constraints is offered by discussing their application to PSE. One Tableau for optimal candidate of each one word structure formed on the basis of various word-stress and foot patterns.

The thesis is concluded in the Chapter 7, which presents the summary of the findings of the thesis along with discussion. Then it provides comparison of word stress and foot patterns of PSE with that of British Standard English (BSE) and highlights the differences by explaining an influence of Urdu syllable structure; stress and foot patterns. Moreover, it discusses important issues about OT as a model for analysing syllabification, stress and foot patterns in particular and other phonological processes in general. Recommendations and suggestions are also given at the end with some speculative proposals regarding future research.

CHAPTER 2

LITERATURE REVIEW

This chapter presents review of literature on the concept of ‘English variety’ and related views which better help to understand a type of language variety under study. Then, superasegmental features with special emphasis on stress patterns of different English varieties and Urdu language are discussed. Moreover, lexical phonology, previous researches on Pakistani English, acoustic phonetics, and overview of OT with its application in metrical phonology are also reviewed. It includes detail of the concept of ‘variety’ and ‘World Englishes’ in Section 2.1, explanation of all fundamental superasegmental or prosodic features in Section 2.2, stress patterns of different varieties of English and Urdu in 2.3. Section 2.4 highlights the interface of phonology with morphology. The previous research in Pakistani English is presented in Section 2.5. Then, Section 2.6 states all pertinent terms in acoustic Phonetics which are essential for the understanding of spectrographic analysis. An overview of OT and its role in the study of metrical phonology are presented in Section 2.7. Finally, summary of this chapter is given in Section 2.8.

2.1 Concept of ‘Variety’ and World Englishes

The global rise of English has fascinated many linguists. They are so keen to study those structural features of the language which affect it when it is adopted by people of different linguistic background around the world as a *lingua franca*. It is spoken with differences of various linguistic features and those differences are recognized and studied in different varieties, dialects or accents. Edwards (1997) defines ‘dialect’ as a variation of

a language. He discusses many reasons such as isolation, regional differences, influence of native language, of this change.

Lyons (1981) and Petyt (1980) highlight differences between two terms 'dialect' and 'accent' in which accent is limited to variations of pronunciation, whereas 'dialect' covers other linguistic differences also such as vocabulary and grammar. In Brook's view (1979, p.13) "A dialect may be defined as a subdivision of a language that is used by a group of speakers who have some non-linguistic characteristic in common". Whereas, Cook (1997) discusses difference of accent and dialect on the basis of region.

On the basis of these dialectal and accentual differences, English native and non-native varieties are further distinguished as 'Standard English'. Wilkinson (1995, p. 25) provides the complex interpretations of Standard English in following words: 'distinctive, correct, basic, authorised, usual, accepted, superior, measurable, and so on'. According to Rhys (2007) standard English is a kind of social dialect and its use is based on speakers' access and exposure to this prestigious variety. For Yule (2010, p.240) any standard language is 'an idealized variety' which does not belong to any region rather it is associated with upper class and educated people of the society. On the other hand, a nonstandard variety of language is termed as 'vernacular' which is a kind of social dialect spoken by lower-status group of people (Yule 2010, p.261).

Almost two decades ago, other than standard variety of language, any variety was labelled as 'dialect'. However, later the stigmatized belongings and negative connotation of this term was replaced with 'variety' and these 'new' and 'emerging' varieties of English are quoted as 'World Englishes' (Kachru & Nelson, 1996; Sum-hung & Mahboob, 2012).

Traditionally, for language acquisition, and language teaching only native varieties of English language was taken as the appropriate model for language description.

However, over the last twenty years, as linguists explore and document the English language variations around the world, which causes a growing acceptance of other varieties and of World Englishes. According to Mullany & Stockwell (2010) 'world Englishes' is a growing field of sociolinguistic study since 1980s.

Because of this increased interest in plurality of 'Englishes' as different varieties in a world, linguists offer various models to show the position of numerous English varieties. One of the most famous models of World Englishes is three concentric circles model which is presented by Kachru (1986). This model reflects the idea of spread of English which start from the countries it is spoken as a mother tongue; these countries for example; the United Kingdom, the United States of America, Australia, Canada, and New Zealand, are placed as the 'inner circle' countries. And the varieties of English used there are called 'Inner Circle Englishes' such as American English, British English etc. Next are the countries it is used as an 'official' language and is taught as a compulsory subject at schools. These are the varieties of English that were formed as a consequence of colonization as in India, Pakistan, Bangladesh, Hong Kong, Kenya, and Singapore. These varieties of English are named as 'Outer Circle Englishes'.

This spread of English is an on-going process as the number of people around the world learning and communicating in English increases, especially because of the boom of computer technology and the multi-national corporations where the medium of communication is English. Because of these reasons, English is also being used in most other countries as a foreign language such as Spain, Brazil, China, Japan. These varieties of English are termed 'Expanding Circle Englishes'. This model is given in Figure 2.1 below.

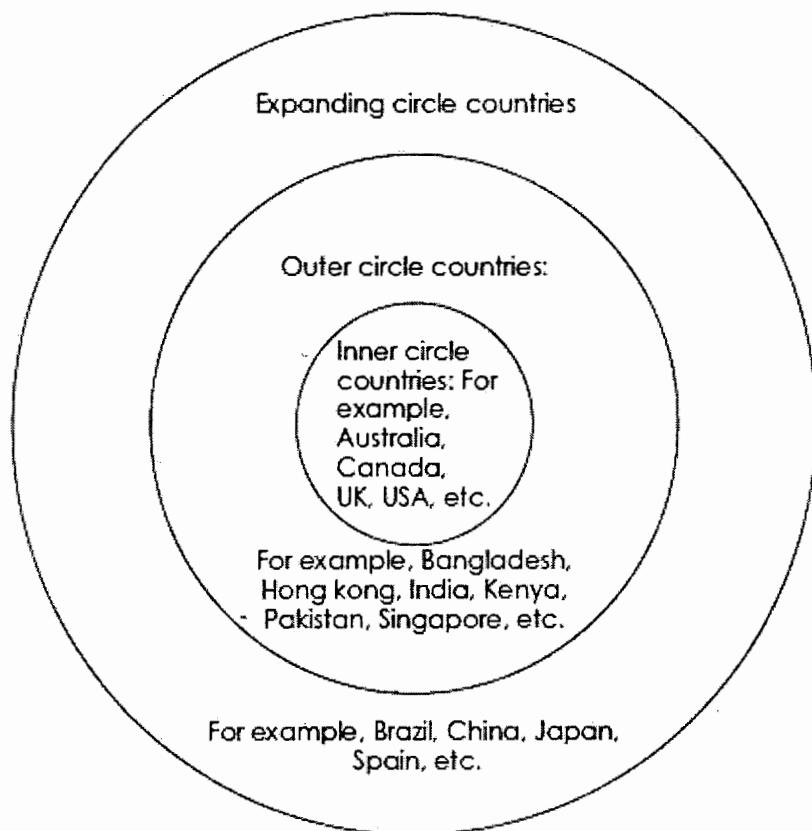


Figure 2. 1 Kachru's three concentric circles model

Another categorization given to different varieties of English is 'standard' and 'non-standard'. Trudgill (1975, p.92) termed 'restricted code' or 'non-standard dialect' on the basis of nonstandard grammar and informal vocabulary. According to Winkler (2008) non-standard varieties are more distant from standard varieties. However, Sayeed (2007, p.100) rejects the notion of 'standard' and 'native English Variety'. According to him, 'the dichotomy of native/non-native varieties (of English etc) is unwarranted and illegitimate'. He considers that every variant of the English language must be taken as a unit, so speakers of that unit is the native speaker.

Bailey (1973, cited in Lodge p.121, 2009) gives his own view of linguistic sameness that one language has only one grammar, so all varieties of English follow the same grammar with minor variations. This notion is called ‘panlectal grammar’.

Other phenomena which occur because of dialectal variations are known as ‘pidgin’ and ‘creole’. For Fromkin et al. (2005, p.420) “When a pidgin comes to be adopted by a community as its native tongue and children learn it as a first language, that language is called a creole”. Crystal (1987, p.334) defines pidgins in these words: “Pidgins are demonstrably creative adaptations of natural languages, with a structure and rules of their own”. Because of increased interest in the linguistic studies of different varieties or dialects a separate field, that is ‘dialectology’ has emerged in the last two decades (McMahon, 1994).

Varieties and sub-varieties of a language are also described on the basis of socio-economic or educational background of their speakers. McArthur (1998, p.3) terms a variety of language as ‘basilect’ which is nonstandard or a low prestige variety; whereas, ‘mesolect’ is a variety spoken as mix local with standard variety. Finally, the variety which is similar or close to the standard variety is called ‘acrolet’; hence it is most high-status variety.

This section has provided an overview of the various terms used for different forms of languages spoken with linguistic variations. These terms are coined according to the type and nature of linguistic variations in those forms. It is also discussed that how languages are labelled with accordance to the social status of the speakers of those languages.

2.2

Supersegmental Features

Suprasegmental phonology is the study and account of those phonological features of pronunciation that cannot be segmented because they spread over more than one segment,

or sound. Intonation and tone are suprasegmental features of spoken language. ‘The variation of pitch and prominence over longer stretches of speech is known as Intonation’(Skandera and Burleigh p.87, 2005).

Tone languages use a pitch of separate vowels or syllables to contrast meanings of a word. There are two types of tones: (i) Register occurs when tone pitch is level across the syllable. (ii) In contour, tone pitch changes, i.e. high to low or low to high, across the syllable. Tones commonly play a lexical function, i.e. differentiating between words at the semantic level. However, in some tonal languages, it may play a grammatical function, which is classifying words by their grammatical category (Fromkin et al., 2007).

This section also presents other features which go beyond the level of segment, i.e. syllabic and prosodic structure and other relevant concepts such as stress and rhythm. Several issues are raised in this section: the relation between the structure of the syllable and its position in the foot, the role of syllable weight and mora in prosodic word and the relation between weight and sonority at various levels of the prosodic hierarchy. Section 2.2.1 discusses prosody and its structure, 2.2.2 and 2.2.3 highlight important issues about stress and rhythm respectively.

2.2.1

Prosody

Different supersegmental features including stress, syllable, and foot together are referred to as prosody. Sometimes it is known as a study of rhythm. For Pennington (1997,

p.128) prosody refers to 'transegmental or supersegmental aspects of speech... to the patterns in individual words of stress, of pitch and of tone, as well as the rhythmic and intonational patterns of longer utterances'. Intonation is also taken as a part of prosody when prosodic study goes to the level of sentence. O'Connor states about intonation that "The words do not change their meaning but the tune we use adds something to the words, and what it adds is the speaker's feelings at that moment; this way of using tunes is called intonation." (1980, p.108)

Fromkin et al (2007) have their own perspective about it, for them the term 'prosodic' comes from poetry and is referred to metrical structure of a verse. The prosodic hierarchy based on different supra-segmental features is illustrated in Figure 2.2 below.

Prosodic hierarchy

Prosodic word

 |
 Foot

 |
 Syllable

 |
 Mora

Figure: 2. 2 Hierarchy of Prosody

In Figure 2.2 'Mora' is the minimal unit of prosodic hierarchy. Zec (1995) discusses mora as weight unit of syllable. Syllable weight is one of the major areas of research in syllable phonology. For encoding syllable weight, the moraic outlook of the syllable is a generally accepted approach. Syllables are categorized as heavy or light on the basis of counting the number of morae or moras (plural of mora) in it. Within this approach, it is generally agreed that a short vowel constitutes a single mora while a long

vowel is bimoraic (Lass, 1984). With respect to consonants at 'coda position', however, there is a controversy over whether the difference between a single consonant and a geminate (long) consonant is one that affects syllable weight or not. In this regard, Hayes (1988) postulates the moraic theory of geminates which says that a geminate consonant is moraic but a single consonant is not.

Consonantal phonemes as a nucleus of a syllable can also play role in the weight of a syllable. As one important function of some special consonantal phonemes such as /l, n, r/ in a syllable is that they can be syllabic because of their high sonority values. However, a syllable having these syllabic consonants at a nucleus instead of vowel are called 'weak syllable'. Hence, such weak syllables are always unstressed in English. In a narrow phonetic transcription, a syllabic consonant is indicated by a small vertical line [,] under the relevant symbol. The particular environments for each of these consonants in which they occur as syllabic consonants are given below.

In English, the syllabic [l] is the most frequent of the other syllabic consonants. It is most noticeable that [l] behaves syllabic when it comes at the end of a word, and is preceded by a consonant, as in Table [ter.bl], double [dʌ.bl], and bottle [bɒ.tl]. On the other hand, [l] is non-syllabic when it is in the onset position of a syllable e.g. please [pliz] and followed by a vowel in the coda position, e.g. normal [nɔ:.məl].

The syllabic [n] also occurs in a coda position of syllable when it is preceded by a plosive or fricative but not in onset position of syllable, as in button [bʌt.n]. The syllabic [r] is very common but in many rhotic accents of English only. On the other hand, it is rare in

non-rhotic accents, where this phoneme is usually completely missing (except before a vowel).

About these two classes of syllable nuclei: vowels and syllabic consonant; Zec (1995) states that all English syllable nuclei are not on an equal footing. He distinguishes in the distribution of those syllables whose nuclei are based on /l/ or a nasal, and those whose nuclei are either a vowel or /r/. The former class of syllables, those with light nuclei, has a severely restricted distribution, which is stated below:

‘Distribution of syllables with /l/ or a nasal in the nucleus (L = l or nasal)

- a. CL and CLC syllables are never stressed.(C is any consonant other than L)
- b. There are no monosyllabic CLC words or disyllabic CLCL words.’ (p. 127, 2003)

He gives the following weight hierarchy, with CL and CLC syllables figuring as lightest English syllables.

CVC, CVV, CV, CR >> CL, CLC

R stands for /r/ as a nucleus.

After mora comes ‘syllable’ in the above given prosodic hierarchy, in the substance of the syllable structure there are segments, the ingredients of the syllable. According to Hayes (2009) the consonants before vowel, i.e. onset in a syllable is often obligatory in syllable structure of many languages and is often articulated more forcefully; whereas coda, that is consonant(s) after vowel in a syllable are optional or forbidden in many languages. There is strong relation between these segments’ quality and syllable structure. So, by focusing the segmental properties of syllables, it can be understood that what type of role each type of segment play in determining properties of the shape of the

syllable (for detail see section 5.1.1 below). Other than shaping the syllable structure, quality of segments also play vital role in phonotactic constraints, i.e. possible clusters at syllable edges. Minimum unit or segment at the level of phonetics and phonology is 'phoneme'. Phoneme is an abstract sound segments and the basis of speech (Roach, 2009). Moreover, the length of a segment also affects syllabification patterns. So, one of the consequence of segmental length is ambisyllabicity, i.e. "The association of a consonant with two syllables at the same time" (Giegerich 1992, p.182).

Given that all above, a presence of consonants also plays role in the structural categorization of a syllable. One type of syllable is called 'closed syllable', i.e. which ends on a consonant. It is sometimes also termed as a checked syllable, and the vowel forming the nucleus is then a checked vowel. Second type is the one without consonant at the end called 'open syllable' (Katamba, 1989; McMahon, 2002).

Nesset (2008, p.51) makes the following three way distinction in syllables while discussing the stress phenomenon in Russian language:

1. Syllables with stress and mora (${}^{\acute{}}\sigma_{\mu}$)
2. Syllables with a mora, but no stress (σ_{μ})
3. Syllables with neither stress nor mora (σ)

Cho and King (2003, p.187) present the notion of 'semisyllable' which is a syllable 'that contain no mora'. They also tell the following six properties of semisyllables:

1. Without nucleus
2. Without coda
3. Without stress/accent/tone
4. In prosody, it is invisible

5. Onset clusters are well-formed
6. It is restricted to only peripheral positions of a morpheme

After syllable, there comes foot in the prosodic hierarchy. It is an organizing structure for joining syllables. Davenport & Hannahs (p. 149, 1998) define foot as: 'A stressed syllable combined with any associated unstressed syllables constitutes a foot.' Every foot contains only one stressed syllable with one or more unstressed syllable. The stressed syllable of a foot is called its 'head'. Foot are categorized according to the number of syllables and presence of stressed syllable on any edge, i.e., left or right. On the basis of these characteristics, there are following five types of foot:

- (i) Degenerate foot: it has only one stressed syllable.
- (ii) Left headed bounded or trochaic: It contains two syllables with head on the left edge.
- (iii) Right headed bounded or iambic: It also consists of two syllables with stressed syllable on its right edge.
- (iv) Unbounded left headed: It may have two or more unstressed syllables with stressed syllable in its left side.
- (v) Unbounded right headed: It also consists of two or more unstressed syllables with head in its right side.

Languages vary in their foot patterns. Some make bounded foot, left or right headed while other form unbounded foot pattern with difference of headedness. However, degenerate foot can occur in a language of any foot pattern (Dobrovolski & Katamba, 1996; Davenport & Hannahs, 1998; Ewen & Hulst, 2001). It is interesting about Guahibo language that its default stress pattern is trochaic but it is also iambic as lexically marked pattern (Kondo, 2001)

Many languages show a phonological process of lengthening in stressed open syllables. When this process happens in iambic languages, it is known as 'iambic lengthening'. Hayes (1995) argues that the impetus behind this process is to create a well-formed, canonical (LH) iambic foot in agreement with the Iambic/Trochaic Law (Hayes 1995, p.80) given below:

- a. Elements contrasting in intensity naturally form groupings with initial prominence.
- b. Elements contrasting in duration naturally form groupings with final prominence.

While discussing the foot patterns of English, Akmajian et al. (2010) distinguishes three different types of foot on the basis of number of foot. A 'unary foot' is consisted of one syllable, a binary has two syllables and ternary contains three syllables. See section 5.1 below for more detail about foot patterns of English.

Backley (2011, p5) discusses the representation of phonological categories by elements in element theory; he states the double association of elements in these words: 'they are associated with physical patterns in the acoustic signal and also with segmental representation in the mental grammar'. He further tells relationship between elements and different units of prosodic structure. Weakening processes also function within prosodic domains, such as, syllable, foot or word. It is clear in the foot domain that segments are weakened in weak syllables. For example, [p^heti] is pronounced [p^heri] in some English varieties, in which [t] is weakened as [r] because it exists in a weak syllable of foot and [p] is aspirated being the onset of stressed syllable.

2.2.2 Stress

Many phonologists, Gimson (1975); McCarthy (1978); Laver (1994); Ladd (1996); Radford et al (1999); Fox (2002); Gordon (2004); Knight (2012), have discussed about the nature, elements, levels, phonetic correlates and types of stress in different domains. It is generally known at the level of auditory phonetics that the prominence of a sound can be recognized mainly to a combination of loudness, pitch, duration, and sound quality. Ball and Rahilly (1999) define stress as syllable prominence, which derives from different phonetic factors such as increased length, loudness, pitch movement or a combination of these aspects.

As there are more prominent and less prominent sounds within a syllable depending on their inherent sonority; similarly, there are more prominent and less prominent syllables within a multi-syllabic word. Moreover, at the level of articulatory phonetics, the same four features as mentioned above - loudness, pitch, duration, and sound quality - are also the main elements of stress. So, prominence in the perception of speech results from stress in its production.

There are three levels of stress, according to the degree of prominence. Primary, secondary and tertiary stress levels are labelled as the most prominent, prominent and least prominent syllable respectively. And the syllable without prominence is considered to be unstressed. According to Harmer “In multi-syllable words, there is often more than one stress, in such cases we call the strongest force the primary stress” (2001, p.32). Giegerich’s view about secondary stress is: “Stress that is weaker than the main (or primary) stress but stronger than that of an unstressed syllable” (1992, p.179).

Word stress or lexical stress is about the stress carried by a syllable within a word. A smallest domain is a word in which contrast of stressed and unstressed syllable appears

(Dalton & Seidlhofer, 1994). In some languages such as English word stress is contrastive, i.e. placement of stress depicts the grammatical category of a word. Whereas Knight (2012) distinguishes between 'lexical stress' and 'rhythmic stress' with reference to the stress pattern of words produced in isolation and in sentences respectively.

Stress system is divided into two kinds: metrical and prominence driven. In metrical stress systems, main stress comes at the edge of a prosodic word and is bound to appear at that edge by foot-form restrictions. In contrast, prominence-driven systems allow syllables with certain properties to overrule edge-attraction, with stress attracted to syllables with high-sonority nuclei, long vowels, codas, onsets or any of a number of other characteristics (Prince, 1983; Everett and Everett, 1984).

Abercrombie (2000, p.35) defines stressed syllable in terms of pulmonic airstream mechanism. According to him 'a syllable produced by a reinforced chest-pulse is called a stressed syllable, and the extra strong muscular movement itself is called a stress-pulse'.

For a better understanding of multiple stress functions, it is important to discuss various stress related phenomenon. Stress not only plays its role in the formation of prosodic structure (as discussed in section 2.2.1 above) but it also affects the length of segments. Hussain (2010) gives examples from different languages in which vowels as well as consonants are affected by stress in many languages. Carlos (1980, cited in Hussain 2010) explains example of Finnish language in which the length of coda consonants in the stressed syllable is increased.

Lacy (2002) proposes in the theory of tone-stress interaction that there is a similarity between higher tone and heads and there is a similar appeal between lower tone and non-heads on the basis of the empirical claims. So, tone can also affect main stress position. Ladefoged defines tone as "Pitch variations that affect the meaning of a word are

called tones" (2001, p. 234). The tonic stress is carried by the tonic syllable, which determines the particular intonation contour. It is also called nuclear stress.

Hammond (1997a) argues that English has a QUANTITY constraint. It has larger implications for the theory of stress and quantity which shows strong relation of stress and the quality of vowel. He states that in the phonology of English two kinds of vowels (long or diphthong and reduced or short) make two kinds of syllables: monomoraic and polymoraic. With QUANTITY and REDUCTION, the system basically readjusts so as to differentiate full vowels (polymoraic) from reduced vowels (zero-moraic and monomoraic). For example, in the word [teɪkɪŋ] first syllable is polymoraic because of diphthong [eɪ] and second syllable is monomoraic because of short vowel [ɪ].

According to Spencer and Luis (2012), there is interaction of clitics with some phonological processes such as stress and prosody. They define clitics as a form of a word which is phonologically adjoined to another word. Mostly clitics behave like affixes and attach with some 'host' words. If they are attached to the left edge of a host word like prefix they are called 'proclitic'; and when like suffix they join to the right edge of host word they are known as 'enclitic'. For example, in English 'queen's crown' 'queen' is a host word 's' is enclitic which is attached on the right edge of its host word. Where as 'endoclitics' are affixed inside the host word, the way infix does. In terms of their interaction in the prosody that they are adjoined commonly with the stressed syllables as most of clitics themselves are unstressed.

2.2.3 Rhythm

The rhythm of a language is based on the recurrence of prominent constituents of speech to be regular intervals of time (Mortimer, 1985). Depending on the particular rhythmic type of a language the prominent elements are usually either syllable or stress,

and they can also be high pitch, for example, as is in many oriental languages. No matter whatever the prominent elements are in a language, but the time that passes from one prominent element to the subsequent is always of approximately equal duration.

The type of rhythm is a suprasegmental feature, or prosodic feature, in the pronunciation of any given language which makes the basis for one of the fundamental categorizations of the languages of the world (Thomas, 2011). Rhythm can be of two different types. If stress determines the rhythm of a language, as is the case in English, Russian, and Modern Greek, that type of rhythm is called isochronous rhythm, or isochronism (Skandera and Burleigh 2005). And such languages are called stress-timed languages. According to Ladefoged these are “Languages in that stresses were said to be the dominating feature of the rhythmic timing” (2001, p. 231). In stress-timed languages, stresses tend to occur at somewhat equal intervals of time, irrespective of the number of the un-stressed syllables between them. In other words, the amount of time between stressed syllables is roughly the same.

On the other hand, if syllable is the determining factor of the rhythmic pattern of a language then this type of rhythm is what Skandera and Burleigh (2005) referred as an isosyllabic rhythm or isosyllabism. Languages such as French, Spanish, etc. are called syllable-timed languages that is: “Languages in which syllables tend to recur at regular intervals of time” (Ladefoged p.231, 2001). In syllable timed languages all syllables tend to occur at equal intervals of time irrespective of being stressed or unstressed. In other words, it is the duration of syllable which causes rhythm.

About distinguishing the languages in terms of their rhythmic pattern types; Roach (1982) discusses that ‘isochrony in English speech (i.e. the occurrence of regular stress

beats)' can only be tested with the help of acoustic or articulatory information otherwise differentiating between stress-timed or syllable-timed languages is not possible.

There is also third class of timed language which is mora-timed language.

This section discusses that prosodic hierarchy of a language is based on different suprasegmental features such as; mora, syllable and foot. It is reviewed that stress is central phenomenon in the study of foot patterns, rhythm and prosody of any language. Moreover, stress as a phonetic or a phonological process is also defined with reference to a particular language in terms of acoustic properties for instance; pitch, frequency, intensity, duration; and phonological measures such as syllable weight.

2.3 Stress Patterns

Stress is the property of syllable but to understand stress patterns of any language usually a word is taken as a domain. As Anderson (1985, p. 185) asserts 'stress patterns typically characterize an entire word'. Stressed and unstressed syllables versus strong and weak syllables in a word make different stress patterns, such as ultimate, i.e. stress on the final syllable (ult) of a word; penultimate, i.e. stress on the second syllable (penult) from right edge of a word; antepenultimate, i.e. stress on the third last syllable of a word (Chomsky and Halle, 1968; Yavas, 2006).

Variation in stress patterns is the important factor in the study of change in accent and different varieties of a language. Moreover, the stress patterns differences among different varieties of a same language can cause problem of unintelligibility. As Jenkins (2000) confirms 'nuclear stress' as one of the three core features of intelligible pronunciation.

2.3.1 Word Stress Patterns of Native English Varieties

Every native speaker of English follows some word stress pattern while speaking English, which is in the intuitive knowledge of the native speakers. No English speaker is entirely free in the stress-placement: there are also certain grammatical and lexical constraints. Generally speaking, content words (nouns, verbs, adjectives, and adverbs) tend to be the main carriers of meaning and so often get selected for prominence. Hyman (2006, p.225) explains word stress by distinguishing it from tone and he describes both as prototype system, “which have two inviolable, definitional properties: (i) obligatoriness (every word has at least one stress accent); (ii) syllable-dependency (the stress-bearing unit is necessarily the syllable).”

Word stress is so important that it can help in the taxonomy of world languages. According to Ladefoged (2001, p. 231) ‘Perhaps a better typology of rhythmic differences among languages would be to divide languages into those who have variable word stress (such as English and German) and those that have fixed word stress (such as Czech, Polish, and Swahili)’.

Different linguists such as Gimson (1962) try to generalize some rules of English which can explain the intuitive word stress pattern of native speakers of English but also there are exceptions. Gimson’s work was later revised by Ramsaran (1989) and Cruttenden (2001). Whereas others discuss these patterns with different perspective; for example, according to Katamba (1989) rules for word stress pattern of English are quantity sensitive. It must make crucial reference to syllable weight. On the other hand, Fudge (1986) presented English word stress for pedagogical purposes. He stated that all important principles of English word stress as a guide to ESL teachers and learners. Wells (1986) discussed prosodic features differences of different accents of the British Isles

including variations in the English speakers of London, South, North, Wales, Scotland and Ireland.

Ortiz-Lira (1998) discusses a difference in the stress patterns of Received Pronunciation (RP) and American English (Am E) particularly of the words which are of French origin. He explains the tendency of Am E speakers to put stress on the last syllable, i.e. ultimate of di-syllable words following a French pronunciation; whereas RP speakers mostly produce penultimate stress patterns in same words such as *ballet*, *brochure*, *café*, *précis*, *vaccine*, etc. Similarly, these two native varieties also vary in stress patterns of tri-syllable and tetra-syllable words; tri-syllable word like *attaché* is pronounced with ultimate stress pattern in Am E if it is penultimate in RP. Tetra-syllable word like 'advertisement' is produced with penultimate stress in Am E but antepenultimate in RP.

It is not only the quality of a vowel in a syllable, that is weak syllables containing reduced vowels such as /ə/, /ɪ/; or a syllabic consonant which are always unstressed in English; but there can be other factors which affect stress in a word. Skandera and Burleigh (2005) discuss three major factors that influence word stress patterns of English. These are: word origin, word class, and the presence of suffixes, but they influence stress only in non-compound words. Stress in words of Germanic (language family) origin is influenced by word origin (mainly from Old English and Old Norse, the language of the early Scandinavians). These kinds of words tend to have stress on the first-syllable as in *answer* and *brotherhood*, while words of Romance (language family) origin (mainly from French and Latin) mostly contain stress on later syllables, as in *respond* and *fraternity*.

Another factor which is most frequently discussed in the literature in phonology is 'Word class' which influences stress in that nouns and adjectives tend to have first-syllable stress, as in *present* /pré.znt/ and *record*/ 're.kəd/, while verbs have a tendency to

have second-syllable stress, as *present* /pre.'zent/ and *record* /re.'ko:d/. A third factor which is presence of suffixes, is also important. So many phonologists such as (Kreidler, 1997) tell about different type of suffixes in English words which influence stress patterns. In these types some suffixes are of a kind that usually attract stress, whereas other suffixes commonly specify which of the syllables of a word carries stress, and still other suffixes usually cause a shift in stress. For example, words containing the suffixes *-ee*, *-eer*, *-ese*, *-esque*, and *-ette* usually carry the (primary) stress regardless of which syllable was stressed before the addition of suffix, as in *mountaineer* derived from *mountain* and *kitchenette* derived from *kitchen*. Syllables containing the suffix *-ate* also usually carry the stress (but in American English they usually don't) when they occur in disyllabic verbs, as in *dictate* /dɪk'teɪt/ and *frustrate* /frəs'treɪt/ (in American English /'dɪk.teɪt/ and /'frəs.treɪt/).

In trisyllabic verbs, the (primary) stress mostly occurs on the first syllable, as in *dominate* /'domineɪt/ and *fluctuate* /'flʌktʃueɪt/ and in four-syllable verbs, it is the second syllable which carries the (primary) stress, as in *deliberate* /di'libəreɪt/ and *facilitate* /fa'siliteɪt/. And some suffixes are known as 'stress- shifting' such as *-ial*, *-(i)an*, *-ic*, and *-it*, *they* usually shift the stress from the syllable that carries the stress before the suffix is added to the syllable immediately preceding the suffix, as in *tutorial* /tju:'tʊ:riəl/, derived from *tutor* /'tju:ta/, and *climatic* /klai'mætɪk/, derived from *climate* /'klaimət/.

There are also suffixes, however, which do *not* usually affect stress position at all. These are named as stress-neutral suffixes. Among such suffixes are *-ish*, *-ite*, *-less*, *-ment*, *-ness*, *-ous*, and *-y*. They usually retain the stress on the same syllable that carries the stress before the suffix is attached, as in *involvement* /ɪn'vɔlvmənt/, derived from *involve* /ɪn'vɔlv/, and *dangerous* derived from *danger*.

As mentioned above that *present* /prezənt/ and *record* /reko:d/, as the noun and the verb, are words with identical spelling, which are distinguished most noticeably by their stress patterns, i.e. they have contrastive stress in English.

In the stress patterns of English, strong forms can appear in both prominent and non-prominent positions, i.e. they can be either stressed or unstressed; but weak forms can only be present in non-prominent positions, i.e. they are always unstressed. The stress behavior of grammatical words or functional words is also generally predictable. As they usually do not convey most of the message of an utterance, so they are often in non-prominent positions and are therefore mostly unstressed.

O'Connor (1980, p.90) wrote about word stress pattern of English, 'Every English word has a definite place for the stress and we are not allowed to change it'. Collins and Mees (2003) discuss changing in the word stress pattern of English in the twenty-first century (See Collins and Mees (2003: 182-183 for details).

Zamma (2003, 2005a), summarizes that English has the following five major stress Patterns: (i) when last syllable is extrametrical; the extra syllable at the edge of any word which is never the part of any foot (Liberman and Prince 1977); and stress falls on the antepenult if the penult is light as in (nátu)<ral>, (húmo)<rous>, (dómi)<nant>, (áddi)<tive> (ii) when stress falls on the light penult with non-extrametrical syllable as in alco(hóli)<c>, a(tómi)<c>, ti(táni)<c>, sym(phóni)<c>, however, in these words there are extrametrical consonants (iii) non-retracting patterns in which stress falls on the last syllable , jóurnalése, ènginéer, vòluntéer, picturésque, cigarette, rognze, (iv) strongly-retracting are those in which stress falls on the antepenult as in désignte, démonstrte, confiscate, stisfy (v) In weakly-retracting stress falls on the penult if it is heavy as in ellpsòid, mollscòid, stalgmite, gelignte,

elementary. Representative suffixes of each pattern discussed above are summarized below:

- (i) extrametrical suffixes are: -ity, -ion, -(i)an, -al, -ous, -ive, etc.
- (ii) non-extrametrical suffixes are: -ic, -id, etc.
- (iii) non-retracting suffixes are: -ese, -eer, -esque, -ette, etc.
- (iv) strongly retracted suffixes are: -ate, -(i)fy, -ize, etc.
- (v) weakly retracted suffixes are: -oid, -ite, -ary, -ory, etc.

These details about stress patterns are not new, having been studied and described by many researchers such as Chomsky and Halle (1968), Liberman and Prince (1977) and Hayes (1980). In the literature, however, it is generally supposed that a suffix categorically shows one of these possible stress patterns. Liberman and Prince (1977), for example, give an analysis in which suffix 'oid' as in android is assigned a 'Weak Retraction rule' while suffix 'ate' as in communicate acquires a 'Strong Retraction rule'. Yet there are some words which do not conform to these statements and are simply considered as 'exceptions.'

2.3.2 Stress Patterns of Non-native English Varieties

Other than native varieties of English, many researchers have worked on the non-native varieties of English as well. For example, Wells (1986) discusses the prosodic characteristics of Anglo-Indian accent of Indian English which are reported to be similar to South Welsh accent. It was mentioned that in this variety difference of stressed and unstressed syllables depends on pitch and duration mostly, so, intensity is least relevant in this case.

Gramley & Patzold (1992) in their survey of modern English describe national and regional varieties of English in British Isles, America, Australia, New Zealand, Africa and Asia. In their description of English in Asia, they describe Indian English, Singapore

English and Philippine English. Kachru (1983) and Bansal (1990) described the stress patterns of Indian English variety that there is no distinction of stress patterns of bi-syllable words as noun and verb rather speakers of this variety regularize stress either on first or on second syllable. So, no difference of stress position in word 'record' as noun as well as verb. Similarly, absence of stress shift is also reported in this variety, as in derived forms of words, which are words with suffixes, no shift in stress position is brought, so the stress position of the stem of the word is retained. For example, 'examine' and 'examination' are pronounced with same stress patterns.

Similarly, Pennington (1997) reported word stress patterns of other non-native varieties of English such as: Hong Kong English, Malaysian English, Singaporean English and Guyanese English. In these varieties, alternate stress patterns of stress shift from first to second or from second to first syllable are observed .

Moreover, Bobda (2010) discusses problems in the form constraints that Cameroonian and Nigerian L2 learners of English face in assigning a word stress. The major restraints which have developed in the process of indigenization of the English language are summarized as follows:

- i. Noun-verb alternation (NVA), i.e. they cannot maintain this contrastive stress difference of grammatical categories.
- ii. Heavy syllable stress (HSS), i.e. they tend to stress every heavy syllable.
- iii. Affix stress property (ASP), i.e. they are making different stress patterns by applying generalized ways of assigning stress to all types of affixes.
- iv. final obstruent verbal stress (FOVS), I-stress (IS) and N-stress (NS): It refers to the

several cases where the presence of any obstruent , /i/ or /n/ in the final syllable rhyme tends to pull stress to the ultimate syllable.

2.3.3 Stress Patterns of Urdu

It is important to discuss syllabification and stress patterns of Urdu, a language spoken by all participants of the present study, i.e. news casters, to understand its effect on PSE. There are different studies done on the syllable stress and foot patterns of Urdu. First of all, Bokhari (1985) explained the phonology of this language with focus on its segmental features and described its syllable structures. Then, Hayes (1995) discussed the foot pattern of Urdu. According to him, Urdu language is fixed. It makes unbounded right-headed foot patterns. After that Hussain (2010) studied the syllable structures and word stress patterns of this language. He provides the following complete list of possible syllable structures of Urdu with simple onset (1-6) and complex onset (7-12):

1. CV
2. CVC
3. CVCC
4. CVV
5. CVVC
6. CVVCC
7. CCV
8. CCVC
9. CCVCC
10. CCVV
11. CCVVC
12. CCVVCC

(p. 45, 2010)

It is clear from these syllable structures that Urdu, unlike English which allows even three or four consonants in one cluster, allows cluster of maximum two

consonants at onset or coda position. Moreover, this language does not allow any kind of consonant as a nucleus.

In addition, he discusses the lexical stress patterns of Urdu. According to him, the basis of the position of word stress in Urdu is the weight of syllable. This weight is measured on the basis of the number of segments in the rhyme and consonants at coda position are also 'moraic'. Hence, Urdu syllables are categorized into following three types on the basis of their weight differences:

- i. Monomoraic or light syllables having (V) in a rhyme.
- ii. Bimoraic or heavy syllables containing (VV or VC) in a rhyme.
- iii. Trimoraic or superheavy syllables with (VVC or VCC) in a rhyme.

Hussain further explains that most commonly the last heavy syllable is stressed. In case of absence of heavy final syllable, the penultimate, i.e. second last syllable is stressed. It infers that a notion of extrametricality, i.e. the final mora of the word plays no role in stress assignment. He further discusses the effect of stress on different phonetic properties of Urdu vocalic and consonantal segments that in stressed syllable short vowels are further reduced and the coda consonants are lengthened. Moreover, he describes stress patterns of Urdu that in multi-syllable words final syllable is only stressed when it is superheavy. So, in case when final syllable is heavy or light its preceding heavy or superheavy syllable is stressed.

It is discussed in section 2.3 that stress patterns differences occur not only in the native varieties of English but also in non-native varieties of English. Lexical stress patterns differences in the native varieties are found because of three reasons: difference of origin of the words, morphological structures and syntactic categories. Whereas these differences in non-native varieties of English are formed because of the influence of the

native languages of those varieties speakers. To understand the influence of Urdu on PE, this section ends with the description of the stress patterns of Urdu language.

2.4 Lexical Phonology: Model of morphology-phonology Interaction

In Lexical Phonology, phonology and morphology are organized serially; for example, all phrase-level phonology applies after all lexical phonology. The field of study that covers the overlapping concepts between morphology and phonology is also named as morphophonemics or morphophonology (Skandera and Burleigh (2005). According to Carr (2008, p. 90), 'lexical phonology is a model of interaction of phonology and morphology which postulates different levels or strata of word formation, with different phonological rules'. Similarly, for McMahon (2000) lexical phonology is a model to integrate phonology and morphology. So, it is equally important in phonological as well as morphological areas of study.

This interaction of phonology and morphology is also important in the study of stress patterns. For example, Siegel (1974) provides division of English derivational affixes into different Classes not only by reference to morphological factors, but also by additional evidence from phonological behaviour in terms of stress patterns of these affixes. She classifies the following two classes of affixes:

- i. Class I suffixes shift the stress of the stem as 'va.lid becomes va.'li.di.ty by shifting penultimate stress into ante-penultimate.
- ii. Class II affixes are stress-neutral. For example, there is no change in the stress position in the stress pattern with the addition of 'ness' as a suffix in 'valid': 'va.lid and 'va.lid.ness.

From the above discussion, it is obvious that lexical phonology deals with the affect of affixation in the word on the position of stress in English words which are morphologically complex.

2.5 Previous Research on Pakistani English

Almost three decades ago, PE had no individual identity; it was just discussed as a part of South Asian English; as Kachru (1983) did not differentiate between Indian English and English spoken in other countries of South Asia, namely Pakistan, Bangladesh, Nepal and Sri Lanka. There are several reasons for this claim. Firstly, Hindi and Urdu have many linguistic similarities. Secondly, it was claimed at that time when PE was not much explored. Although Usmani (1965) discussed the stress system of English and Urdu to explain the use of English by Urdu-speaking Pakistanis, but Kachru criticized his work as simple and confusing.

Rahman (1990) described four sub-varieties of PE having the following linguistic features: Phonological and Phonetic, Morphological and Syntactic, and Lexical and Semantic features. In Phonological and Phonetic features, he was concerned with the segmental features of PE, but non-segmental features were only touched upon briefly. For example, he emphasised the effect of rhythmic patterns, i.e. syllable timed, of first language L1 of Pakistani speakers on PE. Moreover, he highlighted intonation patterns of PE is also different because of L1 interference. But these differences are not explained in detail. He categorises PE variety into four types of sub-varieties of PE, i.e. anglicized, acrolect, mesolect and basilect (detail is given in section 2.1 above). These types are discussed with reference to L1 interference, from least to most respectively, in English. This work of Rahman, which was done in UK, is criticized by Mahboob & Ahmer (2004) because of its small sample size and unclear framework of procedure.

Baumgardener (1990 & 1993) writes about the indigenization of English in Pakistan. He focuses on the effects of local languages such as Urdu in the use of English in Pakistan. His first article is on the teaching of syntactical aspects of English through Pakistani newspapers, and the other article focuses on lexico-semantic features of English. He emphasises that PE has its own identity although it shares many linguistic features with other English varieties.

Talaat (1993) differentiated lexical patterns of borrowed words from English into Urdu. She discussed some of English nouns which were converted into grammatical shift to a verb in PE and Urdu. These lexical variations were explored from Pakistani English newspapers.

Mahboob and Ahmer (2004) explain Pakistani English phonology but they describe PE phonology at segmental level only. For the prosodic features of PE, they report that 'description of stress, based on studies of other South Asian dialects of English, may be used to describe PakE as well, since no independent reliable studies of stress of the latter are currently available' (2004, p.1013).

Raza (2008) in his research article on 'Patterns of Pakistani English' discusses phonological features of four sub-varieties of PE categorized on the basis of the speakers' first language background: Urdu, Punjabi, Sindhi and Pashto. In his research, differences at the phonemic level and word stress pattern of only three English words in terms of placement of stress and change in length of stress of the above mentioned four sub-varieties are compared with Received Pronunciation (RP) of British English.

Nomaan (2009) discusses variety in Pronunciation in PE and she claims that the length of stress as a primal cause of confusion in comprehension for the listeners.

Afsar and Kamran (2011) compared the consonantal phoneme of PSE with British Standard English (BSE). In this study, they highlighted the inventorinal, realization, incidental and distributional differences in the consonantal phonemes of these two varieties. In this regard, the following differences in the phonemes of BSE and PSE are given (p. 35-36) :

BSE	PSE
<ol style="list-style-type: none"> 1. /p/ as in <u>pay</u> 2. /b/ as in <u>bacon</u> 3. /t/ as in <u>today</u> 4. /d/ as in <u>day</u> 5. /k/ as in <u>kangaroo</u> 6. /g/ as in <u>go</u> 7. /tʃ/ as in <u>chew</u> 8. /dʒ/ as in <u>joy</u> 9. /f/ as in <u>fail</u> 10. /v/ as in <u>voice</u> 11. /θ/ as in <u>think</u> 12. /ð/ as in <u>themselves</u> 13. /s/ as in <u>singer</u> 14. /z/ as in <u>zeal</u> 15. /ʃ/ as in <u>shout</u> 16. /ʒ/ as in <u>measure</u> 17. /h/ as in <u>husband</u> 18. /m/ as in <u>mat</u> 19. /n/ as in <u>now</u> 20. /ŋ/ as in <u>sing</u> 21. /w/ as in <u>was</u> 22. /l/ as in <u>low</u> 23. /r/ as in <u>raid</u> 	<ol style="list-style-type: none"> 1. /p/ 2. /b/ 3. /t/ 4. /d/ 5. /tʃ/ as in <u>turmoil</u> 6. /dʒ/ as in <u>discount</u> 7. /k/ 8. /g/ 9. /tʃ/ 10. /dʒ/ 11. /f/ 12. /v/ 13. /t^h/ as in <u>think</u> 14. /d/ as in <u>themselves</u> 15. /s/ 16. /z/ 17. /ʃ/ 18. /ʒ/ 19. /h/ 20. /m/ 21. /n/ 22. /ŋ/ 23. /v/ <u>worm</u> 24. /l/ 25. /r/ 26. /tʃ/ <u>cart</u> 27. /j/

24. /j/ as in cumulative	
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Furthermore, two important phonological processes, i.e. rhoticity and gemmimation discussed in this study about PSE are crucial in exploring the syllable structure and stress patterns of PSE.

Moreover, Melchers and Shaw (2011, p.147) discussed the following common phonological features of PE by giving the salient features of South Asian English: 'syllable-timing, and relatively lightly marked word stress.'

Ahmar (2013) presents a broad description of the morpho-syntactic features of PE identified in the WAVE profile. He also discusses some of the issues that occurred in the analysis of the WAVE data and its limitations.

Because of the fact that English is widely spoken in many countries so there are many new varieties of English. In this regard, Platt et al (1984) generalized the following few tendencies which are shared by some or all of the new varieties of English:

- Replacement of short vowel sounds as in words like 'purse', the /ɜ/ into /ʌ/.
- long and short vowels are replaced e.g. in 'genetic', the /e/ is substituted by /æ/.
- Replacement of the central vowels with either front or back vowels as in 'vehicle', the /ə/ is replaced by /i/.
- Replacement of diphthongs with one long pure vowel by leaving out the second element in a diphthong e.g. in 'gate', /eɪ/ is pronounced as a monophthong, /e:/.

Although these reported featural changes are general tendencies in new varieties of English not particular to PE but these tendencies are later confirmed by Sheikh (2012) in the vowel system of PE.

To sum up, many linguistic aspects of PE as one variety and its subvarieties have been explored and also compared with native English varieties; however, none of the

study on PE earlier focused on the description of suprasegmental features such as syllable structure, stress and foot patterns, and prosody of PE.

2.6 Acoustic Phonetics

Every phone or sound segment has its own physical properties. Acoustic phonetics studies the physical properties; such as fundamental frequency, pitch, intensity, duration; of speech sounds to describe various acoustic signals (Harrington, 2013). With the help of acoustic analyses the physical facts of sound waves are revealed. 'Praat' software is used for doing phonetic analyses of individual sounds and group of sounds. It is widely used for experimental study in the field of phonetics and phonology (O' Grady, 2013).

For analysing segmental as well as suprasegmental features in various languages, many phoneticians (Ladefoged (1996, 2001, 2003); Hayword, 2000; Johnson, 2003; Gussenhoven, 2002 & 2004; Odden (2005); Hewlett & Beck (2006); Yavas (2006); Reed (2011); Yaeger-Dror & Fagyl (2011); explain scaling, reading and interpretation of waveform and spectrum for spectrographic analysis. For example, Harrington (2013, p.83) clarifies about the formants of vowel sounds that their formants are more prominent because of the 'resonances of the vocal tract' and in vowel sounds 'the waveform is periodic'.

Acoustic representation is helpful in the study of acoustic correlates of lexical stress. For example, Fundamental frequency of a stressed syllable is typically thought to be connected to pitch. Generally, stressed syllables have tendency to be produced with higher pitch as compared to unstressed syllables. However, Catford (2001) explains interesting facts about some dialects of English in which primary stressed syllable are pronounced on a lower pitch than the adjoining unstressed syllables.

Moreover, appearance of formants in spectrum is also a clue for visual evidence of stress. Unstressed phonemes have more reduced realizations than their stressed counterparts; it is visible in the formant values. Spectrum also provides the energy in a number of frequency bands, which can be extracted from the waveform to yield information about the spectral tilt. Another phonetic correlate of stress is intensity and this overall intensity is usually thought to be correlated with lexical stress. Duration in lexical stress is generally found to be correlated with phoneme duration and most common duration of vowel in a syllable. As Gussenhoven (2004, p. 16) discusses the correlation of length of vowel and stress in these words: 'the longer phonetic duration of stressed syllable may lead to distributional correlations between stressed syllables and long vowels'. He further explains following three degrees of stress with their positions in structure and their phonetic correlates:

1. Unstressed; these are weak syllables in a foot. Its phonetic correlates are reduction in quality and duration which is shown as a steep spectral tilt.
For example, in /pə.teɪ.tə/ first and third syllable is unstressed.
2. Stressed and unaccented; these are strong syllables in a foot. Vowels in these syllables show no reduction in quality and duration so, their spectral tilt is less steep. For example, second syllable of /rɪ.kɒ:d/.
3. Accented; these are stressed syllables which contain intonational pitch accent. They are also strong syllable in a foot but with additional pitch is configured as 'sentence accent'. For example, in the utterance 'I like CAULiflower' CAUL is accented syllable.

Lexical stress has been demonstrated to influence acoustically not only vowels, but also consonants. Notably, none of the previous auditory approaches or non-experimental methods have taken into account the well-observed influence that stress has on consonants: stressed and unstressed consonants are realised differently and stressed consonants have a longer duration. Consonants are influenced by speaking style in the same way as vowels are: duration, spectral tilt and formant frequencies (for consonants with a formant structure). It suggests similar effects can be found for lexical stress on consonants.

Spectral features are measures for the effort with which phonemes are pronounced. Some of these features are important in identifying stressed syllables in the spectrograms. It is also discussed that fundamental frequency slope is a better predictor of stress than the raw fundamental frequency (Ladefoged, 1996). The speaking effort is a continuous measure: it probably increases over the start of a stressed syllable and decreases by the end. Therefore it can be concluded that derivatives for spectral features should also be correlated with lexical stress, specifically for consonants.

Many researchers have been interested in the acoustic correlates of lexical stress of different languages. For example, Sluijter (1995) in fundamental linguistic research on the acoustic properties of stress minimal pairs demonstrates that lexical stress in English and Dutch is signalled mostly through duration, formant frequencies, intensity, and spectral tilt. The latter is a feature that denotes the energy in high frequency bands relative to the energy in low frequency bands. This study describes the importance and the feasibility of detecting lexical stress in speech. That stress works on the syllable level and can be modelled effectively by adding stress marks to the phonemes in the lexical entries of a speech recogniser.

Other than syllable level, Heuven (1994) claims that single segments can also be prosodic domains which come below the syllable. In acoustic analysis of segments' domain following six properties were measured:

1. Duration of segment
2. Pitch movements duration
3. size of deviation of pitch movements
4. In segment boundaries synchronization of pitch movements
5. Intensity of segment
6. Distribution of spectrum

It is easy to get these properties measured in the spectrographic analysis of speech. Duration of a segment and pitch movement duration are shown in milli seconds (ms) at the horizontal axis of the spectrograph. Similarly, size of pitch movement, intensity and distribution are also illustrated with pitch and intensity lines on the spectrum.

Fletcher (2013, p.531) also discusses the effect of stress on the length of vowel, she claims that duration of vowel can be added from '30 ms to more than 70ms depending on the degree of stress'. She also reports many studies on English stress and prominence which analysed additional articulatory or acoustic correlates such as: ' magnitude and velocity of opening and closing articulatory gestures, vowel formant patterns, spectral tilt, vowel intensity, pitch height or pitch change' (2013, p. 533).

Spectrographic analysis is also useful for finding a number of syllables in one word which is some time challenging through simple perception. In this regard, Ashby & Maidment (2005) illustrate that each section of high amplitude in a waveform of a word corresponds to the number of syllables in a word.

To sum up, acoustic phonetics helps in understanding the differences of physical properties of a segment and their correlation of lexical stress. Syllable structures and stress

patterns of the words can be explored by measuring these properties in the waveform and spectrograms.

2.7 OT and its Application in Metrical Phonology

This section first gives an overview of OT with the detailed discussion of all its relevant concepts, then presents various constraints of syllable and prosody to explain role of OT in the study of syllable, stress and foot patterns of various languages. A recent development in linguistics in general and metrical phonology (detailed discussion is given in section 5.2) in particular is optimality theory (OT). OT is an expansion of ‘Generative Grammar’ and was first proposed by Prince & Smolensky (1993/2004). According to them Universal grammar consists of ‘constraints’ instead of rules and individual grammar of any language is based on the proper ranking of these constraints. OT is different from earlier work in two ways. First, it does not offer individual grammars for description of rules like others, instead it presents ‘Gen’ (Generator) which performs candidate analyses to generate many forms. According to McCarthy (p 8, 2002) ‘Gen is universal’ which means that all produced candidates by Gen for a given input are the same in all languages. These candidates are very varied. This property of Gen is what he calls ‘inclusivity or freedom of analysis’.

Secondly, OT theorists unlike other theorists believe in the universality of constraints that they are not language specific, it is the hierarchy of the constraints which makes a language specific grammars. For the OT analysis of the whole data of one language about any linguistic feature there is need of set of constraints on that feature which covers all generalizations and relevant processes of the phenomena. There is also space for the formulation of new constraint(s) or/and modification of some constraint(s) in OT analysis if established set of constraints does not cover the related linguistic process

(es) of the language under discussion. So the set of constraints should be elaborative enough to accommodate all possible varied patterns in the presented data.

It also requires one consistent hierarchy of constraints (OT grammar) which should fit to evaluate only one optimal candidate from the multiple candidates. An optimal candidate is one which incurs fewer and least serious violations, i.e. violation of lower-ranked constraints as compared to all other candidates.

Further more, McCarthy (p. 172, 2002) explains that OT architecture is a modular, one 'that is neither global nor parallel'. The general idea is that the whole phonology of a language involves several OT constraint hierarchies which are connected serially, with the output of one functioning as the input to the next. Each of these serially linked modules is technically named as a 'grammar or syntax' which is a discrete ranking of the constraints in CON. Then, modular architecture encompasses factorial typology from between language to within-language variations, and combines this with the derivational structure of 'harmonic serialism'. This is how OT formulates universal constraints with the help of factorial typology. He further discusses 'globality and parallelism' as the most controversial properties of OT. This architecture is global because a single grammar i.e. a single ranking of the constraints in CON, is sufficient for all derivations in a particular linguistic feature. It is parallel because the derivation is flat, which maps out input directly to output without further applications of the grammar.

Kager discusses the quality of output that is never perfect showing 'fallacy of perfection', i.e. 'no output form is possible that satisfies all constraints' (p. 16, 1999). Some pointing symbol is used to indicate the optimal candidate among all others. OT makes some typological predictions about language specific patterns which according to him can be checked by constructing a 'factorial typology' by reranking of different types

of constraints. For constraint ranking, Prince & Smolensky (p.99, 2004) define ‘Pāṇini’s theorem’ in these words:

‘Let constraints S and G stand as specific to general in a Pāṇinian relation.

Suppose these constraints are the part of the constraints hierarchy CH, and that G is active in CH on some input i. Then if $G \gg S$, S is not active on i.’

In this theorem, symbol \gg stands for higher-ranking of the constraint. So, it can be inferred that higher-rank constraint outranks the effect of lower-rank constraints.

OT represents a major step forward in many respects with the help of its constraint based approach. According to Archangeli, (1997) OT, like other models of linguistics, suggests an input and an output and a relationship between the two. The input which is the well-formed linguistic structure, is the commencing point. Then there is a series of operations executed on the input, and the result of these procedures is the output. The relationship between input and output is interceded by two formal devices, GEN and EVAL (evaluator). As discussed above, GEN produces a candidate set of possible outputs and notices their faithfulness relations to the input. For this purpose, EVAL exercises the language’s constraints hierarchy to opt the best candidate for a given input from among the candidates produced by GEN. It is assumed that almost the same set of constraints is applicable for all languages. In this way, the constraints also determine markedness in a language: the higher ranked constraints specify the means in which the language is marked while the lower ranked constraints show how a language is unmarked. So, in this way markedness is preset in OT.

Berry (1998) summarizes the following five basic principles of OT:

i) Universality.

A set CON of constraints is universal and universally present in all grammars.

ii) Violability.

Constraints in OT are violable; but violation is minimal.

iii) Ranking

Ranking of constraints of CON is language-particular; the concept of minimal violation is based on this ranking. A ranking of the constraints set makes grammar.

iv) Inclusiveness

The constraint hierarchy, i.e. grammar evaluates a set of candidate analyses that are conformed by general considerations of structural well-formedness.

v) Parallelism

There is one constraint hierarchy that is best-satisfied by the whole candidate set. There is no idea of serial derivation.

Guest et al. (2000, p.274) explain the role of transitivity in OT ranking relation 'which means that if $A \gg B$, and $B \gg C$, then $A \gg C$ '. In this case, transitivity is so important that without it selection of optimal candidate is impossible.

Another basic tenet of OT is the 'Richness of the Base Hypothesis' which puts no restrictions on the input for the grammar of the language, i.e. anything that is a logically possible linguistic representation should also be a potential input for the grammar of any language (Prince & Smolensky, 1993/2004).

McCarthy (2002 & 2008) discusses constraints typology by distinguishing two types of constraints in OT: (i) faithfulness constraints which ensure similarity between the input and the output candidate under evaluation. This type of constraints is considered

‘unique to OT’. There is also requirement of ‘correspondence’ for this optimal output. McCarthy (2008) discusses ‘correspondence theory’ as a property of faithfulness constraints. According to this theory, there is ‘correspondence relation’ between input and the output which links some or all linguistic elements of input with that of output. On the basis of this correspondence relation ‘correspondence theory’ is developed. To comprehend the role and character of correspondence in phonological processes within Optimality Theory, there is a need of a model of constraints on faithfulness of the output to the input to provide a basis for the study of over- and underapplication. Thus, Correspondence Theory eliminates the need for special, distinct theories of input–output faithfulness and base–reduplicant identity. This unified theory of faithfulness and identity is particularly good to consider the range of parallels between them. OT also suggests correspondence constraints that govern the associations between the candidates and related forms, such as inputs and bases. For example, Dependency- input- output (DEP-IO), i.e. every segment of the output has a correspondent in the input, is a constraint based on this theory and its function is to prohibit phonological epenthesis.

(ii) Markedness constraints evaluate the output form which should be permissible language structure or language inventories. This type of constraints demand the structural ‘welformedness’ of the output forms. Many of the markedness constraints are also discussed in pre-OT literature. However, the interaction between these two types of constraints is a focal point of any OT analysis. According to Kager (p. 6, 1999) ‘Markedness and faithfulness are inherently conflicting’ and these conflicts can be resolved by ‘domination’, i.e. in a pair of conflicting constraints, the higher-ranked takes precedence over the lower-ranked one. He further discusses the properties of OT constraints their ‘softness’ and ‘violability’ which should be ‘minimal’.

The third family of constraints is 'Alignment constraints'

McCarthy (p 10, 2002) summarizes the basic architecture of OT in this way:

Input → Gen → candidates → Eval → output

In OT analysis, the evaluation is usually presented in the form of a tableau, which is a table containing constraints, the data is presented in "Tableau" form. In literature, different types of tableau are discussed (Prince & Smolensky, 1993/2004; Kager, 1999; McCarthy, 2002& 2008). For example, summary tableau is made for the working out of the data analysis. This type of tableau is essentially used to omit such constraints which play no role in the selection of winner or loser candidates. A comparative or combination Tableau illustrates a comparison between the most harmonic candidate, i.e. optimal candidate and one of its contestants. Another type of tableau is known as 2×2 Tableaux which focuses only on a single interaction by ignoring the rest of the constraints. So, this 2×2 Tableaux is criticized because of this limitation which could not help in providing overall interaction of a full set of constraints which are important in validating the ranking argument. Finally, a traditional 'violation' tableau helps in computing the number of violations done by various candidates to choose the one with lesser number of violations.

In the tableau, the constraints are ranked across the top, going from highest ranked on the left to the lowest ranked on the right. Solid lines between constraints specify essential rankings while broken lines (illustrated in Constraint B and Constraint C in table 2.1) imply that the ranking is not vital and constraints ranking does not affect the selection of the optimal candidate. Symbol of asterisks (*) shows violations, and an exclamation point highpoints each "fatal" violation, i.e. the violation that entirely rejects a candidate as shown in Table 2.1.

Table 2. 1 Sample Tableau in OT

Input: A	Constraint A	Constraint B	Constraint C
►► Candidate A			*
Candidate B	*!		
Candidate C		*!	

The most crucial and practical part of OT analysis is understanding of constraints interaction and developing ranking hierarchy. For this purpose, many proposals are offered. 'Maximum Entropy Model' is given by Goldwater and Johnson (2003) to specially cover the grammars of languages showing free variation. This model is statistical in nature and is based on few parameters.

Another way which assures to produce a consistent set of ranking arguments by always preferring optimal candidate is an algorithm named as 'Recursive Constraint Demotion' (RCD) presented by Tesar and Smolensky (1998). This method is based on the comparisons of optimum with suboptimum candidates. The proposed algorithm is justified by illustrating this comparison in multiple comparative Tableaus to give understanding of the difference of properties of the competitors. It is based on the key idea that learning of grammar implicates constraint demotion. In RCD every input is compared with output, which is derived from the same input, to know which constraint(s) support winning candidate. The constraint which favors loser is demoted in the ranking as the main idea in

this algorithm is that any loser-favoring constraint required to be dominated by some winner-favoring constraint. The table shows the number of W that stands for winner and L which is used for loser under each constraint. Then the constraint(s) with more number of W's dominate the constraint(s) with L's. So, loser-favoring constraints are demoted. This is called Constraints Demotion or C/D Lemma in this method. About this comparative tableau and the ranking process, Prince (2002) asserts that 'ranking and optimality are based on pairwise comparisons between desired optimum and its competitors'.

Coelho (2002) discusses that the primary stress system patterns of Thompson River Salish language; spoken in British Columbia, Canada; exhibits pattern of conflicting directionality, i.e. words without accented morpheme are assigned stress leftward; whereas stress assignment is rightward in words with accented morphemes. Hence, this complex issue is comprehensively described with the help of OT analysis.

There are many effects of OT on the metrical view of phonology. It predicted all the other developments due to its fullness. Optimality theory addresses all the issues that have been a concern of linguistic process. The main focus of linguistic study is to search for various patterns in languages, difference among the pattern of different languages, language universals and the language markedness. These points have never been discussed simultaneously in any of the previously discussed theories, including the syllable structure and metrical view. OT, however, focuses all the issues in a comprehensive way.

Kager (1999) highlights the achievements of OT in term of merging of the phonetic and phonological features into one set of hierarchy of constraints. However, he also explains unresolved issues or current modifications in a theory. One of the issues is 'opacity' which 'refers to the phenomenon that output forms are shaped by generalizations that are not surface-true' (Kager, p.372, 1999). It is a problem which needs solution

because ‘surface-oriented OT’ disallows reference to pre-output levels through well-formedness constraints. For example, output of word showing processes of ‘epenthesis of vowel’ for breaking of consonants cluster is ‘opaque’ and its context of application cannot be recovered at the surface level. So, An output-oriented theory of this type should not neglect the patterns of phonological opacity, arising out of generalizations that should be stated at some nonsurface level of account. Opacity has been a focus of study in traditional generative phonology. In terms of Kiparsky’s (1973:79) following definition two different kinds of opacity can be differentiated that formed the basis of most later study on the topic:

‘A phonological rule P of the form $A \rightarrow B / C _ D$ is *opaque* if there are surface structures with any of the following characteristics:

- a. Instances of A in the environment $C _ D$
- b. Instances of B derived by P that occur in environments other than $C _ D$.

That is why in OT selection of Input and generating of multiple possible outputs are very crucial phases to avoid this problem of Opacity.

McCarthy (2002) discusses ‘Sympathy theory’ which takes a very different point on the issue of opacity. The notion in sympathy theory is that, in addition to the winning output form, EVAL may choose a sympathetic candidate, which is the second most harmonic candidate that conforms some specified faithfulness constraint, called the selector. So, the rankable constraints require the output form to be similar to the sympathetic candidate in some respect, and in this way, the sympathetic candidate, even if not the winner itself, may put an indirect effect over the outcome.

With all its success and some limitations discussed above, OT has been preferably applied as a model to study syllable, stress and foot patterns of not only English but also other languages. Hayes (2004, p.306) suggests especially about the phonological constraints that they are commonly ‘phonetic in character’. He further says, ‘They are not phonetic itself, but could in principle be “read off” the phonetics’. Sections 2.7.1 and 2.7.2 throw light on the OT application in the description of syllable structure and prosody of various languages respectively.

2.7.1 Syllable Structure of different languages in OT

Syllable structure and syllabification of many languages and varieties of languages are discussed in optimality theoretic framework. All those properties of syllable, its structure and syllabification; which are discussed in detail in section 5.2 are given the form of universal constraints in OT literature. Following are those different universal constraints on syllable:

1. *Complex-Onset (*Comp-Ons) or *Complex-Coda (*Comp-Coda): This constraint disallows tautosyllabic cluster, that is consonants or vowels cluster in a syllable, in the specified position. Sometimes combined into the cover constraint *Complex. It detains the occurrence of more than one C or V associated to any syllable position mode.
2. Cunsyll or Appendix (App): It requires that there should be no unsyllabified segment. Same as Exhaustivity (syllable) or Prince and Smolensky’s faithfulness constraint ‘Parse’ which bans deletion and FILL that bans insertion, Archangeli (1997) names ‘Faith C’ and ‘Faith V’ as faithfulness constraints. Faith V resists epenthesis of vowel in a syllable of output form if it does not occur in the input form. Whereas, Faith C stops deletion of any

consonantal segment from the syllable of output form which occurs in the input form. Hammond (1997b) calls it as 'faithfulness' which restricts the addition or deletion of any segment in syllable.

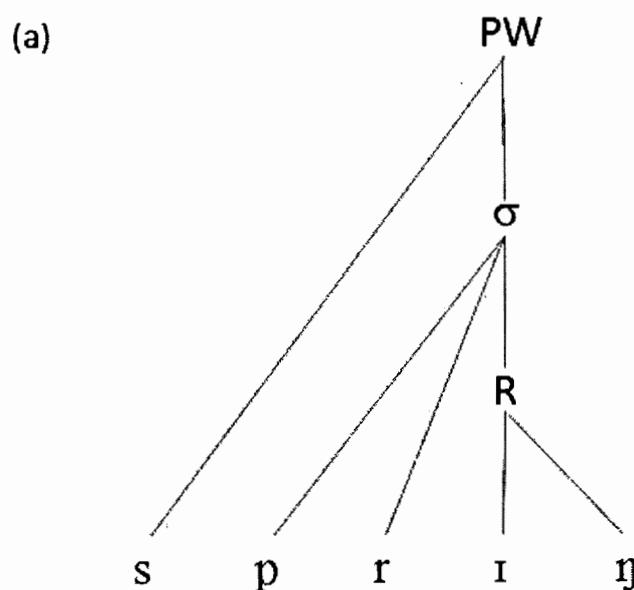
3. Nucleus/ X (Nuc/ X): It assures a segment in a syllable nucleus that belongs to sonority class X . Sometimes called Peak/ X . It is replaced by the 'The Nuclear Harmony Constraint' (HNuc constraint) in Prince and Smolensky (1993/2004) according to that a nucleus with higher sonority value is more harmonic than one of lower sonority value.
4. No-Coda: It ceases presence of coda in a syllable and favors open syllable.
5. Onset/ X or Coda/ X : It demands segment in the specified position that belongs to the sonority class X . Sometimes combined into the cover constraint Margin/ X .
6. Coda-Condition (Coda-Cond): It rejects consonant place specification that is not linked with an onset consonant .Sometimes used as a cover constraint for a collection of restrictions on consonant clusters that includes the Coda-Condition proper. It obligates the stem final syllable to close the stem syllable.
7. Nucleus (Nuc) or Have-Nucleus (Have-Nuc): It refrains syllable without a nucleus. Same as Headedness (syllable). It is also named as 'Peak'
8. Onset: It requires one consonant before nucleus in a syllable.
9. Sonority-Sequencing (Son-Seq): It says that onset or coda cluster should appear with appropriate sonority profile by following SSG (detail of SSG can be seen in section 5.1.1), this is a common cover constraint for a family of constraints on the sonority profiles of tautosyllabic clusters (Prince and Smolensky 1993/2004; Archangeli, (1997); Kager, 1999; McCarthy, 2002 & 2008).

10. LICENSING: It restricts the word-initial and word final consonants clusters according to phonotactic conditions of that language (Hammond, 1997b).

11. Strict Layer Hypothesis (SLH): It suggests that every component lower in the hierarchy is properly dominated by an element one level higher (Selkirk, 1984).

According to Roca and Johnson (1999, p. 482) SLH requires that 'Each phonological domain contains precisely one or more phonological domains of the rank immediately below.' They introduced it as a constraint to evaluate syllable structure of English word 'sky'. The violation of this constraint supports (Son-Seq). To adjust extra-syllabic 's' in the onset of 'spring' [sprɪŋ] and 's, t' in the coda of 'next' [nɛkst]. This violation is illustrated in Figure 2.3

(a) and (b).



(b)

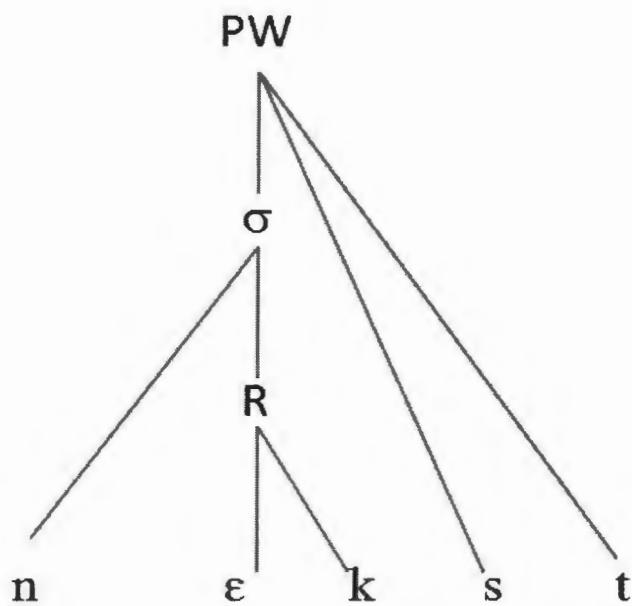


Figure 2.3 Violation of SLH in (a) [sprɪŋ] and (b) [nekst]

In Figure 2.3 (a) extrasyllabic 's' leaves out its syllable and affiliates with phonological word (PW) node. Similarly, configuration in 6.1 (b) also exemplify the direct linking of coda cluster 's, t' with higher domain by violation of SLH. This constraint also solve problem of all consonant clusters which violate SSG principle.

Levelt and Vijver (2004, p.206) categorise 'Onset, No-Coda, *Complex Onset, *Complex Coda' as structural constraints by that they mean ' that demand outputs to be structurally unmarked'.

By ranking these above mentioned constraints, Syllable structures and syllabification of different languages are analysed with the help of optimality theoretic framework. OT does not only capture unmarked or general variations of a language but also marked features which are specific language distinctions. For example, some important discovery about Imdlawn Tashlhiyt dialect of Berber (ITB) is that in this

language any segment – consonant or vowel, obstruent or sonorant – can make the nucleus of a syllable. Prince & Smolensky (1993/2004) apply OT to seek the optimal syllable in the harmonic syllabification of this language. To evaluate very distinct and marked type of syllable nucleus of this language, they introduce Hnuc constraint which says: ‘A higher sonority nucleus is more harmonic than one of lower sonority, i.e.

If $|x| > |y|$ then $\text{Nuc}/x \tilde{N} \text{Nuc}/y$.’ Prince & Smolensky (p. 14, 2004)

Then ranking of Ons » Hnuc is proved to be crucial to obtain the grammar of Berber.

Hammond (1997b, p.37) presented the factorial typology, i.e. ‘the possibility of languages exhibiting each possible ranking’, of four types of languages. Following are rankings of these four types:

Type 1: Language with syllable structure in which only vowel (V) as nucleus is compulsory whereas onset (O) and coda (C) are optional, i.e. (O) V (C) such as English. So, Syllable constraints ranking for type 1 is:

Faithfulness >> Onset, No-Coda

Type 2: This type of languages’ syllable structure has onset and vowel as nucleus both are obligatory but coda is not allowed. For example, syllable structure of Senufo spoken in Guinea is OV. Hence its ranking is:

Onset, No-Coda >> Faithfulness

Type 3: Yawelmani language of California falls in this type. Its syllable structure has obligatory onset and vowel but coda is optional, such as OV (C). Syllable constraints ranking of this type of languages is:

Onset >> Faithfulness >> No-Coda

Type 4: This type of languages such as Hawaiian has only obligatory vowel and it allows onset as optional part but coda is never present, such as (O) V. So, its ranking is:

No-Coda >> Faithfulness >> Onset

After presenting this factorial typology of three general syllable constraints of four types of languages, Hammond (1997b) gives the following complete hierarchy of English syllable structure constraints:

Peak, Licensing, Sonority >> Faithfulness >> Onset, No-Coda, *Complex

In this hierarchy, Peak, Licensing and Sonority are undominated constraints which come first followed by other three general constraints discussed above. In the end comes complex constraint which is low ranked in English because only few syllables allow more than one consonant at any edge of syllable.

Archangeli (1997) discusses OT model and its application in linguistics by giving constraints hierarchy of syllable structure of Yawelmani language spoken in California. She selects /xat-en/ as an input then she presents that how OT determines the optimal syllabification /xa-ten/ which represents two possible syllable structures, which are CV and CVC, by following constraints ranking:

Peak, Onset, *Complex, Faith C, FaithV >> No-Coda

(1997, p.12)

Roca and Johnson (1999) also present OT analysis of syllable structure of English by introducing a new constraint 'Strict Layer Hypothesis (SLH)' to cover the dominance relation of Son-Seq in the syllables having consonants cluster with problematic /s/. After

discussing OT analysis of syllabification patterns in English, they present the following final syllable constraints hierarchy:

*Complex^{coda}, Son-Seq » Dep, Max» Onset, No-Coda, *Complex, SLH

In some languages, two vowels occur together as nucleus of two different syllables in a word. For such languages, Fery and Vijver (2003, p.5) introduce the concept of 'Hiatus' which is 'the phonetic result of the immediate adjacency of vocalic syllable peaks'. So they added a constraint against hiatus ' *Hiatus' to analyse that how different languages resolve hiatus by ranking of this constraint which shows markedness in relation to faithfulness constraints such as Max (V), which is vowel deletion; and Dep (C), that is epenthesis of consonants. They report the difference of three languages; Hawaiian, German and French; in the constraint ranking in the following way:

In constraint ranking of Hawaiian, it is clear that hiatus is allowed.

Max (V), Dep (C) » *Hiatus

Whereas in German hiatus is avoided with the epenthesis of consonant.

Max (V), *Hiatus » Dep (C)

Similarly in French also hiatus is avoided but by deletion of vowel.

Dep (C), *Hiatus » Max (V)

This is how they prove that OT is effective in explaining general as well as specific syllable structures of world languages.

2.7.2 *Prosody of different languages in OT*

As discussed above, there are two types of constraints in OT, i.e. faithfulness and markedness constraints suggested by Prince & Smolensky (1993/ 2004) and McCarthy (2002). Sections 2.7.2.1 and 2.7.2.2 explain these types; some other constraints related to stress, which are introduced while doing OT analysis of different languages, are given in 2.7.2.3. In the end, prosody of various languages are discussed in OT.

2.7.2.1 **Faithfulness constraints**

As the title shows faithfulness constraints control difference between the output candidate and the input. The following five constraints of stress come under this category:

1. Parse μ

It is one of the parse-type constraints which says that every mora (μ) is parsed into syllable.

2. Parse σ

It is another parse-type constraints. It says that every foot should be parsed into syllable. According to Hammond (1997b) Parse-syllable prohibits two adjacent unfooted syllables.

3. $Lx \approx Pr$

It states that every lexical word (Lx) should be prosodic word (Pr). This constraint is named as 'Rooting' by Hammond (1997b) which says that every word must be stressed even if it is monosyllable. Whereas Prince & Smolensky (2004, p.51) define this morphology-phonology interface constraint as 'A member of the morphological category MCat corresponds to a PrWd'.

4. Align-L

This constraint is related to the 'Directionality' parameter of language. In Align-L, L stands for left i.e. feet are formed from right to left. It belongs to that family of constraints which regulates the relation between prosody and grammatical structure.

5. Edge-most (Edge-L/R)

It is about the position of head foot in the prosodic word. In Edge-L/R, L and R stand for left and right respectively.

2.7.2.2 Markedness constraints

Constraints under this category focus on the evaluation of the well-construction of the output candidates. So these constraints put check on the selection of the optimal candidate. Below is given five more constraints of stress, which come under markedness constraints category:

5. Foot Binarity (FT-Bin)

This constraint tells the general structure of the foot that is about the binary nature of the feet. It differentiates the languages with unbounded foot pattern from the languages with bounded foot pattern. There are two levels of analysis for feet which are: μ & σ . It means feet can be binary either at the level of μ by containing one heavy syllable or at the level of σ by having two syllables in one foot. As reported by Lee (1995) English strictly enforce FtBin on the moraic level as no occurrence of foot with one heavy (H) and one light (L) syllable is found in English.

6. Rhythm Type (Rh Type: I/T)

There are two types of bounded foot: Iambic and Trochaic. In

Iambic feet, the stressed syllable is always on the right edge of the foot whereas in trochaic feet, the stressed syllable is on the left side of the foot.

7. Non-finality ($\acute{F}; \acute{\sigma}$)

This position constraint prohibits the prosodic head of the prosodic word ($\acute{F}; \acute{\sigma}$) in the final position.

8. Weight to Stress Principle (WSP)

This constraint tells about the stress assigning factor. It states that it is the weight of the syllable which carries stress. In other words, heavy syllables with more morae are stressed.

9. Rhythmic Harmony (Rh Hrm)

This constraint is given different names such as Rhythm- $\acute{\sigma}$ by Lee (1995) and 'no clash' by Frid (2001) who studied Swedish stress in optimality theoretic framework. It restricts the occurrence of two adjacent foot heads. It causes distressing in the words, that is why it is seen only single primary stress in one prosodic word the other stressed syllables contain either secondary or tertiary stress.

2.7.2.3 More constraints on Stress

Other than these ten constraints discussed above, Kager (1999) introduced 'Uneven Iamb', i.e (LH) foot structure, as a constraint in the OT analysis of Hixkaryana. Another constraint which is introduced for OT analysis of this language is:

DEP- μ -IO i.e. "Output moras have input correspondents" It is considered as anti-lengthening constraint. (Kager, 1999, p. 156)

Now, the description of prosodic features such as, word stress and foot patterns of various languages including English is given in the framework of OT.

Berry (1998) characterizes the differences between the stress patterns of the languages by the following rankings.

Pintupi, Warao: FtBin >> PARSE σ >> AlignFt

Ono: PARSE σ >> FtBin >> AlignFt

French: FtBin >> AlignFt >> PARSE σ

In Ono the occurrence of monosyllabic feet covered by ranking of PARSE σ over FtBin, and the fact that in French only one foot occurs is due to the ranking of AlignFt over PARSE σ . This is how ranking in OT provides a way of explaining why some constraints but not others are violated and thus, covers the variations between languages in the apprehension of outputs.

McGarrity (2003) also applies OT model to analyze stress system of Khalkha Mongolian language. Its grammar is finalized with the following constraint ranking:

WSP » NONFINALITYHD » ALIGNR ($\sigma \square$, PWd), ALIGNL ($\sigma \square \mu$, PWd) »
NONFINALITY

In this hierarchy the difference of occurrence of primary and secondary level stress in the final position of the prosodic word is covered by inclusion of two separate constraints in the hierarchy i.e. NONFINALITYHD and NONFINALITY

Houghton (2005) studies stress patterns in Tripura Bangla. In it stress is assigned in a ternary pattern. In words with only light syllables, main stress is on the first syllable; secondary stress is placed on every third syllable afterwards, except where it creates a

word-final stress. For all words with only light syllables, the following stress constraints ranking is established:

TROCHEE

ALIGN-L(HD,WD)

EXTENDED-LAPSE-AT-END

ALIGN-BY- σ (FT,WD, L)

EXTENDED-LAPSE-AT-PEAK

*LAPSE

LAPSE-AT-PEAK

LAPSE-AT-END

Fery (2000) presents the OT analysis of lexical stress in German. She gives the following hierarchy of constraints:

Final-Head, No Clash, Foot-Form (Trochaic), Non Head \emptyset , (un-dominated) » Head-Match (FT),

WSP, Foot-Bin, Align-Foot- Right » Align-Foot- Left » Parse- Syll

OT analysis of stress in native variety of English is done by Lee (1995). In which he argues interaction of constraints and ranks all stress constraints by doing separate analyses of primary and secondary level stress in English. Following is a final stress constraints hierarchy given by him:

Ft-Bin, Rhythm Type: T, No Stress \emptyset , WSP, (un-dominated) »

Lx≈Pr » Non-Finality» Edge-R» Rh-Hrm » Align-L » Parse σ » Parse μ

To sum up, it is seen that OT is the only constraints based theory which covers every kind of linguistic variation in a language without exception by just ranking of those constraints. So for OT analysis of any linguistic feature of any language, there is need of set of constraints and selection of method to be applied on inputs of a language for the hierarchy of those constraints.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter discusses the research methodology used in the research in different sections of this chapter. Section 3.1 tells about the size of the data of research. The details of data collection and research tools are given in section 3.2. Section 3.3 provides an account of the methods used in the present study. Then section 3.4 explains different forms of analyses of the data used to describe syllable structure and prosody stress of PSE. The overall research procedure is given in section 3.5 below. The chapter concludes by summarizing the whole research methodology in 3.6.

3.1 Data and its size

In this study, qualitative and quantitative methods are integrated in order to conduct an in-depth investigation of the PSE. The quantitative data in the form of recordings from PTV channel and Radio Pakistan English news were downloaded in CD's in recorded form.

This study explores the news media as a sub-variety of Pakistani English Variety. The data is taken from the newscasters of English news of PTV and radio Pakistan. According to Creswell "representative refers to the selection of individuals from a sample of a population such that the individuals selected are typical of the population under study" (2002: p151). So, the representative of PSE, data from the newscasters of Pakistan Television (PTV) and Radio Pakistan are taken by the researcher. These people of PTV and Radio media are selected because they are specially trained for good pronunciation, are heard all over the world as Pakistani speakers of English, and they are people who are fluent in speaking English because of their education and exposure to English language; because of these reasons, they have less effect of their mother tongue on the stress pattern of English;

so fewer variations as compared to other most localized varieties with sociolinguistics perspective as mesolect and basilect (see section 2.1 above).

According to a 'Proficiency Based Model' of Graddol (2006) the newscasters, whose recordings are taken as data for this study, fit in the high proficiency area. This model focuses on a proficiency in the language regardless of which English variety speakers use and their links to the language (mother tongue, ESL, EFL). This model is shown in Figure 3.1 below.

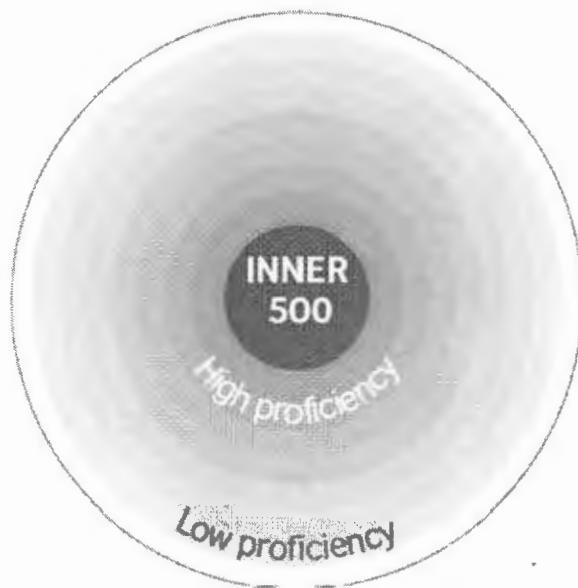


Figure 3.1 Proficiency based model

People from PTV and Radio media are suitable representative of PSE. Kachru (1983) also defines 'Standard' Indian English (IE) as the English used by educated Indians, who institutionalize IE through literature, newspaper, journals, radio and TV, and government communication. Similarly, newscasters of BBC and voice of America are also considered to be representatives of British Standard English BSE and American General English AGE. Hence, this researcher assumes that for oral data of PSE, newscasters are the most appropriate representative of 'Standard' variety of Pakistani English. The English

news recordings of total eleven news casters, four male and seven female, are taken as a sample. These are the official news casters who read news in the year 2012 out of them six are from PTV and seven from Radio Pakistan.

For data, monosyllabic words are not analysed to investigate word stress and foot patterns. As prosody of any language can only be explored by studying word stress patterns which form the foot patterns of a language, so only those words are relevant in this study, which are poly-syllabic, that is words containing more than one syllable.

Selkrik and Shen (1990) suggest the construction of 'the prosodic word' according to a theory of syntax-phonology mapping; but this word has to be of lexical category therefore functional or non-lexical word such as; pronoun, preposition, conjunction; can not serve this purpose. For this reason, only lexical words are taken as a sample for this study.

However, in terms of morphological structure of the words, there are both types present mono-morphemic, that is a word with single free morpheme such as 'complex'; as well as morphologically complex words, which are words with more than one morpheme such as 'complex-ity'. For this reason, 2134 poly-syllabic words are found from English Pakistani news recordings. A list of the words is given in appendices (A-E). After listening to news recordings, researcher included all poly-syllable words for exploring syllable structures and word stress patterns of PSE.

Those 2134 poly-syllabic words which are used as a data for present study include:

- i. Bi-syllable words, i.e. words containing two syllables are 908
- ii. Tri-syllable words, i.e. words with three syllables are 728
- iii. Tetra-syllable words, i.e. words having four syllables are 332
- iv. Penta-syllable words, i.e. words of five syllables 114

v. Hexa-syllables, i.e. six syllables words are 52

3.2 Research Tools

For the present study, PRAAT software version 5.3.56 (Boersma and Weenink, 2000) was used as a tool by downloading it from 'www.praat.org' to get the waveforms and spectrograms; to measure the intensity, pitch, duration and frequency of the segments and syllables in a word; for the spectrographic analysis (detail is given in section 2.6) of the data with authenticity. Hence, for spectrographic analysis PRAAT was used to:

1. get waveform
2. paint visible spectrogram
3. view the energy in spectral bands
4. measure the intensity which was included in the feature vectors
5. extract the fundamental frequency
6. extract visible pitch contour
7. draw visible formants contour
8. make pulses visible
9. draw full praat picture of each word to represent for discussion

With the help of waveform and spectrogram, number of syllables and stressed syllables become visible which are then useful for acoustic analysis. This software accepts only few formats of sound files to be played or opened such as sound files (.wav, .aiff files), .Textgrid files, .formant files, .spectrogram files, etc. To convert the recorded files of English news into required format, the 'RealPlayer converter' was used. Moreover, 'the Snipping tool' was used to snip the complete PRAAT pictures with captions after being saved in the word file.

To play this software and for recordings, computer also plays very crucial role. It is used for downloading the English news from PTV and radio Pakistan online from the archives. But when those downloaded news were listened to, a monotonous beep sound was found in the recordings which caused distortion in visible pictures made with the help of Praat. Then recorded English news were transferred on CD's and USB on written request from the PTV and Radio Pakistan (Islamabad) for analysis.

International Phonetic Alphabet (IPA) chart was used for the narrow phonetic transcription of the words used for data analysis. Phonetic transcription was done by the researcher with the help of the practical guidelines given by The International Phonetic Association (1999); Lecumberri & Maidment (2000); Ashby (2005). These guidelines include set of symbols for segmentals and suprasegmentals; diacritics or other marks; handling stress by knowing the difference of strong forms and weak forms. Lecumberri & Maidment discuss that in connected speech grammatical words such as; pronouns, auxiliary and modal verbs, prepositions, conjuctions; do not carry considerable semantic weight, hence are unstressed. They further explain that phonetic reductions and weaknings, for instance shortening of sound or complete elision, commonly affect unstressed syllable. Moreover, they provide the list of vowels given below as they tend to change in weak forms.

strong vowel →

weak vowel

/i:/

/ɪ/ , /I/

/u:/

/ʊ/ , /ʊ/

/e/ , /a:/ , /æ/ , /ɒ/ , /ɔ:/ , /ʌ/

/ə/

(p. 19, 2000)

3.3 Methods

For investigation of stress patterns in any variety of a language, stress can be perceived by either listening to the words or through an experimental method. Walker (2010) suggests two ways for investigating variables: (i) auditory or impressionistic analysis; (ii) acoustic or instrumental analysis. For this study, to explore the syllable structure and prosody of PSE, both of the methods are used. First, the researcher listened to the polysyllabic words carefully and repeatedly and then transcribed them with syllabification and stress marks by using IPA convention. It was ensured that the tokens were produced by more than one speaker so that individual idiosyncratic pronunciation patterns could be avoided.

Then for spectrographic analysis, these recordings are opened in praat software after converting these sound files of Radio Pakistan and video files of PTV in (.wav) format. After that only required words, i.e. only poly-syllabic word, is selected to be viewed in 'praat object file' which makes a waveform and spectrograph of selected part. This visual representation helped the researcher in verifying the syllable structure and stress patterns of these words. A sample of waveform and spectrogram of word 'cable' is shown in Figure 3.2.

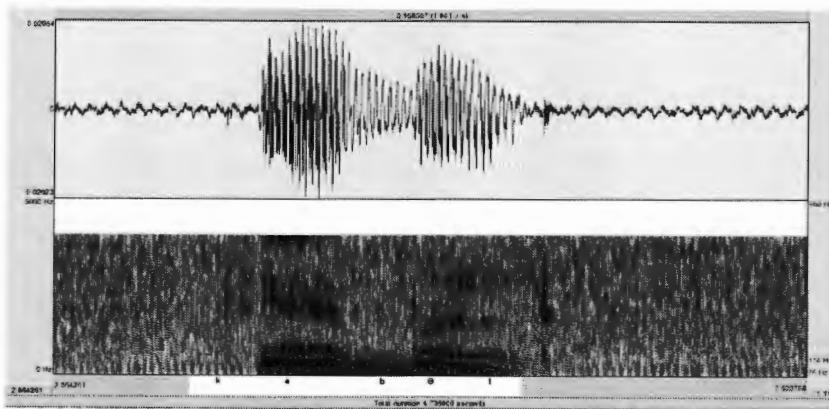


Figure 3.2 Waveform and spectrograph of word 'cable'

In the above figure, above part is showing the waveform of the word 'cable' and the below part is the spectrogram. From the waveforms, it is clear that it is a bi-syllabic word as number of peaks of waves can be used in identifying the number of syllables in a word. Moreover, the width of the wave shows the duration (a phonetic correlate of stress) of production of a syllable which helps in understanding the stress position.

After confirmation of stress position at different levels, i.e. primary and secondary stresses it contains, the words are separated in terms of number of syllables. For example, all bi-syllabic words from the data were put in one file to check their possible occurring stress patterns and then emerging stress patterns were noted. Similarly, different files of other polysyllabic words which include tri-syllable, tetra-syllable, penta-syllable and hexa-syllable; are prepared and their stress patterns are reported in Chapter Four.

After exhibiting various syllable structures and word stress patterns of all polysyllabic words which form various word structures, 'PRAAT picture' of one multi-syllabic word of each type of word structure was saved in the 'word file' for representation of spectrographic analysis.

This followed by phonological description of syllable, word stress and foot patterns of PSE, various syllable and stress approaches and theories were reviewed in detail with examples from data of PSE. Stress is also identified on the basis of weight of syllable discussed in phonological theories about syllable, its structure; stress and foot patterns (see chapter 5 below). This review of phonological theory highlights the differences in the syllable structure, word stress and foot patterns of Pakistani English variety from that of any other native English varieties such as American or British English.

First, the description of the phonological analysis of these supersegmental features in PSE on the basis of phonological theoretical viewpoints of syllabification and metrical phonology are done. Finally, OT which is the most recent development in metrical phonology, is applied as a model to comprehensively describe the syllable structure, word stress and foot patterns of PSE. The most important argument in favour of OT given by Archangeli (1997) is that the stress based phenomena in different languages are best treated in terms of constraints, rather than rules.

3.4 Data Analyses

For data analysis of oral data different types of analyses can be done. In the field of acoustic phonetics, spectrographic analysis is used for exploring phonological units; segmental or suprasegmental. Similarly, phonological analysis of prosody can be done in the light of different phonological theories such as syllable theory, moraic theory, rule-based theory and OT.

This study conducts three types of analyses of syllable structure and prosody of PSE namely: (i) Spectrographic analysis (ii) Phonological theory analysis (iii) OT analyses.

Spectrographic analysis of the polysyllable words of PSE is done to explore syllable structure, word stress which yielding to foot patterns by taking the view of the sound in waveforms and spectrograms. The waveform helps to view the syllable structure in term of its boundaries and number of syllables in a word. It also provides visual evidence of the prominence of syllable by making thick and high waveform. Spectrogram demonstrates the information about the pitch, intensity and duration of the individual sound in a selected word. The visual information of pitch, intensity and duration is

measured in their measuring units, i.e. hertz (Hz), decibel (Db) and milli-seconds (msec) respectively. This information as a whole assists in identifying stressed syllable. It also illustrates the formants of a vowel sound which helps in confirmation of identifying a vowel. A detailed discussion of PRAAT pictures and spectrographic analysis of those word structures is presented in Chapter four.

Phonological theory analysis is done after reviewing all theories about syllable structure, stress and foot. These theories provide an insight about syllable structure, its template, syllabification, some limitations or constraints on the combination of different segments in a syllable, stress, its patterns, interaction of stress with the morphological structure of word, different types of foot, and other stress related phenomenon in other varieties of English or any other language. This understanding is essential for the phonological analyses of suprasegmental units of PSE. The detailed overview of the prosody of PSE in phonological theory is presented in Chapter five.

For OT analyses of syllable structure and prosody of PSE, first, syllable, stress and foot patterns related constraints are studied through the review of literature on OT. The explanation of these constraints and introduction of OT is presented in section 2.7 above, along with the practical part of OT. To understand OT grammar, descriptive generalizations of syllable and word structure of PSE are focused as the constraints hierarchy of an OT grammar is not possible without knowing the structures or patterns of a language under discussion (Prince & Smolensky, 1993/2004; Kager, 1999; McCarthy, 2002& 2008). According to McCarthy (2008, p 54) formulation of these ‘OT-friendly descriptive generalizations’ is the first step of OT analysis as these ‘descriptive statements are analogous to OT markedness constraints’. After exploring syllable, word stress and foot patterns of PSE by perception and spectrographic analysis; descriptive generalizations

are formed. Then, these generalizations are analysed in the framework of OT. For OT analysis of prosody of PSE, important step was to decide the proper ranking of constraints with the help of interaction of these constraints, that is establishing language specific OT grammar. For this purpose, different methods, for example: Maximum Entropy Model by Goldwater and Johnson (2003) and Tesar and Smolensky's (1993) Recursive Constraint Demotion (RCD) algorithm are reviewed (detail is given in section 2.7 above).

After re-examining these methods, in the present study, to decide which of those constraints are undominated and should be placed as higher in ranking and which constraints interact get dominated over others, the researcher has developed her own method which is termed as 'Violations Computing Method' (VCM). This method is explained by giving sample Table 3.1. In this method, all patterns or real data of any language variety is put in the right hand column and all relevant constraints are put on the top row to calculate the number of violations each 'real inputs' takes.

Table 3.1: Constraints ranking via VCM

Inputs	Con A	Con B	Con C	Con D	Con E
1. A	✓	*	*	*	✓
2. B	✓	*	*	*	✓
3. C	✓	*	*	✓	✓
4. D	✓	✓	*	*	✓
5. E	✓	✓	✓	✓	✓

6. F	✓	✓	*	✓	✓
7. G	✓	*	✓	✓	✓
Total number of Violations:	0	04	05	03	0

In this Table 3.1, first column from the left is showing inputs in the form of real possible structures or linguistic forms of any variety and five relevant constraints are presented in the top row. Symbol ✓ shows NO violation of the constraint at the intersection of the syllable row and constraint column and the violation of constraint is shown by asterisk symbol *. The bottom row of table demonstrates total number of violations made by candidates with respect to each constraint.

Table: 3. 2 Constraints' violations summary

Sr no.	Constraints	No. of Violations
1	Con A	0
2	Con E	0
3	Con D	03
4	Con B	04
5	Con C	05

In Table 3.2 constraints' violations summary is presented from top to bottom in order of increasing number of violations. After getting the summary of number of constraints violation, a relation of constraints violations and constraints ranking can be established. It is verified that the higher is the number of violations, the lower is the constraint in ranking.

The verification of this perception can be done by applying a simple formula of VCM:

$$\text{No. of } V \propto \frac{1}{CR}$$

In this formula, V stands for violation, C for constraint and R for ranking. It states that number of violations is inversely proportional to the ranking of constraint. With the application of VCM the following hierarchy of constraints is made:

Con A, Con E » (undominated) Con D » Con B » Con C

In this hierarchy Con A, Con E are higher in ranking because these two constraints are undominated by other three constraints as they show NO or '0' violation. Next comes Con D whose number of violations is '3' which is greater number of violation than that of higher-ranked constraints but smaller than Con B which shows '4' violations. The lowest-ranked constraint in this hierarchy is Con C with highest number of violations i.e. '5'.

3.5 Overall Procedure

The following procedure was used to conduct the present study:

1. The newscasters of PTV and radio English news were selected as a representative sample of the study.

2. Some recordings of English news were downloaded from the website of PTV and Radio Pakistan but because of monotonous beep in recordings spectrographs formed were not appropriate. Then the recorded news of year 2012 were copied in USB and CD's through written request from PTV and Radio Pakistan.
3. After listening to these recordings, 2134 poly-syllabic simple and compound words were found.
4. These words were noted in phonetic transcription with their grammatical categories.
5. The recorded data was converted in Wave Sound (.wav) format to open it in Praat.
6. 2134 poly-syllabic words of different grammatical categories from this oral data were analyzed through Praat software to get the waveform and spectrograms of these words to identify stress patterns.
7. After spectrographic analysis of the polysyllable words, the prosody of the PSE was discussed in the light of various Phonological theories about syllable, stress and foot patterns.
8. A thorough description of syllable structure, the emerging word stress and foot patterns were analysed by applying Optimality theoretical framework as a model.
9. For identifying dominance relation of universal constraints of syllable and stress, and describing their grammars in PSE; the researcher proposed and verified a new method named as violations computing method (VCM).

3.6. Summary

This chapter provides an insight of the complete research methodology. It includes the type of oral data its size and analyses. From the recordings of radio Pakistan and PTV English news casters, total 2134 multi-syllabic words are first analysed acoustically with the help of praat. After spectrographic analysis, the syllable structures and various word

structures along with their lexical stress patterns are analysed in phonological theory.

Finally, description of PE prosody is made by using the OT framework. For OT analysis,

hierarchy of constraints is made by using new proposed method named as VCM. In this

method the researcher also suggested a formula of calculating the ranking of constraints.

CHAPTER 4

SPECTROGRAPHIC ANALYSIS OF SYLLABLE AND STRESS PATTERNS IN PSE

The spectrographic analysis of the syllable structure and word stress patterns of PTV and Radio Pakistan news is done from the spectrograms taken with the help of PRAAT software. The explored stress patterns of lexical words of different syllables are shown in the form of word structures. Spectrogram and waveform of one word from each type of structure is also shown. This chapter includes three sub-sections: 4.1 phonetic correlates of lexical stress and phonological basis of assigning stress in English syllable are discussed; section 4.2 presents syllable and word structures, and stress patterns of polysyllable words such as: bi-syllable, tri-syllable, tetra-syllable, penta-syllable, hexa-syllable, octa-syllable words; and lastly section (4.3) gives a descriptive generalization of syllable, word stress and foot patterns of PSE based on spectrographic analysis.

4.1 Phonetic correlates of lexical stress

Three important phonetic correlates of lexical stress in English language discussed by different linguists earlier are: length of vowel, loudness (intensity) and high frequency. According to Ladefoged (2003) stress which is not simple to assess in instrumental terms can be seen in the syllable on auditory/ acoustic bases as a combination of increased pitch, length and loudness, in which first two are of more importance, i.e. pitch and length. He further explained that acoustic correlate of pitch is fundamental frequency through which pitch is measured, which shows 'the rate at which vocal fold pulses recur' (Ladefoged, 2003, p. 75). Similarly, acoustic correlate of loudness is intensity which is 'derivable from the amplitude or amount of increase in pressure during a sound' (Ladefoged, 1996, pp. 22-

23). The unit of measuring the intensity is decibels (dB). Length of the vowel in the stressed syllable can be measured in milli-seconds (ms).

Stress is a complex phenomenon which is not easy to be judged with the help of measuring pitch, intensity and length of nucleus of the syllable. However, it is also important to understand the intensity of the individual segments, i.e. sounds present in the syllable. As some sounds are more sonorant, i.e. loud containing higher intensity than other sounds by their inherent physical property. That is why Ladefoged (2003) argues that intensity is not a good criteria for measuring stress.

Given this, the sonority value of different phonemes in English given by Hogg & McCully (1987), most of the interpretations about stress in a syllable is made by looking at the pitch value, i.e. fundamental frequency and length of vowel first and then comes the intensity as least important factor.

Phonologically, stress is assigned on the basis of weight of syllable in English. In the syllable structure the rhyme part is important in term of weight, while the onset does not play any role in determining syllable weight. Thus, syllables with long vowel or diphthong with or without coda are considered heavy (H) and those which contain short vowels with or without coda are called light (L) syllables. On the same basis, Burzio (1994) distinguishes three different types of syllables in English with the difference of their intrinsic weight. He assigned weight to the syllables as follows:

Heavy: 3

Light: 2

Weak: 1 (Burzio, 1994, p. 148)

Here numbers 1, 2 and 3 refer to occurrence of number of morae in a syllable. This weight of the syllable is also related to the level of stress. The heavier syllables in weight carry primary stress; the light one carries secondary stress while the weak syllable remains unstressed.

Word structures and stress patterns of different poly-syllabic words of PE and analysis of their stress patterns with waveform and spectrogram is presented in section 4.2 below.

4.2 Syllable and Word Structures, and Stress Patterns of PSE

This section presents syllable and word structures of bi-syllable, tri-syllable, tetra-syllable, penta-syllable, hexa-syllable, octa-syllable words in 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6 respectively, in terms of stress patterns. These words lists are attached in appendices (A-E). For showing their syllable structures a dot ‘.’ is used to show the boundary of each syllable according to IPA tradition. The sequences of sounds in words are also shown, where C stands for consonantal sounds and V is for vowels.

4.2.1 *Structures of bi-syllable words*

After analysing 908 bi-syllable words of PE, with light syllable (L) and heavy syllable (H), it is seen that almost 35% words make (L¹L), i.e. words consist of light syllables but right syllable is stressed; 50% words make (LH¹), i.e. the first syllable is light while the second one heavy with stress; and 15% words make (H¹) L structure i.e. heavy syllable with stress is on the left side of word.

Moreover, these three structures make three types of foot as well: (1) (L¹L) is even iambic (2) (LH¹) is uneven iambic (3) (H¹) L has (H¹) as degenerate foot (see section 2.2.1 for further

9.	fiscal	Adjective	[fɪs.kál]	(CVC.CVC)
10.	percent	Adjective	[pər.sént]	(CVC.CVCC)
11.	success	Noun	[sək.sés]	(CVC.CVC)
12.	augment	verb	[əg.mént]	(VC.CVCC)
13.	revenge	Noun	[rɪ.véndʒ]	(CV.CVCC)
14.	seven	Adjective	[sə.vén]	(CV.CVC)
15.	ventures	Noun	[ven.tʃérz]	(CVC.CVCC)
16.	address	Noun	[əd.rés]	(VC.CVC)
17.	contempt	Noun	[kən.témpt]	(CVC.CVCCC)
18.	correct	verb	[kə.rékt]	(CV.CVCC)
19.	confirm	verb	[kən.fírm]	(CVC.CVCC)
20.	pilgrims	Noun	[píl.grílmz]	(CVC.CCVCC)

In Table 4.1 above, twenty bi-syllable words with syntactic categories, phonetic transcription and syllable structures are illustrated. These words consist of two light-weight syllables; in which the first syllable is mostly weak because of having /ə/ as a nucleus. However, both syllables contain short vowels as nucleus with or without coda. In these words the primary stress always falls on the last syllable of each word. So all given words above make ultimate stress pattern, i.e. final syllable of the word is stressed regardless of difference of syntactic categories. Spectrograph and waveform of the word 'protect' with (LL) structure is shown in Figure 4.1 below.

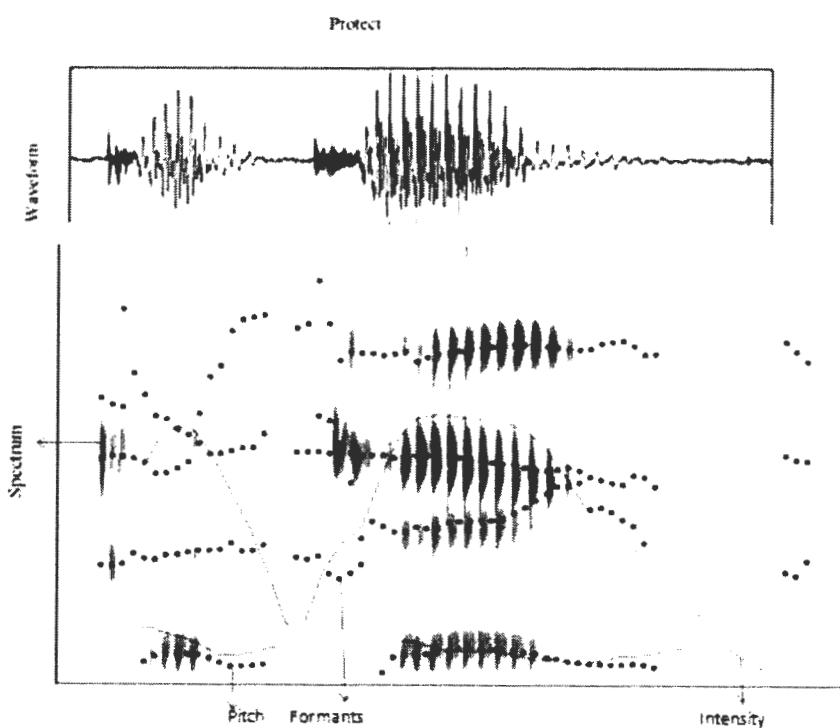


Figure 4.1 **Waveform and spectrograph of word 'protect'**

In Figure 4.1, two syllables of word 'protect' can be seen in two peaks in the waveform. In the spectrograph, two peaks of intensity line show the difference between

the intensity of production of the two vowels. It is obvious in the figure 4.1 that the second syllable of the word 'protect' is produced louder, i.e. with more intensity, which is the indication of stress here as [k] and [t] sounds at coda position of the stressed syllable are not sonorant in nature. Moreover, the spectrogram of the vowel of second syllable shows longer duration of the production as compared to the first vowel. This longer duration is also visible in the form of width of the spectrum and the waveforms of both syllables. This is consistent with the fact that the transcription in which /ə/ is the nucleus of the first syllable which is considered as very short vowel and which makes weak syllable which is always un-stressed. Lastly, the third quality of stressed syllable, i.e. higher pitch, can also be seen in the above Figure. Thus, the spectrograph of word 'protect' provides visible evidence of stress on the second syllable of word.

The phonetic transcription and syllable structure of bi-syllable words' structure (LH) is shown in Table 4.2 below.

Table: 4. 2 Word structure (LH)

Sr no.	Words	Syntactic categories	Phonetic Transcription	Syllable Structures
1.	import	Noun & verb	[im.po:rt]	(VC.CVCC)
2.	mandate	Noun	[men.deít]	(CVC.CVC)
3.	report	Noun & verb	[rə.pó:rt]	(CV.CVCC)

4.	return	verb	[rɪ.tɜːrn]	(CV.CVCC)
5.	headlines	Noun	[hed.laɪnz]	(CVC.CVVCC)
6.	research	Noun & verb	[rɪ.sɜːrtʃ]	(CV.CVCC)
7.	exports	Noun	[əks.poːrt]	(VCC.CVCC)
8.	countries	Noun	[kən.triːz]	(CVC.CCVC)
9.	website	Noun	[veb.saɪt]	(CVC.CVVC)
10.	decade	Noun	[də.ké:d]	(CV.CVC)
11.	preside	verb	[pri.zaɪd]	(CCV.CVVC)
12.	reply	Noun & verb	[rɪp.laɪ]	(CVC.CVV)
13.	demise	Noun	[dɪ.maɪz]	(CV.CVVC)
14.	support	Noun & verb	[səp.poːrt]	(CVC.CVCC)
15.	protest	Noun	[prə.tést ^l]	(CCV.CVCC)

16.	survey	Noun	[sər.véɪ]	(CVC.CV)
17.	destroyed	verb	[dɪs.t्रɔɪ]	(CVC.CCVVC)
18.	venue	Noun	[və.njuː]	(CV.CVV)
19.	sixteen	adjective	[sɪks.tiːn]	(CVCC.CVC)
20.	advise	verb	[əd.váɪs]	(VC.CVVC)

The above list of twenty words exhibits similar pattern in terms of weight of nucleus of second syllable. Some consonants in coda position are produced forcefully as in [prə.tést[!]] in Table 4.2, which is shown as the exclamation mark! as superscript in the phonetic transcription of words represents forceful production of consonantal sound is taken from (Dobrovolski and Katamba, 1996, p. 75) as IPA does not offer any mark or diacritic for forceful production of sounds. The stressed syllable is always heavy with V: or VV or V:C or VC[!] in its rhyme; whereas first syllable is always light which contains either V or VC in its rhyme. In the list, words such as 'research, report, import, etc.' always show (LH) structure whether used as a noun, verb or adjective. It can be concluded that in PSE, difference of stress pattern in bi-syllabic words because of difference of syntactical categories could not be found. The waveform and spectrum of the word 'import' from above list is given in Figure 4.2 below.

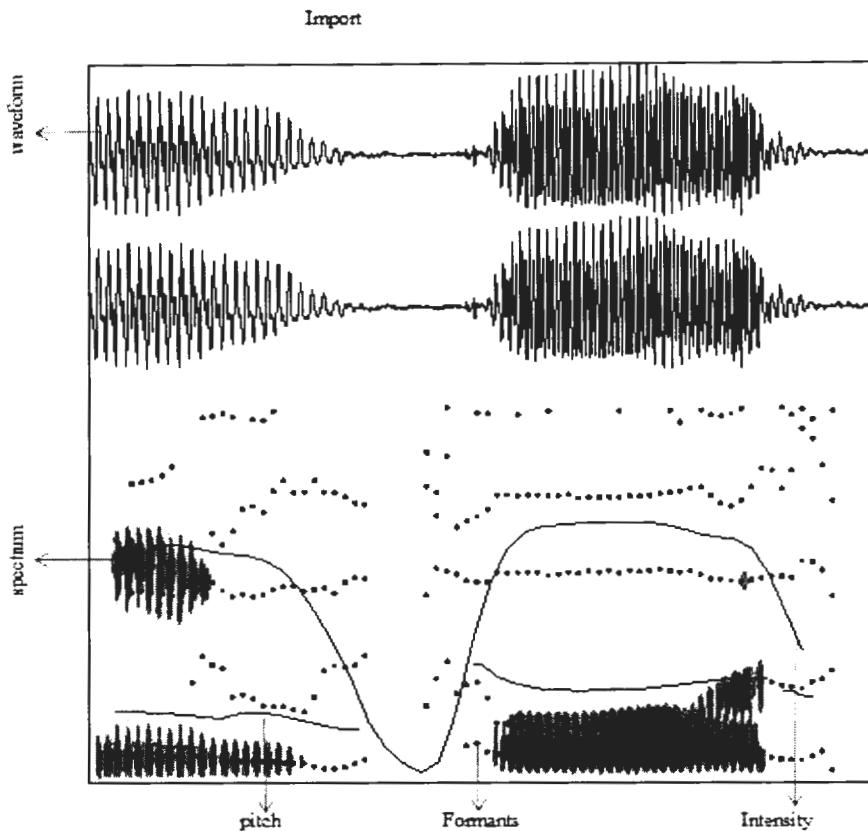


Figure 4. 2 Waveform and spectrograph of word 'import'

In Figure 4.2, it can be seen that last syllable of 'import' has higher pitch, higher intensity and longer length as compared to the first syllable. So this visible prominence of the last syllable shows that this syllable is stressed.

Twenty examples of the third type of word structure (H̄) L of bi-syllabic words with one extrametrical light syllable on its right edge is given in Table 4.3.

Table: 4. 3 Word structure (H̄) L

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Government	[ḡov'.mənt]	(CVC.CVCC)

2.	sentence	[sén'.təns]	(CVC.CVCC)
3.	suffering	[sʌf'.rɪŋg]	(CVC.CVCC)
4.	conduct	[kʌn'.dəkt]	(CVC.CVCC)
5.	nation	[neɪ'.ʃən]	(CV.CVC)
6.	contact	[kən'.tækt]	(CVC.CVCC)
7.	powers	[pɔ:'.vərz]	(CV.CVCC)
8.	children	[tʃɪl'.drən]	(CVC.CCVC)
9.	interest	[ɪn'.trəst]	(VC.CCVCC)
10.	channel	[tʃæ:.nəl]	(CV.CVC)
11.	damaged	[dæ:.mədʒd]	(CV.CVCC)
12.	measures	[mɛ:.ʒərz]	(CV.CVCC)
13.	questioned	[kué.s.tʃənd]	(CVVC.CVCC)

14.	Snow-fall	[snoʊ̇.fəl]	(CCV.CVC)
15.	contest	[kɒ̇n.tɛst]	(CVC.CVCC)
16.	people	[piː.pəl]	(CV.CVC)
17.	ordered	[pí:r.dərd]	(VC.CVCC)
18.	business	[bíz.nɪs]	(CVC.CVC)
19.	rebels	[ræ̇.bel]	(CV.CVCC)
20.	rigorous	[ríġ.rəs]	(CVC.CVC)

In the above table, words like 'government, rigorous' are showing process of syncope which is elision of short vowel like ə in a word. It is clear from the transcription of the words 'government(1) and rigorous (20)' that these trisyllable words are produced as bi-syllable by syncopating second weak syllable of each of these words that is before a stressless syllable as one position of syncope in speech. The following three different positions of syncope in fast speech are given by Hammond:

1. At the beginning of the words : as 'práde' instead of 'paráde'
2. Before a stressless syllable: as 'ópra' instead of 'ópera'

3. After a stressless syllable and before a stressed syllable: 'réspirtòry' instead of 'réspiratòry' and 'glòrificátion' instead of 'glòrification' (Hammond, 1997b, p. 47)

Syncope in these two words 'government and rigorous' can be seen in the Figure 4.3 and 4.4 below.

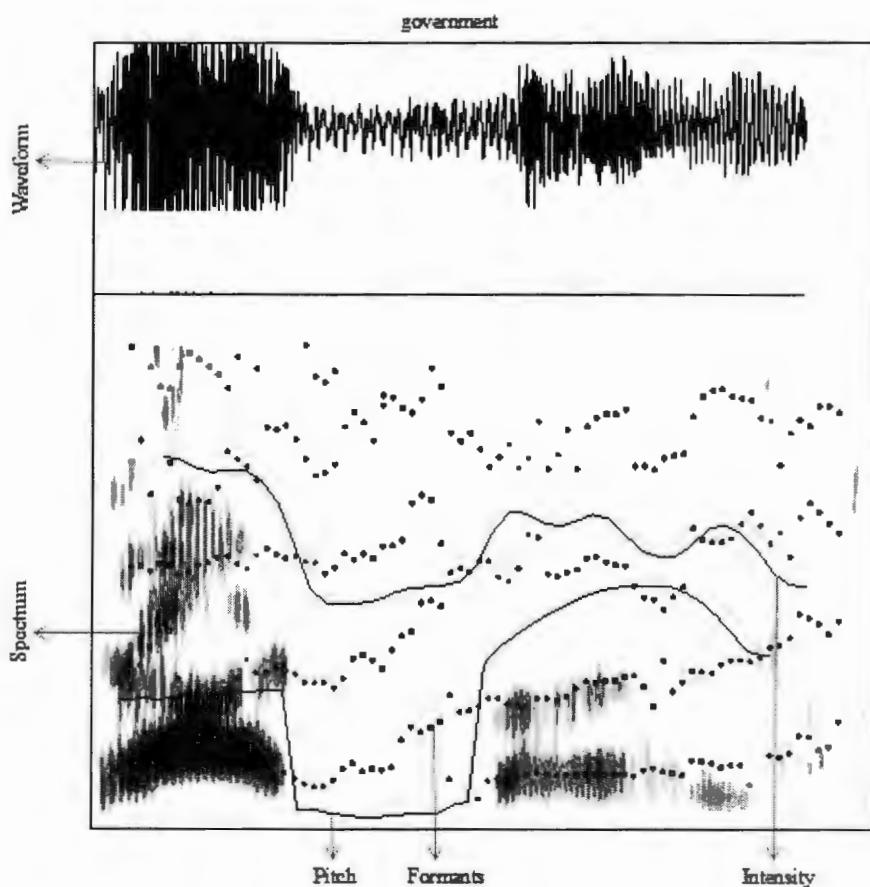


Figure 4.3 **Syncope in 'government' through waveform and spectrograph**

From Figure 4.3 there is a clear visible illustration of production of two syllables in 'government' with the spectrum of two narrow bands. It can be further noticed that in the word 'government' pronounced as [gʌv'.mənt] it is not

only the short vowel \textschwa which is sycopated but the whole weak syllable with coda i.e. [ərn] is syncopated. This phenomenon is effecting the number of syllables in ‘government’ i.e. turning tri-syllable word into bi-syllable. Syncopation of vowel can be seen in Figure 4.4 below.

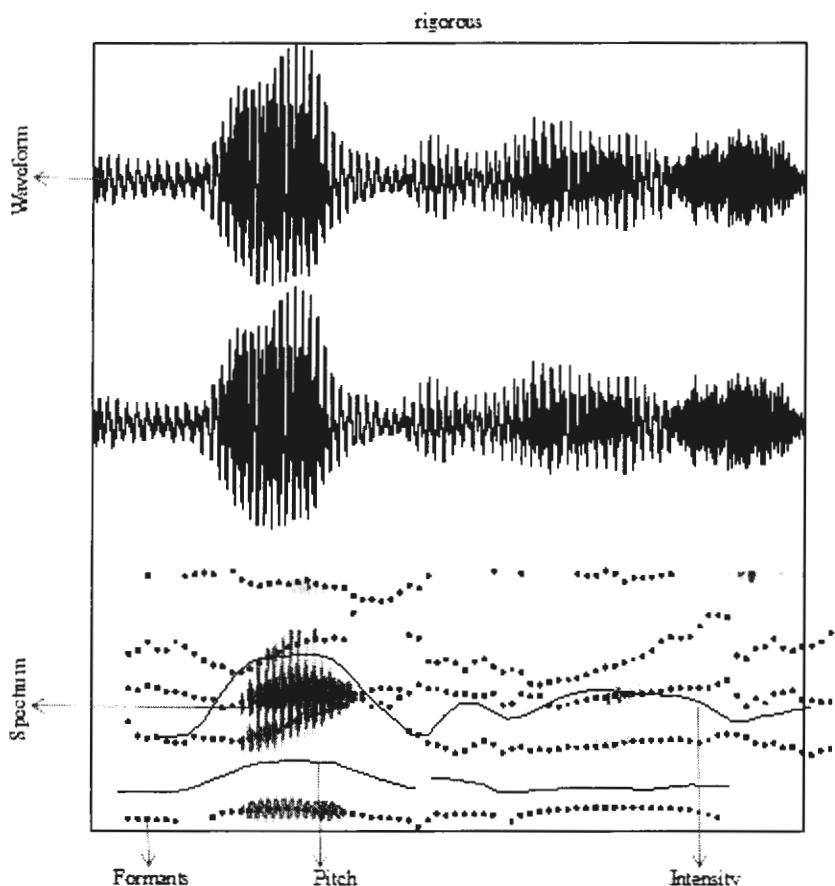


Figure 4.4 Syncope in ‘rigorous’ through waveform and spectrograph

In the above figure, two narrow bands spectrum for word rigorous /rɪ.gə.rəs/ which is pronounced as [rɪg'.rəs] are visible. In ‘rigorous’ onset [g] of second weak syllable is pronounced as coda of preceding stressed syllable by turning this open syllable [rɪ] into close syllable i.e. [rɪg] and short vowel \textschwa of second syllable is syncopated. So, these two

processes i.e. difference in syllabification and syncope is turning this tri-syllable word 'rigorous' as bisyllable.

In the list given above in Table 4.3, other bi-syllable words with (H)L structure are given which do not syncopate. From those words, waveform and spectrograph of bisyllable word 'nation' can be seen in Figure 4.5

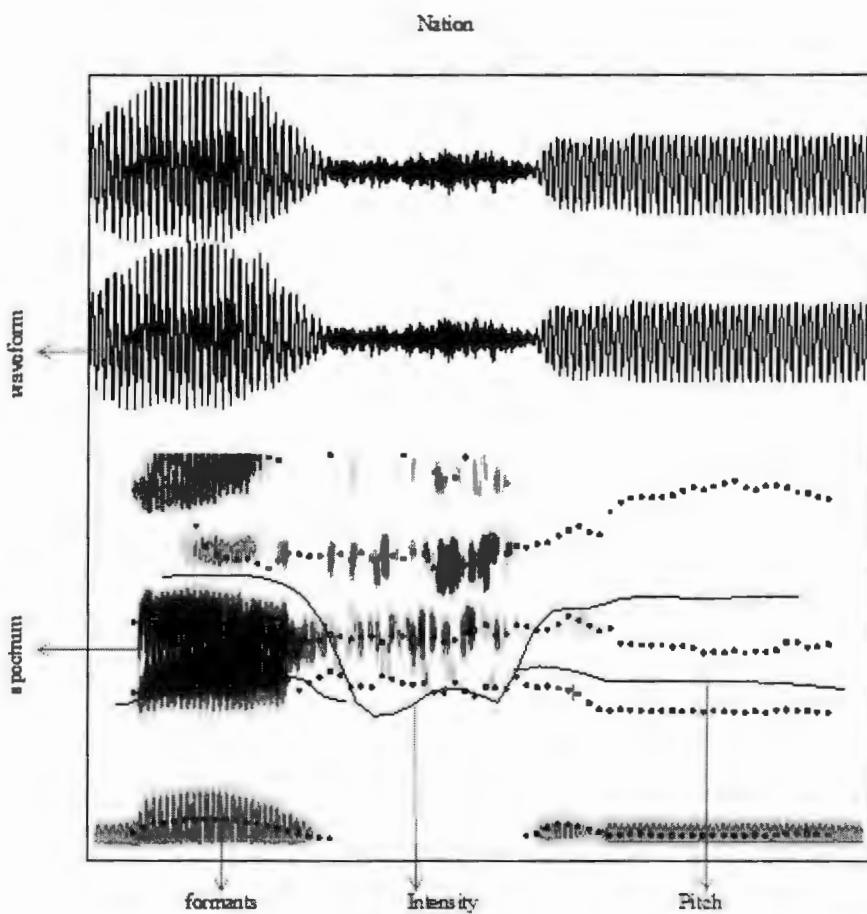


Figure 4.5 **Waveform and spectrograph of word 'Nation'**

In the above figure, the height of first waveform proves that first syllable is produced with more prominence, although pitch peaks of both the syllables are almost the same. Intensity peak of first syllable is also higher than the second one. From the

transcription [ne:ʃən] and the formants patterns, it is obvious that first syllable contains long vowel as a nucleus as compared to second syllable. So, first heavy syllable of 'nation' is the stressed syllable.

4.2.2 *Structures of tri-syllable words*

This section presents three different structures of tri-syllable words, i.e. words containing three syllables in PE. Total 728 tri-syllable words are analyzed, out of which almost 50% words made L (LH) structure and remaining 50% made (LH) L and (H) (LL) structures. Among these two structures, (LH) L was more common as compared to (H) (LL). Twenty different examples of each of these structures are given in Table 4.4, 4.5, 4.6 below.

Table: 4. 4 Word structure (LH) L

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	assurance	[ə.ʃuə.rəns]	(V.CV.CVCC)
2.	agreement	[əg.ri:.ment]	(VC.CV.CVC)
3.	Effective	[ə.fék!.tiv]	(V.CVC.CVC)
4.	Ministry	[mi.nís!.tri]	(CV.CVC.CCV)
5.	Consensus	[kən.sén!.siz]	(CVC.CVC.CVC)

6.	judicial	[dʒu.dɪʃəl]	(CV.CV.CVC)
7.	constructive	[kən.strʌk'tɪv]	(CVC.CCVC.CVC)
8.	commentary	[kə.mén'tri]	(CV.CVC.CCV)
9.	efficient	[ə.fɪʃənt]	(V.CV.CVC)
10.	engagements	[ən.geɪdʒ.mənt]	(CV.CVC.CVCC)
11.	Responding	[rəs.pɔɪn.dɪŋ]	(CVC.CVC.CVC)
12.	Completion	[kəm.plɪʃən]	(CVC.CCV.CVC)
13.	Tremendous	[trɪ.mén'dəs]	(CCV.CVC.CVC)
14.	Expansion	[əks.pen'shən]	(VCC.CVC.CVC)
15.	Important	[ɪm.pɔɪr.tənt]	(VC.CVC.CVC)
16.	Successful	[sʌk.səs'fʊl]	(CVC.CVC.CVC)
17.	Substantive	[sʌb.stæn.tɪv]	(CVC.CCVC.CVC)

18.	Disaster	[dɪ.zə:s.tər]	(CV.CVC.CVC)
19.	Provincial	[prə.vín'.ʃəl]	(CCV.CVC.CVC)
20.	convention	[kən.vén'.ʃən]	(CVC.CVC.CVC)

The words listed in Table 4.4 consist of two light-weight syllables with heavy syllable in the middle. In these words heavy syllable, which is second last, carries stress. So all given words above make penultimate stress pattern, i.e the second from the last syllable of the word is stressed. In the words having this structure one light syllable at right edge is extrametrical. Spectrum and waveform of the word 'important' with (LHÍ) L structure is shown in Figure 4.6 below.

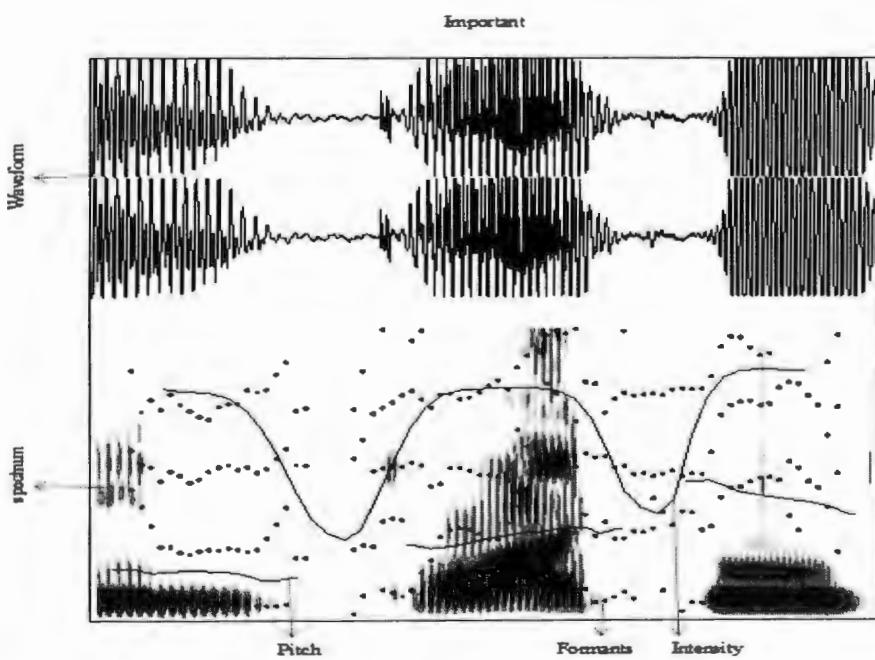


Figure 4.6 **Waveform and spectrograph of word 'important'**

In the above figure, presence of three syllable in the three peaks of waveform and three narrow bands of spectrum can be seen. It is visible that among the three narrow bands, the central one is more prominent because of longer duration as compared to its syllables in the vicinity.

Second type of structure of tri-syllable word is L (LH) which is most common structure in words with three syllables. Twenty examples of these words from PE with their phonetic transcription are given in Table 4.5.

Table: 4.5 Word structure L (LH)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Mitigate	[mɪ.tɪ.geɪt]	(CV.CV.CVC)
2.	Continues	[kən.tɪ.núz]	(CVC.CV.CVVC)
3.	Atmosphere	[ət.məs.fíər]	(CV.CVC.CVVC)
4.	Investors	[ɪn.ves.tírz [!]]	(VC.CVC.CVCC)
5.	Volunteers	[və.lən.tíərz]	(CV.CVC.CVVC)
6.	Endeavor	[ən.dí.vé́r [!]]	(VC.CV.CVC)
7.	Telecast	[tə.li.ká:st]	(CV.CV.CVCC)

8.	pressurized	[prə.ʃə.raízd]	(CCV.CV.CVVCC)
9.	Attendance	[ə.ten.déns ¹]	(V.CVC.CVCC)
10.	Subsidy	[səb.sí.di:]	(CVC.CV.CV)
11.	Investment	[in.vest.mént ¹]	(VC.CVC.CVCC)
12.	Interview	[in.tər.viú]	(CV.CVC.CV)
13.	Recognized	[rə.kəg.naízd]	(CV.CVC.CVVCC)
14.	Officials	[ə.fí.ʃíélz]	(V.CV.CVVCC)
15.	Organized	[ɔr.gí.naízd]	(VC.CV.CVVCC)
16.	Mitigate	[mi.tí.geít]	(CV.CV.CVC)
17.	Pesticide	[pes.tí.saíd]	(CVC.CV.CVCC)
18.	Sacrifice	[sək.rí.fáis]	(CVC.CV.CVCC)
19.	Engineers	[ən.dʒí.níérz]	(VC.CV.CVVCC)

20.	vindicates	[vɪn.dɪ.keɪts]	(CVC.CV.CVCC)
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All words given in the above table consist of three syllables. It is clear from the transcription of these words that first two syllables of each word are either light or weak so remain unstressed and the last syllable of each word is heavy, therefore carries stress. This structure (LLH) is important in term of deciding the foot pattern of PE, i.e. it cannot be trochaic, because of presence of two unstressed syllables on the left side, which does not allow trochaic foot pattern. If first syllable of left edge is considered as extrametrical, then only iambic foot pattern emerges.

Now the visual illustration of the word 'Atmosphere' can be seen in the waveform and spectrograph presented in Figure 4.7. In this figure it is obvious that the third syllable from the left is the most prominent in waveform as well as in spectrograph. The value of pitch and intensity is higher as compared to following two syllables, which is making this final syllable of the word most prominent hence stressed.

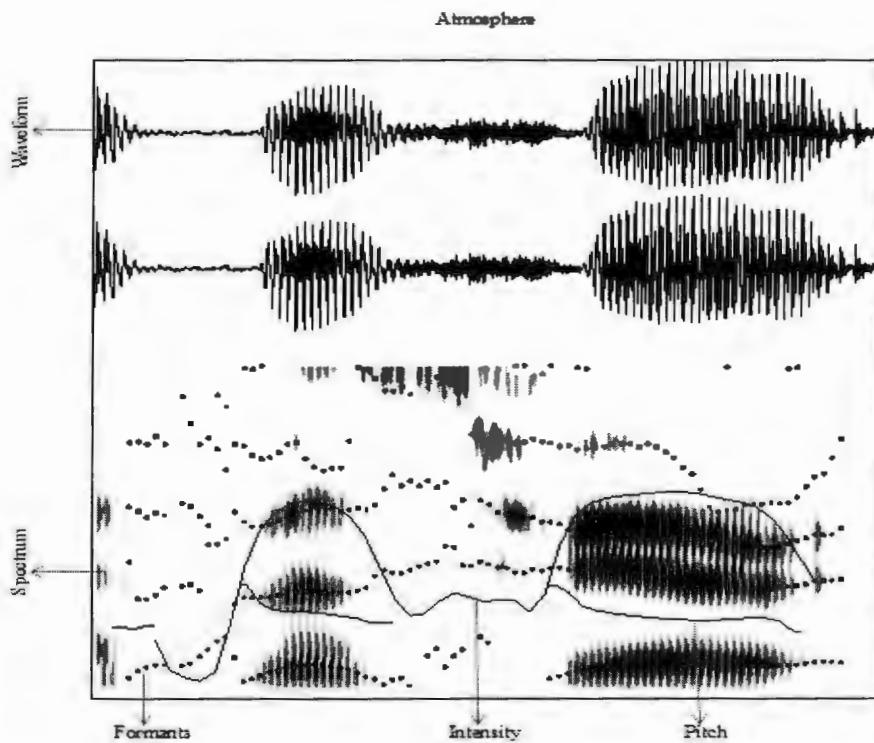


Figure 4.7 **Waveform and spectrograph of word 'Atmosphere'**

Table 4.6 presents twenty tri-syllable words which make (H̄) (L̄L̄) structure with heavy stressed syllable on the left most edge, light unstressed syllable in the centre followed by another light syllable which carries secondary stress. Phonetic transcription of the words given in the Table verifies the nature of nucleus as short and long vowel as well as weight of the syllable.

Table: 4.6 Word structure (H̄) (L̄L̄)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Contrary	[kɒ̄n.t्र̄.rɪ̄]	(CVC.CCV.CV)

2.	Blasphemous	[blé̄s'.fø.mès]	(CCVC.CV.CVC)
3.	Agency	[é̄.dʒən.sí]	(V.CVC.CV)
4.	Custody	[kás'.tø.dí]	(CVC.CV.VC)
5.	Commentary	[kó̄.men.trí]	(CV.CVC.CCV)
6.	Boycotting	[bó̄.kə.tíŋ]	(CVV.CV.CVC)
7.	Challenges	[tʃǣ.lín.džíz]	(CV.CVC.CVC)
8.	Targeted	[taír.get.tíd]	(CVC.CVC.CVC)
9.	Answerable	[á:ns.re.bál]	(VCC.CV.CVC)
10.	Magnitude	[mǣ:g.ní.tʃúd]	(CVC.CV.CVC)
11.	Prosperous	[pró̄:s.pø.rès']	(CCVC.CV.CVC)
12.	Confidence	[kó̄.n.fi.dé̄ns]	(CVC.CV.CVC)
13.	Agencies	[ǣ.dʒen.síz]	(V.CVC.CVC)

14.	Gratitude	[græ:.trɪ.tʃ ʊd]	(CCV.CV.CVC)
15.	Moniter	[mɒ:.nɪ.tər ^l]	(CV.CV.VC)
16.	Dimention	[dá:.men.ʃən ^l]	(CVV.CVC.CVC)
17.	Strategies	[stræ:.trɪ.dʒɪz]	(CCCV.CV.CVC)
18.	Journalist	[dʒé:r!.nə.ʃɪst]	(CVC.CV.CVCC)
19.	Quantity	[kuón.ti.ti]	(CVVC.CV.CV)
20.	De-escalate	[dí:.es.klèt]	(CV.CV.CCVC)

The visual presentation of tri-syllable word with (H) (L₁L₂) structure is shown in the Figure 4.8. This figure presents Waveform and spectrograph of word 'Agency' [e:.dʒən.sí]. In the waveform of this word below, prominence of first syllable is clearly visible. Similar is the case, if three narrow bands of spectrum are compared; it is obvious that first syllable from the left is most prominent with high intensity and pitch value. In the central syllable pitch value and intensity decreases then pitch increases with the third syllable. Narrow bands appearing in the spectrum of third syllable are also more prominent as compared to central syllable. So, first syllable which is the most prominent

carries primary stress and last syllable which is less prominent than first but more prominent than second carries secondary stress.

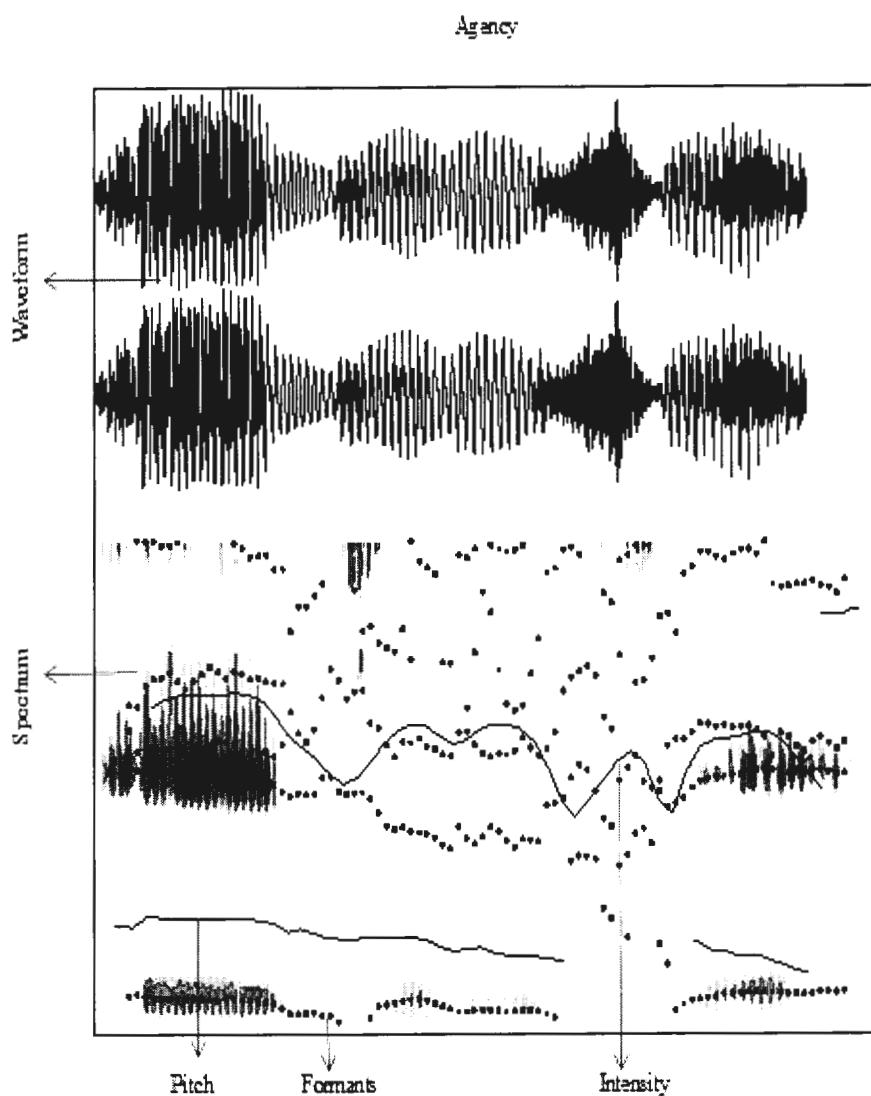


Figure 4.8 **Waveform and spectrograph of word 'Agency'**

After presenting three different structures of tri-syllable words, now various structures formed by tetra-syllable words are given in section 4.2.3.

4.2.3 Structures of tetra-syllable words

This section presents three different structures of words with four syllables. After analysing 332 tetra-syllable words, three different word structures are found. Twenty examples of words with each of structure (L \ddot{L}) (L \acute{H}), (L \acute{H}) (L \ddot{L}), L (L \acute{H}) L are shown below in Table 4.7, 4.8, 4.9 respectively.

Table: 4.7 Word structure (L \ddot{L}) (L \acute{H})

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Analysis	[ə.næ.li.sí:z]	(V.CV.CV.CVC)
2.	Commodities	[kə.mò.dí.tí:z]	(CV.CV.CV.CVC)
3.	Activities	[ək.tí.ví.tí:z]	(VC.CV.CV.CVC)
4.	Conspiracies	[kəns.pí.rə.sí:z]	(CVCC.CV.CV.CVC)
5.	Participate	[par.tí.sí.pe:t]	(CVC.CV.CV.CVC)
6.	Participant	[par.tí.sí.pént ^l]	(CVC.CV.CV.CVCC)
7.	Memorandum	[mə.mò.rən.dém ^l]	(CV.CV.CVC.CVC)
8.	Automobile	[a.tò.mə.bail]	(V.CV.CV.CVVC)

9.	Eradicate	[ɪ.ræ.dɪ.ké:t]	(V.CV.CV.CVC)
10.	Significance	[sɪg.nɪ.fɪ.kéns [!]]	(CVC.CV.CV.CVCC)
11.	Individuals	[ɪn.dɪ.vɪ.dʒuálz]	(VC.CV.CV.CVVCC)
12.	significant	[sɪg.nɪ.fɪ.ként [!]]	(CVC.CV.CV.CVCC)
13.	agricultural	[əg.rɪ.kəl.tʃrál [!]]	(VC.VC.CVC.CCVC)
14.	appreciate	[əp.rɪ.ʃí.eít]	(VC.VC.CV.VC)
15.	Accessories	[ək.sès.sə.rí:z]	(VC.CVC.CV.CVC)
16.	Accompanied	[ə.kʌm.pə.naíd]	(V.CVC.CV.CVVC)
17.	Affidavit	[ə.fí.də.vít [!]]	(V.CV.CV.CVC)
18.	Meritorious	[mə.ri.to.rié:s]	(CV.CV.CV.CVVC)
19.	instrumental	[ɪn.strù.men.tál [!]]	(VC.CCCV.CVC.CVC)
20.	Unfortunate	[ʌn.fórt.tʃu.né:t]	(VC.CVC.CV.CVC)

All words with (LL̄) (LH̄) structure contain three light syllables on their left side with final heavy syllable. Out of first three light syllables second syllable carries secondary stress and final heavy syllable carries primary stress. After analysing 332 tetra-syllable words, it is noted that almost 45% form this structure.

For visual representation of (LL̄) (LH̄) structure, waveform and spectrograph of word 'analysis' is shown in Figure 4.9. In the spectrograph although intensity and pitch is higher in the second syllable but still it carries secondary stress because of difference of length, the final syllable carries primary stress with long vowel and forceful production of coda, which turns final syllable as super heavy.

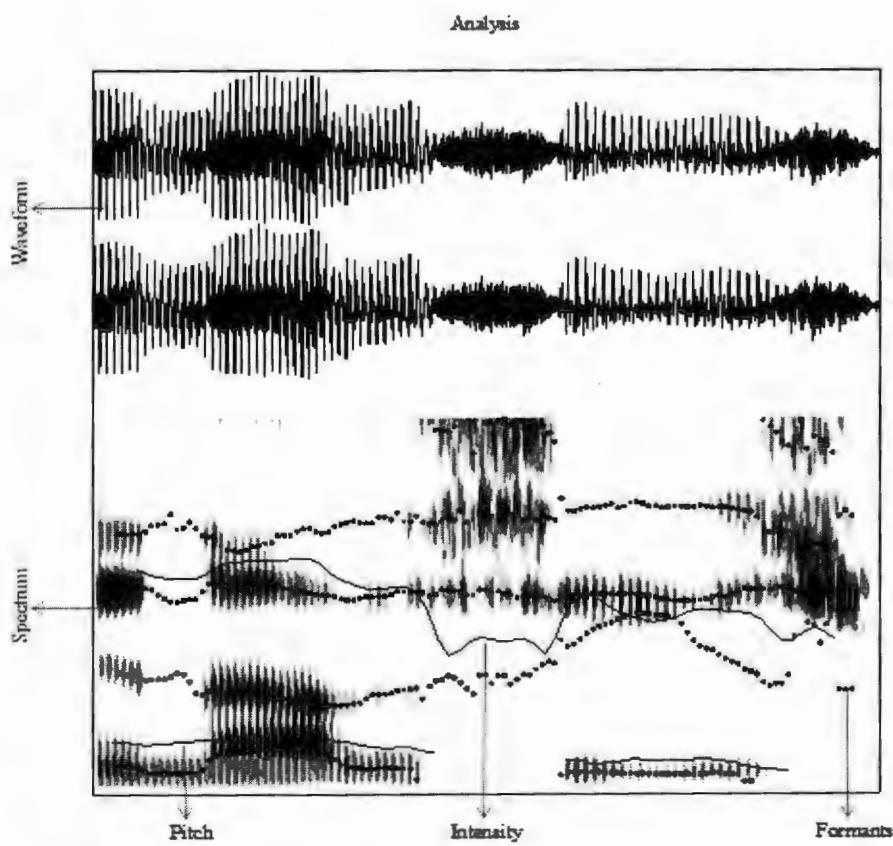


Figure 4.9 **Waveform and spectrograph of word 'Analysis'**

Twenty examples of the words with four syllables which form (LHÍ) (LLÍ) are given in Table 4.8

Table: 4. 8 Word structure (LHÍ) (LLÍ)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Majority	[mə.dʒɔɪ.ri.ti]	(CV.CV.CV.CV)
2.	Authority	[əθɔɪ.ri.ti]	(V.CV.CV.CV)
3.	Technology	[tek.nɔɪ.li.dʒi]	(CVC.CV.CV.CV)
4.	Phenomenal	[fi.nəʊ.mi.nəl]	(CV.CV.CV.CVC)
5.	prosperity	[prəs.pæ.ri.ti]	(CCVC.CV.CV.CV)
6.	Extremism	[əks.tri:m.i.zəm]	(VCC.CCVC.V.CVC)
7.	Democratic	[də.mɔɪ.krə.tik]	(CV.CV.CCV.CVC)
8.	Relationship	[ri.leɪ.ʃən.ʃip]	(CV.CV.CVC.CVC)
9.	Ambassador	[əm.bæs.ə.dər]	(CV.CV.CV.CVC)

10.	Consultative	[kən.sál'.tə.tív]	(CVC.CVC.CV.CVC)
11.	Impregnable	[ɪm.prégl'.nə.bèl']	(VC.CCVC.CV.CVC)
12.	Immunity	[ɪ.miú.ní.tí]	(V.CVV.CV.CV)
13.	Community	[kə.miú.ní.tí]	(CV.CVV.CV.CV)
14.	Responsible	[rɪs.pɔ:n.sí.bèl']	(CVC.CVC.CV.CVC)
15.	Economically	[ɪk.nɒ:.mík.li]	(VC.CV.CVC.CV)
16.	Phenomenon	[fɪ.nɒ:.mí.nàn]	(CV.CV.CV.CVC)
17.	Unbeatable	[ən.bi:.tə.bʌl]	(VC.CV.CV.CVC)
18.	Democracy	[də.mɒ:k.rə.sí]	(CV.CVC.CV.CV)
19.	Minority	[mí.nɒ:.ní.tí]	(CV.CV.CV.CV)
20.	Seniority	[sí.níə.rí.tí]	(CV.CVV.CV.CV)

In all words given in the above table, the second syllable from the left is heavy and is carrying primary stress; and the final light syllable contains secondary stress. Waveform and spectrograph of 'authority' are shown in Figure 4.10. It can be seen in the

spectrograph that the second and the third syllable are almost equal in intensity and pitch level because of the presence of sonorant /r/ sound in the onset position of third syllable [ə.θɒ:.rə.ɪ] but vowel length of second syllable makes it most prominent. Similarly, final syllable is carrying secondary stress because of having /ɪ/ as its nucleus, which is longer than /ə/.

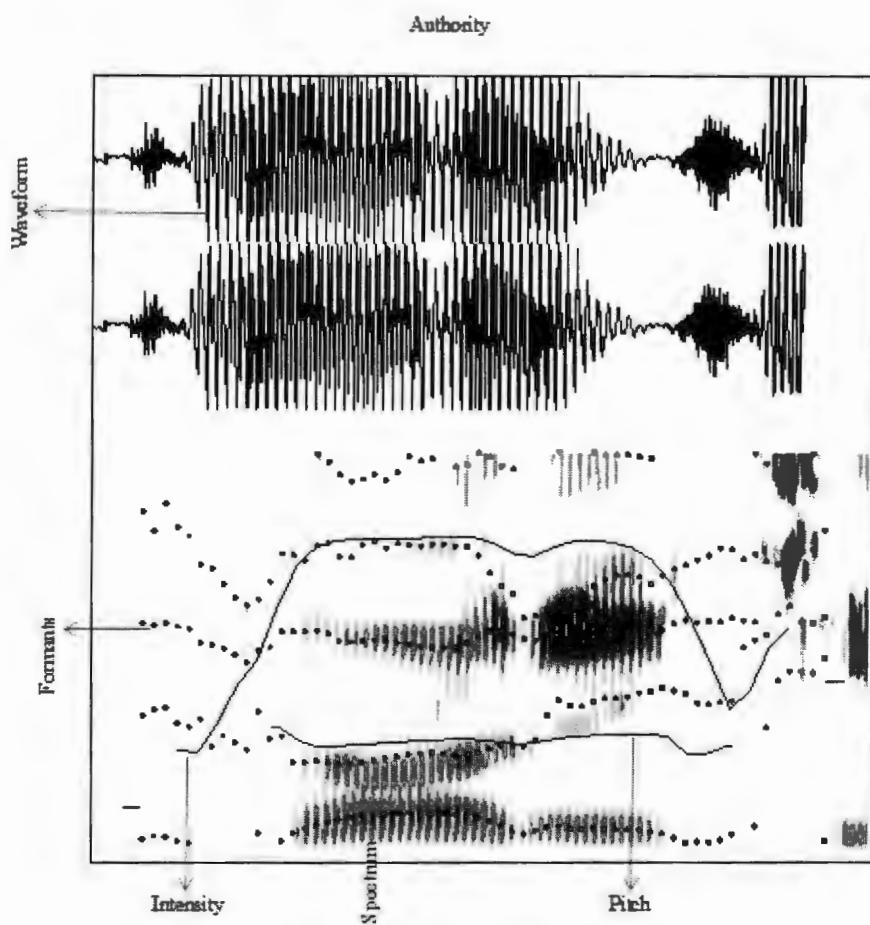


Figure 4. 10 **Waveform and spectrograph of word 'Authority'**

Words with two extrametrical syllables on its both edges are given in Table 4.9. All these words with L (LH) L structure only second last syllable is heavy so primary stress falls on this heavy syllable. No secondary stress could be found in the words with

this structure. All two light syllables on the left side of heavy syllable and final light syllable are having short vowels as their nucleus. Almost 35% tetra-syllable words form this structure.

Table: 4. 9 Word structure L (LH) L

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Agriculture	[əg.rɪ.kʌl ^l .tʃər]	(VC.CV.CVC.CVC)
2.	Dedicated	[də.di.ké.tɪd]	(CV.CV.CV.CVC)
3.	Acquisition	[ə.kʷi.zí.ʃən]	(VC.CV.CV.CVC)
4.	Contributing	[kən.tri.biú.tɪŋ]	(CVC.CCV.CV.V.CVC)
5.	Innovation	[ɪ.no.vé́.ʃən]	(VC.CV.CV.CVC)
6.	Satisfaction	[sə.tɪz.fǽ.k.ʃən]	(CV.CVC.CVC.CVC)
7.	Aspiration	[əs.pi.ré.ʃən]	(VC.CV.CV.CVC)
8.	Operation	[ə.pə.ré.ʃən]	(V.CV.CV.CVC)
9.	Opposition	[ə.pə.zí.ʃən]	(V.CV.CV.CVC)

10.	Composition	[kəm.po.zí:.ʃən]	(CVC.CV.CV.CVC)
11.	Delegation	[de.li.geí.ʃən]	(CV.CV.CV.CVC)
12.	Regulation	[rə.gu.leí.ʃən]	(CV.CV.CV.CVC)
13.	Allocation	[ə.lo.keí.ʃən]	(V.CV.CV.CVC)
14.	Difficulties	[dɪ.fi.kʌl'.tiz]	(CV.CV.CVC.CVC)
15.	Irritation	[ɪ.ri.teí.ʃən]	(VC.CV.CV.CVC)
16.	Appreciating	[əp.rɪ.sié.tɪŋ]	(VC.CV.CV.V.CVC)
17.	Administered	[əd.mi.níš'.tərd]	(VC.CV.CVC.CVCC)
18.	Diplomatic	[dɪp.lə.mé.tik]	(CVC.CV.CV.CVC)
19.	Conservation	[kən.ver.seí.ʃən]	(CVC.CVC.CV.CVC)
20.	Remittances	[rə.mi.téń'.siz]	(CV.CV.CVC.CVC)

Above given words with (LLHL) structure also form clear iambic foot pattern with two unstressed light syllables on the left edge of the word.

Prominence of the third syllable from the left (which is heavy) is clearly visible in waveform as well as in spectrograph of word 'difficulties' with L(LH)L in Figure 4.10. Width of third wave in the waveform and third spectrum from the left in spectrograph are obvious visual representation of stressed syllable.

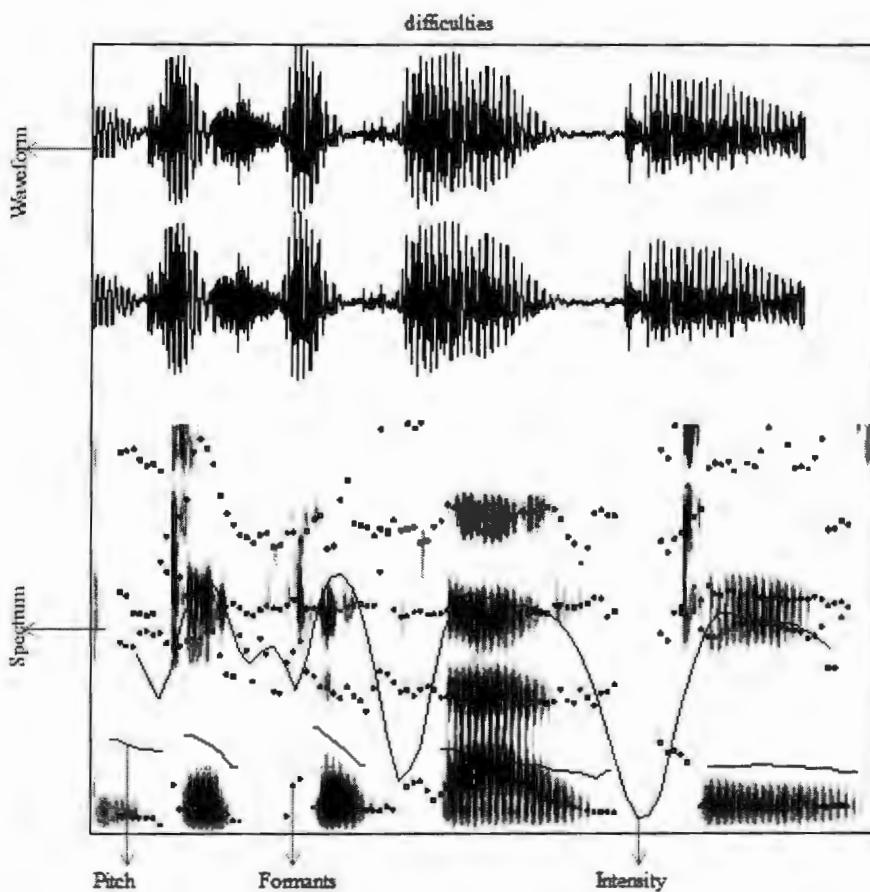


Figure 4. 11 **Waveform and spectrograph of word 'Difficulties'**

This section (4.2.3) presented examples of tetra-syllable words which form three different structures. One word from each type of structure is given in a spectrographic and waveform to illustrate the stress pattern of that structure visually. Different structures made by penta-syllable words in PE are given in section 4.2.4.

4.2.4 Structures of penta-syllable words

After analysis of 114 penta-syllable words of PE, four different structures are found. This section presents examples of these words structures from PE with the phonetic transcription in the Tables. Twenty examples of words with five syllables which are forming L (LH) (LL) are given in Table 4.10.

Table: 4. 10 Word structure L (LH) (LL)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Capability	[kə.pə.bil'.i.ti]	(CV.CV.CVC.V.CV)
2.	Representative	[rep.rɪ.zen.tə.tɪv]	(CVC.CV.CVC.CV.CVC)
3.	electricity	[ə.lek.trí:.sí.ti]	(V.CVC.CCV.CV.CV)
4.	Opportunities	[ə.pər.tʃu:.ni.tiiz]	(V.CVC.CV.CV.CVC)
5.	Meritorious	[mə.rɪ.to:.ri.ʌs]	(CV.CV.CV.CV.VC)
6.	Documentary	[də.kə.mén'.tə.ri]	(CV.CV.CVC.CV.CV)
7.	Civilization	[sɪ.vi.laí.zə.ʃən]	(CV.CV.CV.V.CVC)
8.	philosophical	[fɪ.lo.so:.fi.kəl]	(CV.CV.CV.CV.CVC)

9.	visibility	[vɪ.zɪ.bɪl ^ɪ .i.t̩ɪ]	(CV.CV.CVC.V.CV)
10.	Regulatory	[rə.gu.lé.i.tə.ri]	(CV.CV.CV.CV.CV)
11.	Felicitated	[fə.lɪ.sí:.te.tɪd]	(CV.CV.CV.CV.CVC)
12.	In-fraternity	[ɪn.f्रə.t̩r̩.ni.t̩ɪ]	(VC.CCV.CVC.CV.CV)
13.	Possibilities	[pə.sí.bíl ^ɪ .i.t̩ɪz]	(CV.CV.CVC.V.CVC)
14.	agricultural	[əg.rɪ.kʌl ^ɪ .tʃə.rʌl]	(VC.CV.CVC.CV.CVC)
15.	Introductory	[ɪn.trə.dʌk ^ɪ .tə.ri]	(CV.CCV.CVC.CV.CV)
16.	Inspirational	[ɪn.spi.re.i.ʃə.nʌl]	(VC.CCV.CV.CV.CVC)
17.	Interrogative	[ɪn.tə.ro.i.gə.t̩ɪv]	(VC.CV.CV.CV.CVC)
18.	Absolutism	[əb.sə.lú.t̩.z̩.z̩.m̩]	(VC.CV.CV.V.CVC)
19.	Anonymity	[ə.no.ní:.m̩.t̩ɪ]	(V.CV.CV.CV.CV)
20.	Antipersonnel	[ən.t̩.pér.i.sə.nèl]	(VC.CV.CVC.CV.CVC)

There were 50% words which form L (LH̄) (LL̄) structure. Words given in above Table are twenty examples out of those. All these words contain two light syllables on their left edge with heavy syllable in the centre which is followed by two more light syllables. Primary stress lies on the heavy syllable in these words; whereas final light syllable carries secondary stress. Waveform and spectrograph of word 'Capability', which form L (LH̄) (LL̄) structure, is given in Figure 4.12.

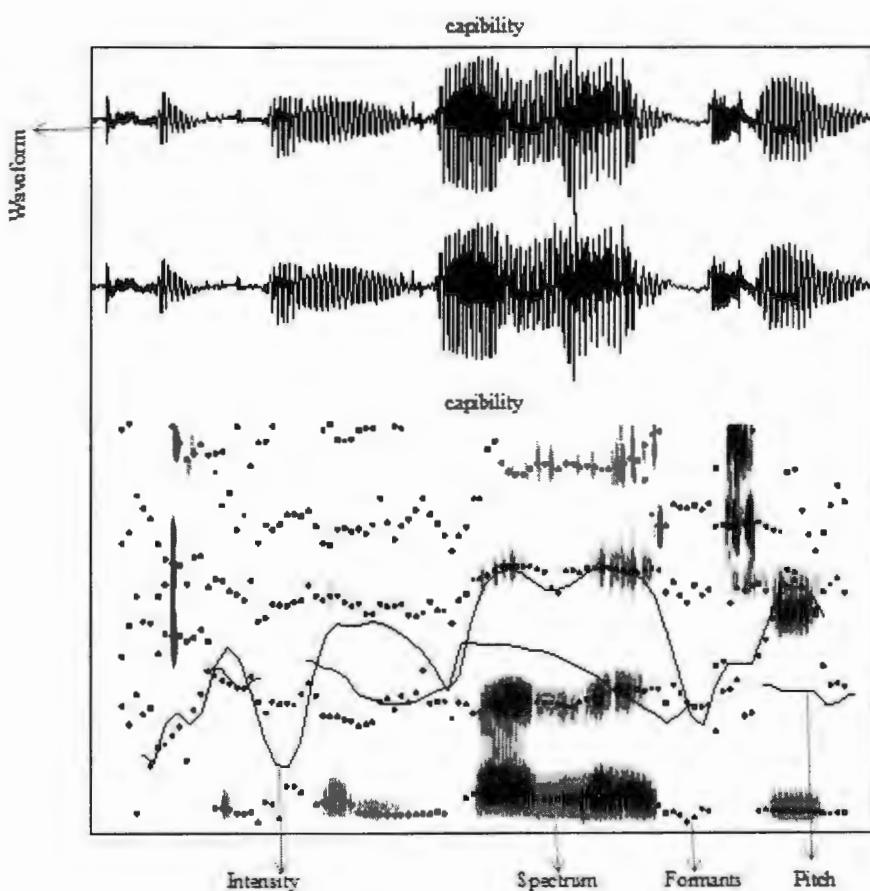


Figure 4. 12 **Waveform and spectrograph of word 'Capability'**

In the above Figure, the prominence of third syllable, which is heavy, is visible with high intensity and pitch value; and long duration from the width of wave as well as spectrum.

A second type of structure formed by penta-syllable word is (LL) (LH) L. Its twenty examples are given in Table 4.11.

Table: 4. 11 Word structure (LL) (LH) L

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	reconciliation	[rɪ.kɔ̄n.si.lié.ʃən]	(CV.CVC.CV.CVV.CVC)
2.	Elimination	[ɪ.li.mi.né.ʃən]	(V.CV.CV.CV.CVC)
3.	Inaugurated	[ɪn.à.gə.ré.ʃən]	(VC.V.CV.CV.CVC)
4.	Manifestation	[mə.ni.fes.té.ʃən]	(CV.CV.CVC.CV.CVC)
5.	Affiliation	[ə.fil.ɪ.é.ʃən]	(V.CVC.CV.V.CVC)
6.	Collaboration	[kə.lè.bə.ré.ʃən]	(CV.CV.CV.CV.CVC)
7.	communication	[kə.mjù.ni.ké.ʃən]	(CV.CV.CV.CV.CVC)
8.	Felicitation	[fə.li.si.té.ʃən]	(CV.CV.CV.CV.CVC)
9.	Interpretation	[ɪn.tè.r.prə.té.ʃən]	(CV.CVC.CCV.CV.CVC)

10.	Counterproductive	[kɒn.tər.prə.dʌk ^t .tɪv]	(CVC.CVC.CCV.CVC.CVC)
11.	Co-ordination	[kə.ɔr.dɪ.neɪ.ʃən]	(CV.CV.CV.CV.CVC)
12.	Appreciating	[əp.ri.ʃɪ.eɪ.tɪŋ]	(VC.CV.CV.V.CVC)
13.	Participating	[par.tɪ.si.pé.tɪŋ]	(CVC.CV.CV.CV.CVC)
14.	Intergovernmental	[ɪn.tər.gəv.mén ^t .təl]	(VC.CVC.CVC.CVC.CVC)
15.	Examination	[ɪg.zè.mi.né.ʃən]	(VC.CV.CV.CV.CVC)
16.	Accumulated	[ə.kjù.mi.leɪ.tɪd]	(V.CCV.CV.CV.CVC)
17.	Legitimacy	[lɪ.dʒɪ.tɪ.mé.si]	(CV.CV.CV.CV.CV)
18.	Investigation	[ɪn.vè.s.tɪ.geɪ.ʃən]	(VC.CVC.CV.CV.CVC)
19.	Implementation	[ɪm.plɪ.men.teɪ.ʃən]	(VC.CCV.CVC.CV.CVC)
20.	Entrepreneurship	[ən.tər.prə.nəʊr.ʃɪp]	(VC.CVC.CCV.CVVC.CVC)

Twenty penta-syllable words are given in the above table which form (L¹L) (L¹H¹) L structure in PE. Words which form this structure have one extrametrical light syllable at its

left edge. Second light syllable L from left contains secondary stress and heavy syllable H which is second from the right is most prominent with primary stress.

The spectrographic and waveform representation of word ‘reconciliation’ is given in Figure 4.13. Although there is minor difference in the intensity and pitch value of these five syllables in [rɪ.kɒn.sɪ.lié.ʃən] but prominence can be seen from the broad width of wave and spectrum number 2 and 4 from the left, which is representing length as most important correlate of stress. It can also be noticed that wave and spectrum 4 is broader in width than 2. That shows syllable number 4 has primary stress and 2 has secondary (from the left).

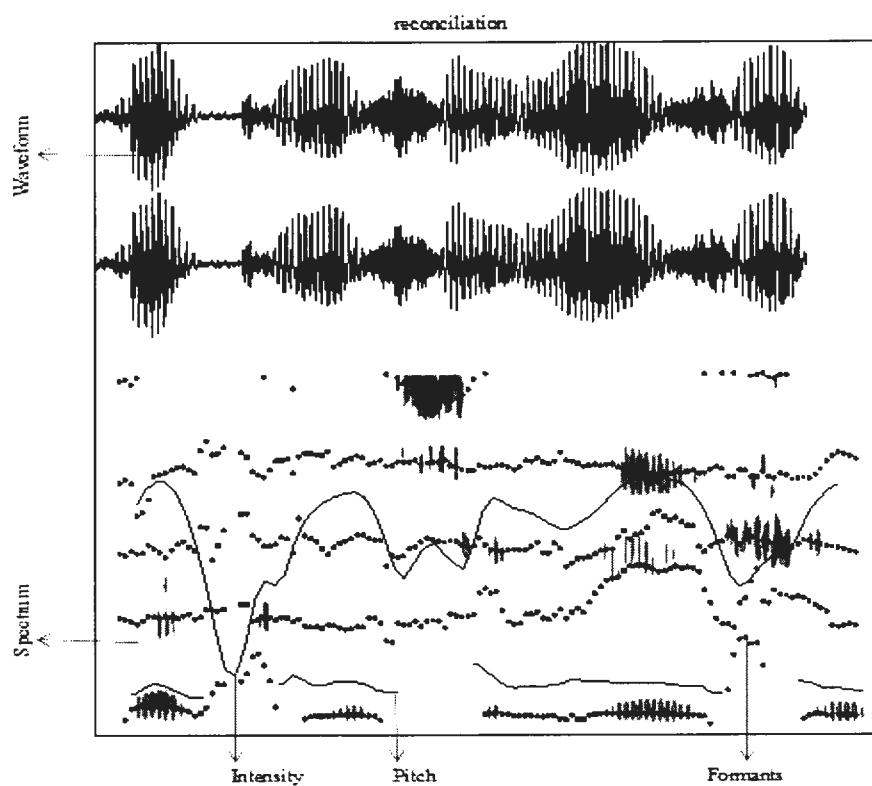


Figure 4. 13 **Waveform and spectrograph of word ‘reconciliation’**

Twenty examples of second structure (H) (LL) (H) L formed by 20% words are given in Table 4.12. Words with this structure have two heavy syllables, in which first heavy syllable from the right contain secondary stress and second from the right heavy syllable contain primary stress. There is one extrametrical light syllable on the right edge of the word.

Table: 4. 12 Word structure (H) (LL) (H) L

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	discrimination	[dɪs' ¹ .krɪ.mɪ.né:.ʃən]	(CVC.CCV.CV.CV.CVC)
2.	entrepreneurship	[ɔ:n' ¹ .tər.præ.nəʊʃr.ʃɪp]	(VC.CVC.CCV.CVVC.CVC)
3.	elimination	[ɪ:.lɪ.mɪ.né:.ʃən]	(V.CV.CV.CV.CVC)
4.	Ophthalmologist	[ɒ:p.θəl.mɒ.lo:.dʒɪst]	(VC.CVC.CV.CV.CVCC)
5.	Qualification	[k्वe:ʃ.lɪ.fɪ.ké:.ʃən]	(CVV.CV.CV.CV.CVC)
6.	unacceptable	[ʌn' ¹ .ək.səp.te:.bəl]	(VC.VC.CVC.CV.CVC)
7.	Administrative	[əd' ¹ .mɪ.nɪs.tre:.tɪv]	(VC.CV.CVC.CCV.CVC)
8.	rehabilitation	[rɪ:.hə.bɪl.té:.ʃən]	(CV.CV.CVC.CV.CVC)

9.	Implementation	[ɪm'.plɪ.mèn. té:.ʃən]	(VC.CCV.CVC.CV.CVC)
10.	Delimitation	[dɪ.li.mì.té:.ʃən]	(CV.CV.CV.CV.CVC)
11.	Inaugurated	[ɪn'.ɔ.gù.ré:.tɪd]	(VC.V.CV.CV.CVC)
12.	Incorporated	[ɪn'.kɔr.pù.ré:.tɪd]	(VC.CVC.CV.CV.CVC)
13.	Unconstitutional	[ʌn'.kɔn.sti.tʃú:.ʃnəl]	(VC. CVC.CCV.CV.CCVC)
14.	Inconsiderable	[ɪn'.kən.sì.dré:.bəl]	(VC. CVC.CV.CCV.CVC)
15.	Incorruptibly	[ɪn'.kə.rʌp.tíb'.li]	(VC.CV.CVC.CVC.CV)
16.	Inconveniently	[ɪn'.kən.vì.niént.li]	(VC. CVC.CV.CVVCC.CV)
17.	Invulnerable	[ɪn'.vəl.nà.ré:.bəl]	(VC.CVC.CV.CV.CVC)
18.	InhospiTable	[ɪn'.hɔs.pi.té:.bəl]	(VC. CVC.CV.CV.CVC)
19.	administration	[æ:d.mɪ.nìs.tré:.ʃən]	(VC.CV.CVC.CCV.CVC)
20.	Authentication	[ɔ:. tʰən.tì.ké:.ʃən]	(V. CVC.CV.CV.CVC)

In Table 4.12, all given words are morphologically complex with some affixation i.e. prefix or/and suffix. First syllable of all of these words is heavy and carries secondary stress. In these words, four different prefixes are used i.e. ' in, un, re, dis ' which carry secondary stress. However, all suffixes used in above words i.e. 'tion, able, ly, al, ive, ed, ans, ship' are unstressed. As all these suffixes at the right edge of the words are light weight with lax vowel and weak coda, hence are extrametrical.

In Figure 4.14, the prominence of second last syllable can be seen which is the heaviest. It is visible that pitch value of this syllable is highest although there is not much difference in the peak height of intensity in these syllables.

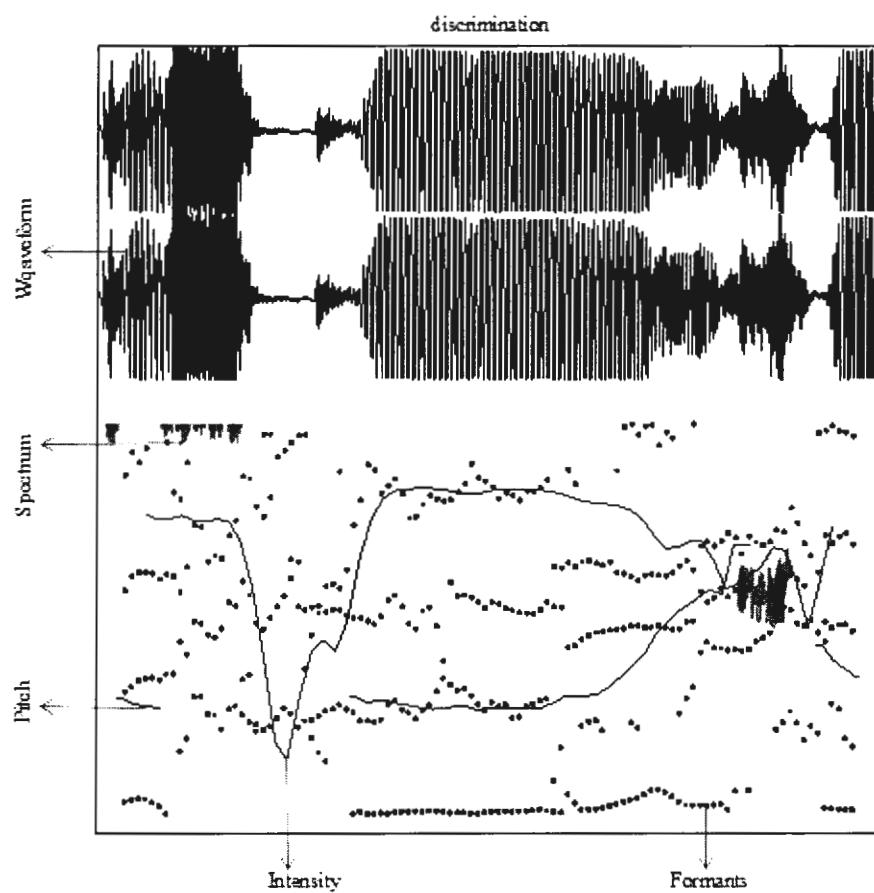


Figure 4. 14 **Waveform and spectrograph of word 'discrimination'**

Fourth structure formed by penta-syllable word is (H) (LH) (LL). Which contains three feet starting from left: first monosyllable feet with one heavy syllable, second foot contains one light syllable on its left edge followed by heavy stressed syllable, third foot is consist of two light syllable, in which rightmost carries secondary stress. Fifty penta-syllable words out of 300 form this structure. Twenty examples are given in Table 4.13.

Table: 4. 13 Word structure (H) (LH) (LL)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	Psychological	[saɪ.kə.lɒ:.dʒɪ.kəl̩]	(CVV.CV.CV.CV.CVC)
2.	Extraordinary	[əks'.trə.ɒ:r.dɪ.nəri]	(VCC.CCV.VC.CV.CCV)
3.	Archaeological	[ə:r.kə.lɒ:.dʒɪ.kəl̩]	(VC.CV.CV.CV.CVC)
4.	Regularities	[rè:.gu.le:.ri.tiz]	(CV.CV.CV.CV.CVC)
5.	Technological	[tèk.nə.lɒ:.dʒɪ.kəl̩]	(CVC.CV.CV.CV.CVC)
6.	Insecurity	[ɪn'.sə.kjō:.ri.ti]	(VC.CV.CCV.CV.CV)
7.	Disabilities	[dɪs'.ə.bɪl'.ə.tiz]	(CVC.V.CVC.V.CVC)
8.	Documentary	[dò:.ku.mén'.tə.ri]	(CV.CV.CVC.CV.CV)
9.	Unacceptable	[ʌn'.ək.sép'.tə.bəl̩]	(VC.VC.CVC.CV.CVC)
10.	Meritorious	[mè:.ri.to:.ri.əs]	(CV.CV.CV.CV.VC)
11.	representative	[rɪ:.pri.zén'.tə.tɪv]	(CV.CCV.CV.CV.CVC)

12.	Irreplaceable	[ɪr' ^l .rɪp.lé'.sɪ.bəl]	(VC. CVC.CV.CV.CVC)
13.	Irreversible	[ɪr' ^l .rɪ.ver' ^l .sɪ.bəl]	(VC. CV.CVC.CV.CVC)
14.	Irresistible	[ɪr' ^l .rɪ.zí's'.tə.bəl]	(VC. CV.CVC.CV.CVC)
15.	Inharmonious	[ɪn' ^l .har.mó'.nɪ.əs]	(VC.CVC.CV.CV.VC)
16.	Instantaneous	[ɪn' ^l .stən.te'.nɪ.əs]	(VC.CCVC.CV.CV.VC)
17.	Alternatively	[ə:l.ter.né'.tiv.li]	(VC.CVC.CV.CVC.CV)
18.	Apprehensively	[ə:p'.rɪ.hé'n'.siv.li]	(VC.CV.CVC.CVC.CV)
19.	Asymmetrical	[ə:sí.mí't'.rɪ.kəl]	(V.CV.CVC.CV.CVC)
20.	Autobiography	[ə:tə.bá'.grə.fí]	(V.CV.CVV.CCV.CV)

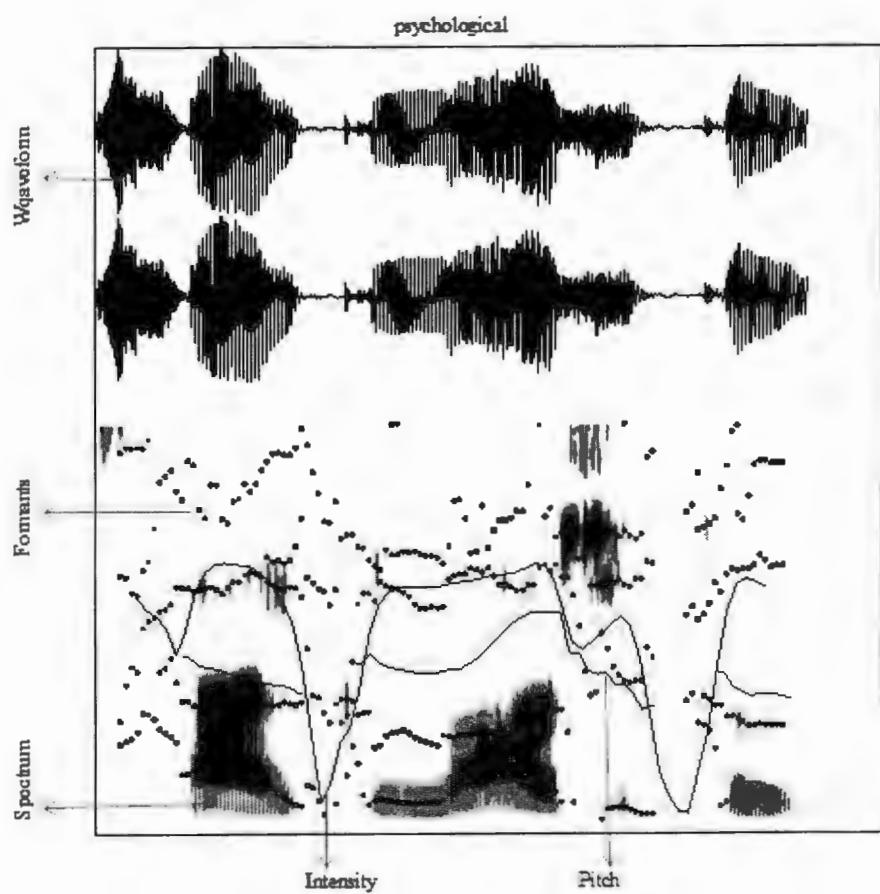


Figure 4.15 **Waveform and spectrograph of word 'Psychological'**

4.2.5 **Structures of hexa-syllable words**

In PE, one structure (L \grave{L}) (L \acute{H}) (L \grave{L}) is found in all analysed 52 hexa-syllables.

Twenty examples of these words are presented in Table 4.14 below.

Table: 4. 14 Word structure (L_L) (L_H) (L_L)

Sr no.	Words	Phonetic Transcription	Syllable Structures
1.	accountability	[ə.kɔ̃.tə.bíl'.i.ti]	(V.CVC.CV.CVC.V.CV)
2.	Accessibility	[ək.sès.i.bíl'.i.ti]	(VC.CVC.V.CVC.V.CV)
3.	Responsibility	[rɪs.pɔ̃n. sɪ.bíl'.i.ti]	(CVC.CVC.CV.CVC.V.CV)
4.	Irregularities	[ɪr.rè.gu.læ:.ri.tiz]	(VC.CV.CV.CV.CV.CVC)
5.	Inter-ministerial	[ɪn.tèr.mi.nísl'.tr.rèl]	(VC.CVC.CV.CVC.CV.CVC)
6.	Non-participating	[nɔ̃n.pàr.ti.cí:.pə.tiŋ]	(CVC.CVC.CV.CV.CV.CVC)
7.	Parliamentarians	[par.li.men.te:.ri.ènz]	(CVC.CV.CVC.CV.CV.VCC)
8.	Sustainability	[səs.tèn.ə.bíl'.i.ti]	(CVC.CVC.V.CVC.V.CV)
9.	Multi-dimensional	[məl.ti.dí.mén'.ʃə.nál]	(CVC.CV.CV.CVC.CV.CVC)
10.	Regularization	[rə.gù.lə.raí.ze.ʃən']	(CV.CV.CV.CV.VV.CV.CVC)

11.	Impossibility	[ɪm. pòs.sí.bíl'.i.tí]	(VC.CVC.CV.CVC.V.CV)
12.	non-technological	[nɔn.tèk.nə.ló:.dʒɪ.kəl]	(CVC.CVC.CV.CV.CV.CVC)
13.	Interdepartmental	[ɪn.tèr.dí.pá:rt.men. tèl']	(VC.CVC.CV.CVCC.CV'C.CVC)
14.	Intercontinental	[ɪn.tèr.kən.ti:.nen.tèl']	(VC.CVC.CVC.CV.CVC.CVC)
15.	Humanitarian	[hju.mè.ní.te:.ri.èn]	(CCV.CV.CV.CV.CV.VC)
16.	Interrelationship	[ɪn.tèr.ri.le:.ʃən.ʃɪp]]	(VC.CVC.CV.CV.CVC.CVC)
17.	Internalization	[ɪn.tèr.nə.láí.zé.ʃən']	(CV.CVC.CV.CVV.CV.CVC)
18.	Investigatory	[ɪn.vèstí.ge:.tə.ri]	(VC.CVC.CV. VC. CV.CV)
19.	Admissibility	[əd. mìs.sí.bíl'.i.tí]	(VC.CVC.CV.CVC.V.CV)
20.	Involuntarily	[ɪn.vò.lən tæ:.ri.li]	(VC.CV.CVC.CV.CV.CV)

In this structure (L¹)(L¹)(L¹) three feet or formed. First and last feet contain two light syllable with stress on right one and central feet has one light and one heavy stressed syllable.

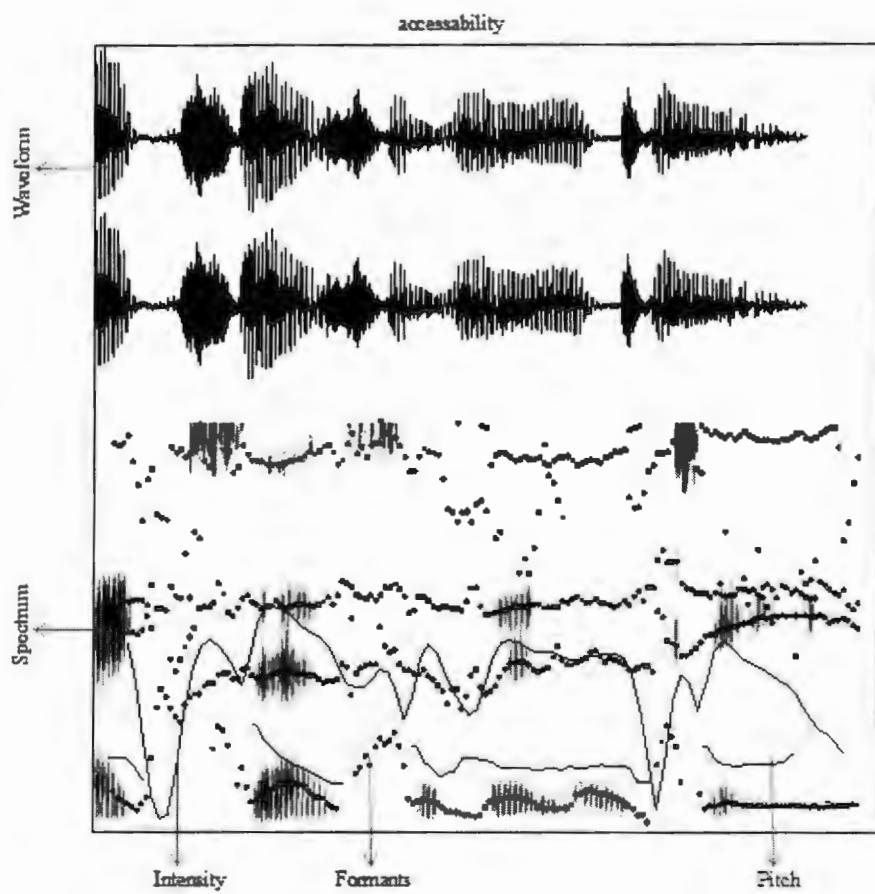


Figure 4.16 Waveform and spectrograph of word 'Accessibility'

In this section 4.2, five different types of poly-syllable words; i.e two-syllable, three-syllable, four-syllable, five syllable and six-syllable words; are analysed which form different word structures. Examples of twenty words from each word structure with their phonetic transcription are given to precisely illustrate the words segments, their syllabification, stress patterns and foot patterns. One word's waveform and spectrograph is presented for a visual verification of those structures.

Following is the summary of analysis of 2134 polysyllabic words of PSE with the detail of number of words and word structures:

Type 1: Bi-syllable words, which form following three structures:

- I. (LH) almost 50% words
- II. (LL) almost 35% words
- III. (H) L almost 15% words

Total number of bi-syllable words analysed: 908

Type 2: Tri-syllable words, which form following three structures:

- I. L(LH) almost 50% words
- II. (H) (LL) almost 25% words
- III. (LH) L almost 25% words

Total number of Tri-syllable words analysed: 728

Type 3: Tetra-syllable words, which form following three structures:

- I. (LL) (LH) almost 45% words
- II. L(LH) L almost 35% words
- III. (LH) (LL) almost 20% words

Total number of Tetra-syllable words analysed: 332

Type 4: Penta-syllable words, which form the following four structures:

I.	(LL) (L \acute{H})L	almost 20% words
II.	L(L \acute{H}) (LL)	almost 40% words
III.	(H) (L \acute{H}) (LL)	almost 20% words
IV.	(H) (LL) (H \acute{L})	almost 20% words

Total number of Penta-syllable words analysed: 114

Type 5: Hexa-syllable words, which form the following one structure:

I.	(LL) (L \acute{H}) (LL)	almost 52 words
----	----------------------------	-----------------

After presenting the summary of word structures and stress position in polysyllabic words of PE, a descriptive generalization of word stress patterns of PE is given in section 4.3 below.

4.3 Descriptive Generalization of Syllable, Word Stress and Foot Patterns of PSE

In the light of the above given analysis of the PSE words, it can be deduced that following syllable structures are found in PSE:

1. V: as in arise [ə.raɪz]
2. VV: as in ideal [aɪ.dɪəl]
3. CV: as in detain [dɪ.te:n]
4. VC: as in import [ɪm.po:rt]
5. CVC: as in regain [rɪ. ge:n]

6. CVV: as in bilateral [baɪ.lə.trəl]
7. CCV: as in protect [prə.tekt]
8. VCC: as in extra [eks.tra]
9. CCVC: as in substantive [səb.stæn.tɪv]
10. CVVC: as in quantity [kuən.tɪ.ti]
11. CVCC: as in research [rɪ.sərtʃ]
12. CCVV: as in climate [klai.mɛ:t]
13. CCCV: as in strategies [stre:.tə.dʒɪz]
14. CCVCC: as in conference [kɒn.frens]
15. CVVCC: as in appointment [ə.pɔɪnt.ment]

In the above examples of the words from PSE, underlined syllable is demonstrating the syllable structure.

After exploring the syllable structures of the polysyllable words, following are the typical properties of PSE syllable structures in multi-syllable words:

- Both types of syllable, open and close, are found
- If a syllable contains only one segment it must be Vowel
- It allows onset as well as coda
- CVC is most frequent syllable structure
- Tautasyllable that is CC at onset or coda position or VV as nucleus are also present.
- Cluster of maximum two consonants is possible at the ONSET position word internally; although three consonants cluster is possible at the onset position of

monosyllable words such as 'strict' (CCCVCC) or word initial syllable for example, stra.te.gy (CCCV.CV.CV)

- Cluster of maximum two consonants is possible at the CODA position; however cluster of three consonants is possible at the coda position of monosyllable words such as 'next' (CVCCC)
- Maximum number of segments in one syllable can be FIVE; whereas in monosyllable words SIX segments are also possible as in 'glimpse' (CCVCCC)
- Only mono or bi-syllabic words permit syllables with FIVE segments, words having three or more syllables contain syllable with no more than FOUR segments.
- Un-syllabified consonants are not allowed.

On the basis of spectrographic analysis of different poly-syllabic words of PSE forming various word structures, the following descriptive generalizations about word stress and foot patterns of PSE are made:

- Bounded feet are formed
- Feet are right-headed, that is iambic foot pattern both even (LL) and un-even (LH)
- Contains primary and secondary both kinds of stress
- Mostly stem contains primary stress and affixes carry secondary stress
- Directionality is right to left
- Extrametrical syllables are found on both edges (left and right) of words
- Feet are always binary, either containing two morae i.e. $\mu\mu$ with (LL) and (H) structures or two syllables with (LL) or (LH) structures. So, foot of three morae $\mu\mu\mu$ is also possible.

- Syllables are quantity sensitive. Length of vowel and presence of coda in the rhyme affects the weight of a syllable.'
- Forceful production of coda is also effecting the weight of syllable
- Onset plays no role in assigning weight to the syllable
- Word headedness: right (most frequently). Morphologically simple words always have head foot i.e. foot having syllable with primary stress, on the right edge. Whereas, complex structured words having suffixes may not have head foot on the right side.
- Polysyllabic words form either ultimate or penultimate stress patterns but do not allow antepenultimate stress
- Extrametrical syllable always exist on the edge of the word
- Extrametrical syllable is always light in weight
- Uneven iamb, i.e. (LH) is frequently found in foot patterns of PSE

Chapter 5 below highlights the syllable structure and prosody of PSE in phonological theory.

CHAPTER 5

PROSODY OF PSE IN PHONOLOGICAL THEORY

This chapter gives a description of prosody of PSE in the light of syllabic phonology and metrical phonology including syllable structure; and stress patterns and foot patterns of PSE respectively. This chapter is divided into three main sections. Section 5.1 introduces different phonological theories about fundamental concepts of syllable to explain syllable structure, template, syllabification and phonotactics of PSE. Section 5.2 discusses word stress patterns and foot patterns of PSE in the light of various stress theories. In the end, conspectus of prosody of PSE is given in section 5.3.

5.1 Syllabic Phonology

In different levels of Phonological analysis, syllable is one of the important levels which is larger than a segment (commonly) and very basic to discuss the prosody (for detail see section 2.2.1) of any language. Syllabic phonology discusses various phonological procedures at the level of the syllable. As syllable is the building block in the metrical hierarchy so, it comes first in the discussion of prosody. This section is divided into two subsections, in which section 5.1.1 presents different theories about the structure of syllable and its representation; section 5.1.2 discusses other relevant concepts about the syllable such as syllabification, phonotactics and syllable weight.

5.1.1 Syllable Theories

There are different theories presented by phonologists about the syllable structure and its representation; in which they discuss about its number of constituents, the obligatory part of syllable, representation of syllable structure, and its boundary. In the

perspective of Jones (1956), syllable is a peak of prominence. He does not pinpoint its boundaries. For example, the word 'investor' in PSE has three syllables as there are three peaks, i.e. vowels in it; but there are no limitations about the boundaries of these three syllables. This is a very old approach in which syllable is not a popular concept.

Similarly, Chomsky and Halle (1968) also do not give much explanation about syllable and its structure. They only name 'syllabic' as a feature of segment as all vowels are mentioned as [+syllabic] and consonants are commonly considered as [- syllabic]. Even 'stress' and its rules are discussed by taking a word as a combination of segments to discuss all phonological processes. So, the notion of syllable is completely ignored in Sound Patterns of English (SPE). Whereas in subsequent work of McCarthy (1979); Selkirk (1980, 1982); Clements and Keyser (1983); Hogg and McCully (1987) syllable is given much importance and is discussed comprehensively.

Selkirk (1982) has given her own views about the syllable structure which is the most important element in the hierarchy of prosodic structure. While discussing the internal structure of the syllable, she first divides syllable into two parts: onset (the initial consonant cluster) and rhyme (the rest). Then rhyme is further divided into two parts: the peak (syllabic nucleus) and the coda (the final consonant cluster). As all English syllables are not so complex that they must contain consonant cluster, so there is also possibility of simple syllables; such as [pen] which contains one consonant in the onset position, one vowel as a peak and one consonant as coda. The representation of the internal structure of English syllable suggested by Selkrik is given below in Figure 5.1 below.

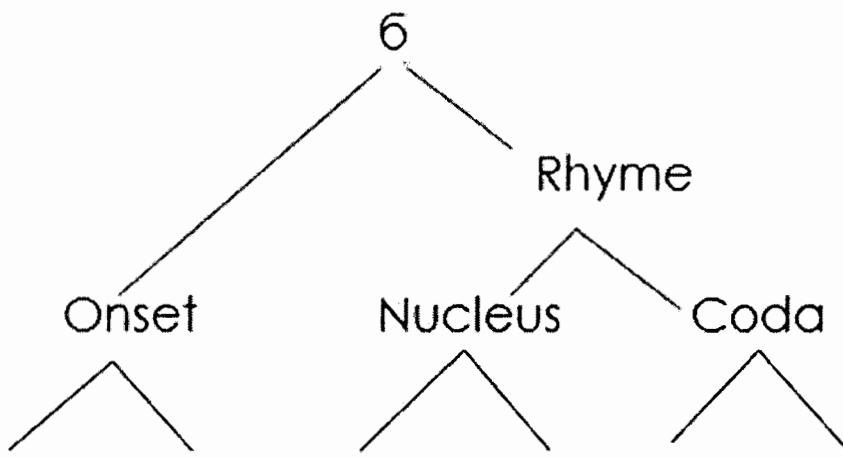


Figure 5.1 Internal structure of English Syllable

In this figure, each part of the syllable contains two segments and the sequence of segments is CCVVCC. About this sequence of consonants at onset and coda position, Selkirk (1984, p.116) establishes a principle 'Sonority Sequencing Generalization' or 'SSG', in which she states; 'in any syllable, there is a segment constituting a sonority peak that is preceded and/or followed by a sequence of segments with progressively decreasing sonority values.'

She expresses this construction of the English syllable by a template given in Figure 5.2 below (Selkrik, 1980, p. 569).

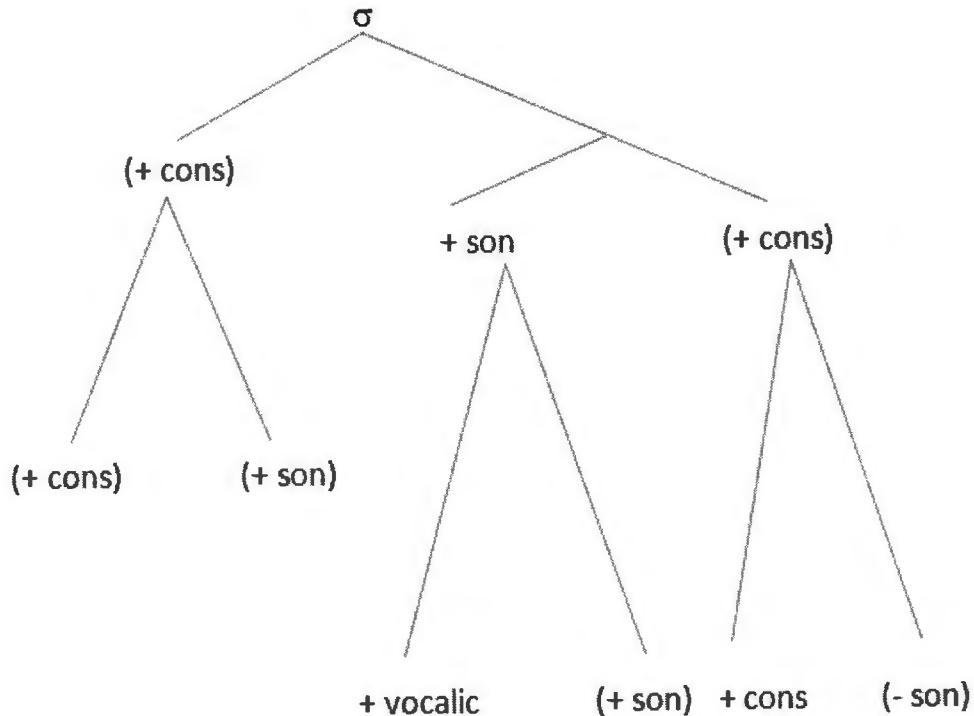


Figure 5. 2 English Syllable template

In the above figure Selkirk specifies the gross features of the segments, which can occur in different parts of the English syllable. According to her, the middle position of the syllable is fixed for sonorant ($+ \text{son}$) segment along with consonants ($+ \text{con}$) at both the sides. In onset position consonant adjacent to nucleus and segment on the right side of vowel should be sonorant ($+ \text{son}$). In coda position, consonant at the right edge should not be sonorant ($- \text{son}$). This template of English syllable allows consonants in a cluster in the same sequence which she discusses in SSG principle.

To apply SSG principle on the segments sequence of PSE syllable, it is important to know the sonority values (SV) of different segments. In Table 5.1 sonority scale of English sounds is given, in which SV is taken as suggested by Hogg and McCully (1987, p. 33)

Table: 5. 1 Sonority scale of English Sounds

Sounds	Sonority Values	Examples
Low vowels	10	/æ,a/
Mid vowels	9	/ʌ,e/
High vowels and glides	8	/i,u/ & /w,j/
flaps	7	/ɾ/
Laterals	6	/l/
nasals	5	/n,m/
Voiced fricatives	4	/v,z/
Voiceless fricatives	3	/f,s/
Voiced plosives	2	/b,g/
Voiceless plosives	1	/p,k/

In Table 5.1 above the hierarchy of sonority values 10 > 1 is like this:

Low vowels > Mid vowels > High vowels and glides > Flaps > Laterals > Nasals >

Voiced fricatives > Voiceless fricatives > Voiced plosives > Voiceless plosives

In which, highest SV is 10 starting from Low vowels it decreases gradually and lowest SV is of Voiceless plosives, i.e. 1. Now, number of syllables in PSE words are found by assigning a value for sonority according to the above given scale (Table 5.1). For

word 'detail' [dite:l] SV are: 2-8-1-9-6; here two sonority peaks are found with high SV of 8 and 9 respectively; and if SSG is applied on the internal syllable structure of this word, it can be seen that SV is progressively decreasing on both sides of the peaks. Thus SSG plays vital role in determining the number of syllables in one word; but it does not address the issue of syllabification in the word like 'detail'. The SV 2-8-1-9-6 of this word helps to identify the number of syllable on the basis of number of sonority peaks but it does not state about the boundaries of these two syllables. According to SSG there are two possibilities of the division of these two syllables: (1) [di.te:l] 2-8 & 1-9-6 (2) [dit.e:l] 2-8-1 & 9-6. As in both cases SSG is not violated and the SV are in progressively decreasing order.

However, in SSG phoneme /s/ behaves differently. As in the word 'sixteen' [sɪks.ti:n] its SV are: 3-8-1-3-2-8-5. In this word two sonority peaks each of SV 8 are depicting the number of syllables which is two. If syllabification of this word is done, there are two possible ways: (1) [sɪks.ti:n] 3-8-1-3 & 2-8-5 (2) [sɪk.sti:n] 3-8-1 & 3-2-8-5 but SSG is violated by syllabifying this word in either way. In [sɪks.ti:n] 3-8-1-3 & 2-8-5 violation occurs in first syllable, where on the right side of the peak SV is not gradually decreasing; and in [sɪk.sti:n] 3-8-1 & 3-2-8-5 second syllable shows violation with higher SV 3 before 2 on the left side of sonority peak.

Hogg and McCully (1987) also discuss the internal structure of English syllable on the basis of SV. They give the idea of 'template' which is the normal maximal structure for an English stressed syllable. It is represented in Figure 5.3 for the word 'grind'.

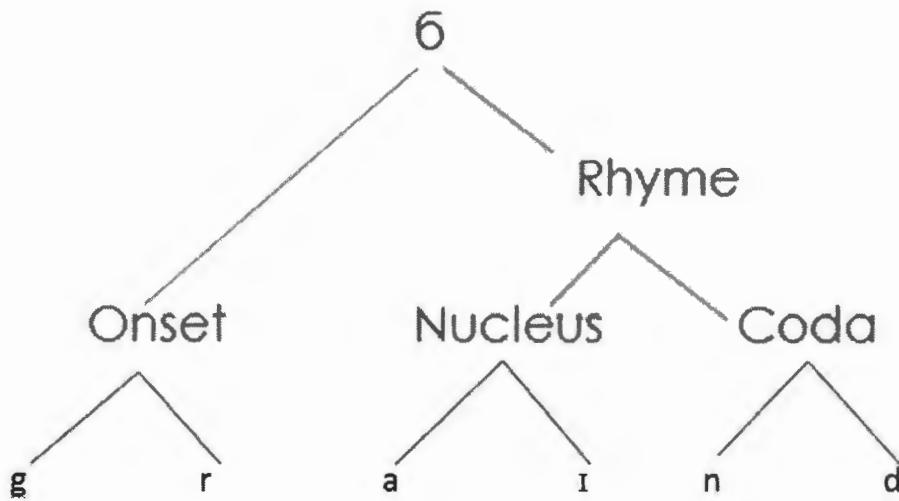


Figure 5.3 Syllable structure of the word 'grind'

In this monosyllable word, there is sequence of six segments, i.e. CCVVCC. In this sequence, the first two CC are the constituents of onset in the hierarchy and VV are of Nucleus, whereas the last two CC belong to coda. Nucleus and coda together make the rhyme part in the hierarchy.

In order to make the position of these segments clear in the syllable, they are numbered outward from Nucleus (N) and shown in Figure 5.4.

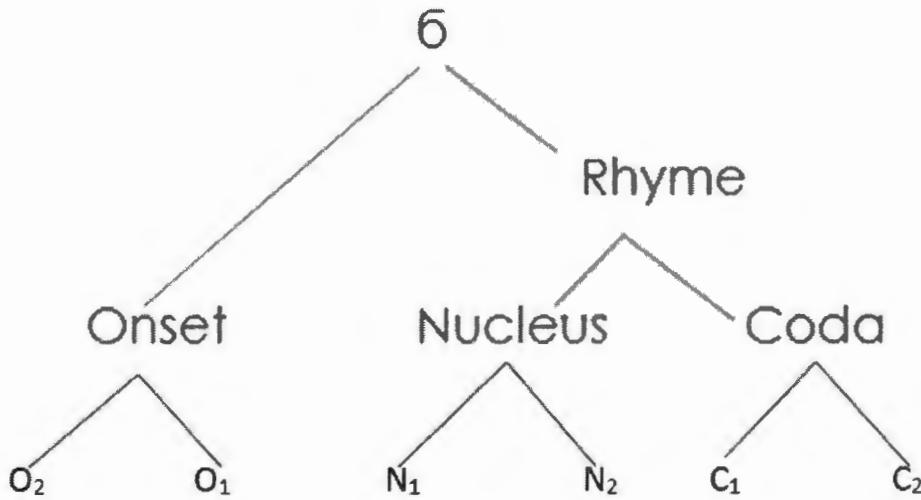


Figure 5.4 Syllable structure template

To distinguish consonant cluster in onset and coda position they are given names O for onset and C for coda in the above figure. The segments are further differentiated by putting numbers. As discussed earlier, /s/ is also problematic in this syllable template because it gives no place to /s/ which is a third segment in the onset of syllable as in words 'spring' or 'stream' or 'scream' but only accommodate syllable with two consonants in the onset position. Similarly, in the above given template there is no place for third segment /s/ in the coda position as in word 'glimps'.

So, for the above mentioned problem of third segment /s/ in words 'spring' or 'stream' or 'scream' onset position O₃ is not given rather it is attached with O₂, which infers that in the template of English syllable suggested in this model, two segments can be attached to two nodes O₁ and C₂ whenever /s/ is present as a third segment either on onset or at coda position. This attachment of [s] with other segment is represented in the Figure 5.5 and 5.6 of syllable structures of words 'strength' [strenth] and next [nekst] respectively.

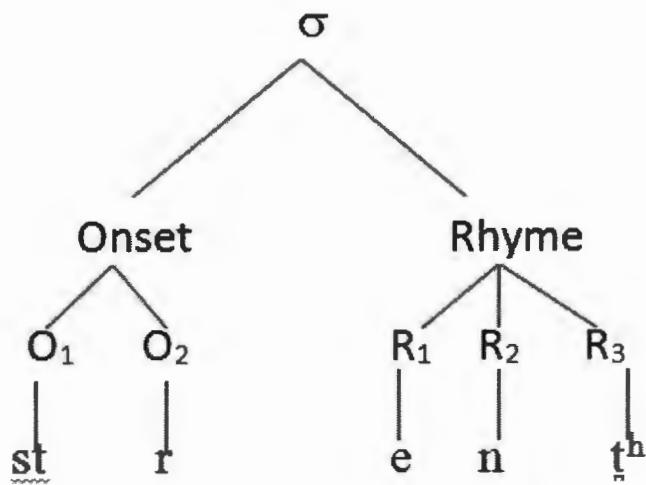


Figure 5.5 Syllable structure of word 'strength'

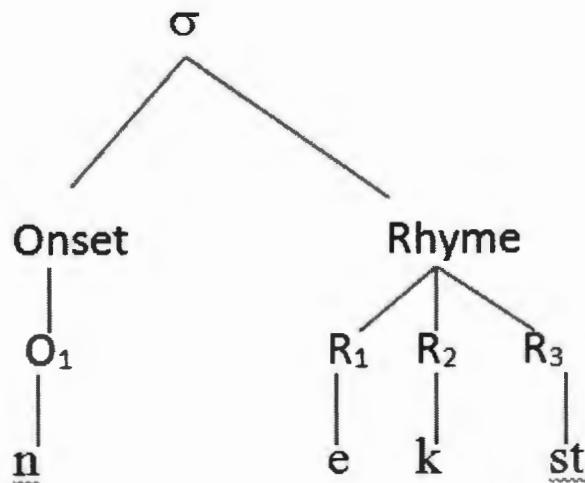


Figure 5.6 Syllable structure of word 'next'

In the above two Figures (5.5 & 5.6) rhyme is not further divided into nucleus and coda. So Nucleus is mentioned as R_1 and Coda cluster as R_2 and R_3 instead of C_1 and C_2 .

For Hogg and McCully (p.43, 1987) the cluster of O_1 and O_2 in English syllable also makes a template. So, the following formal statements are made about the 'onset template conditions':

- i. O_1 is optionally filled.
- ii. O_2 is filled iff (if and only if) O_1 is filled.
- iii. Sonority value (SV) of $O_1 = \text{or} < 8$
- iv. SV of $O_1 = \text{or} > 6$ iff O_2 is filled
- v. SV of $O_2 = \text{or} < 3$

Now, these above given onset template condition are being applied on different words of PSE with different syllable structures. In the monosyllable word 'all' condition (i) is fulfilled, which is without any segment at onset position. In other monosyllable word such as 'blink' there are two segments on onset position but in word 'ball' only [b] as O_1 is placed, it can't be O_2 to fulfill condition (ii). Condition (iii), which says that SV of O_1 can be equal to or less than 8, is also fulfilled in PSE; here is a list of monosyllable words:

Kin, in which SV of O_1 is 1

bin, in which SV of O_1 is 2

fin, in which SV of O_1 is 3

van, in which SV of O_1 is 4

man, in which SV of O_1 is 5

leg, in which SV of O_1 is 6

rim, in which SV of O_1 is 7

wig, in which SV of O₁ is 8

According to condition (iv) which is about the words containing cluster of two consonants in the onset position, SV of O₁ should be minimum 6 or more and SV of O₂ (condition v) should be equal to or less than SV 3. The other two conditions (iv, v) are fulfilled in the following monosyllable words:

‘play’, in which [p] is O₂ with SV 1 and [l] is O₁ with SV 6.

‘ground’, in which [g] is O₂ with SV 2 and [r] is O₁ with SV 7.

‘fraud’, in which [f] is O₂ with SV 3 and [r] is O₁ with SV 7.

‘ground’, in which [g] is O₂ with SV 2 and [r] is O₁ with SV 7.

Katamba (1989) discusses CV-phonology model of syllable structure with its three tasks proposed by Clements and Keyser (1983); which are:

- I. It tells universal principles to govern syllable structure. According to it syllable structure has three-tiers. On the top is syllable node ‘σ’; below it is a CV tier where C is consonantal and V is vowel segments; on the bottom is segmental tier with features matrices. This three-Tiered structure of PSE syllable ‘ten’ is shown in Figure 5.7 below.

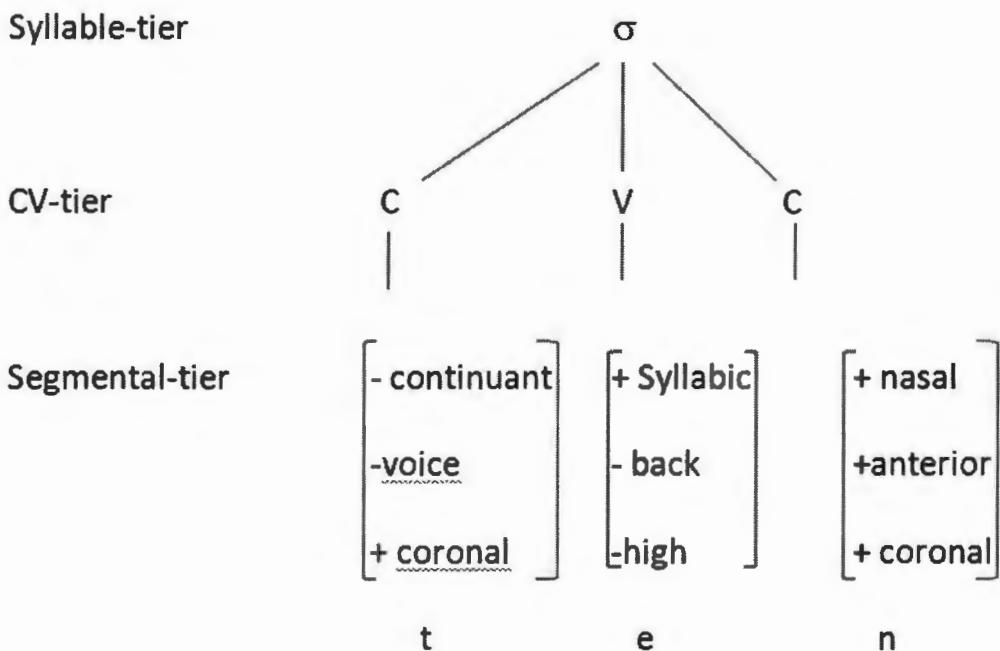


Figure 5. 7 Three-tier syllable structure of 'ten'

II. This model tells us the typology of Syllable structure which defines the range within which syllable structure of one language differ from other language. CV type syllable is considered as a core syllable which occurs in all languages without exception. All other types of syllables are taken as modification of this 'prototypical CV syllable'. So, they suggest the following four canonical syllable types which are present in PSE also.

Type 1: CV as in 'the'

Type 2: CV, V as in 'the', 'a'

Type 3: CV, CVC as in 'the', 'pen'

Type 4: CV, V, CVC, VC as in 'the', 'a', 'ten', 'up'

III. It also explains language-specific rules to govern syllable structure. It covers the languages which contain only 'C' or 'V' as a complete syllable.

But they have not discussed the combinations like CCVCCC as in English syllable 'glimpse'.

Brockhaus (1995) also discusses syllable structure as 'CV tier approach', 'the X theory approach' and 'Moraic theory' in 'Government Phonology'. As 'CV theory' is already discussed above in this section, so 'the X theory approach' and 'Moraic theory' need to be elaborated. In the X theory, there are different tiers to represent the syllable structure, but one difference is that 'CV tier' is replaced by 'X tier'. It can be seen in Figure 5.8 below.

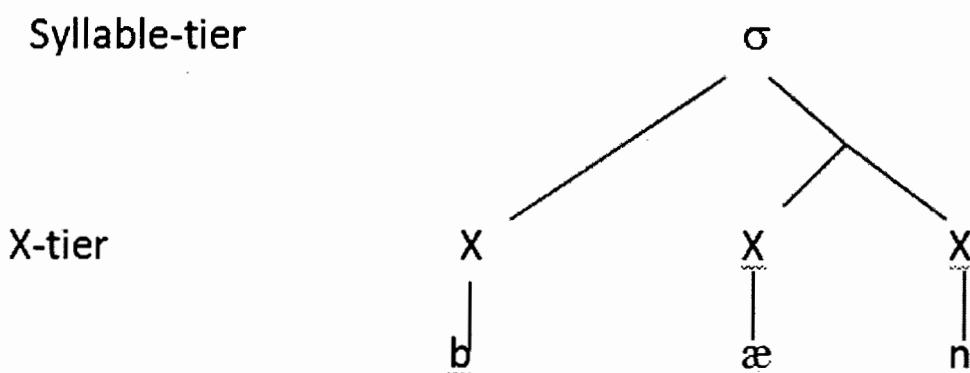


Figure 5.8 Syllable structure of 'ban' in 'X tier'

In the above figure, segments are represented as sequence of 'Xs' instead of consonant (C) and vowel (V). A second difference can also be seen in this representation, the right branch of syllable-tier is further branched into two constituents; whereas in 'CV theory' Syllable-tier is branched into three (Figure 5.7 above). So, it can be said about X theory that it provides further bifurcation of rhyme node in the structure of syllable also.

In 'Moraic theory' (originally proposed by Tranel 1991) there is a skeleton representing the timing units of segments. So, the CV-tier or X-tier is replaced with the

weight units, i.e. moras. Hayes (1989) further provides the comparison of CV theory, X theory and Moraic theory. He says Moraic theory is ‘not segmental’ unlike other two theories which are ‘segmental’. Moreover, for the formal description of ‘prosodic frame’ it is also suitable while other two theories are not because they just represent segments as ‘CV or Xs’ but provide no information about their role in the weight of syllable or prosodic structure of language. In the version of moraic theory, the syllable structure of ‘ban’ is represented in Figure 5.9.

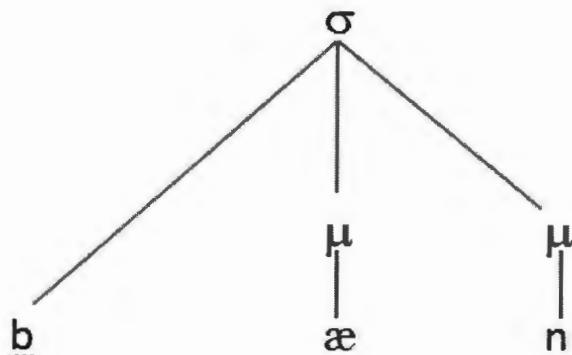


Figure 5.9 Syllable structure of ‘ban’ in moraic theory

In the above figure, μ stands for ‘mora’. It can also be seen that segments which contribute to the weight of the syllable are linked with mora that is ‘rhyme’ part of English syllable whereas onset plays no role in weight, so it is directly joined to syllable node. This notion of mora is important in this theory because it provides distinction between ‘light’ and ‘heavy’ syllable. As the weight of the syllable does not depend on the number of segments in the syllable but on the number of moras in it, so with the occurrence of number of moras the weight of the syllable can easily be measured:

one mora = light syllable

two moras= heavy syllable

three moras= super heavy syllable

So, in English syllable, if one segment such as long vowel (V:) is attached with two moras it is considered as heavy syllable because of the number of moras. As in weight assignment of English syllable, number of segments is not relevant but number of moras is important. More discussion on syllable weight is given in section 5.1.2.3.

Carr (1993) discusses syllable structure in government phonology (GvP) theory which presents a set of 'principles' for all phonological representations of the languages . These 'principles' are universal and shared by all languages of the world. Moreover, 'parameters' are introduced to tell how one language vary from any other language. GvP also gives many principles which concern the place of segments in syllabic and metrical structure. The theory presents governing relations of segments in the syllable at the following two levels: (i) **constituent government** is relation between three syllabic constituents, that is onset, rhyme and nucleus (coda is rhymal complement). Government operates all constituents from left to right. Thus, if onset or nucleus is branching, it is the leftmost skeletal position that governs the rightmost; and within branching rhyme, coda is governed by the nucleus. (ii) **Interconstituent government** is relation between adjoining syllables, i.e. between the head of an onset and a preceding coda, and between a nucleus and a preceding onset head. The third level is about the metrical structure which is discussed in section 5.2.2 below

Clark and Yallop (1995) focus more on the nature of the segment as the syllabic peak in the syllable. A syllable commonly contains a vocalic peak but in some languages

other sounds, consonants can also make a nucleus of a syllable. Then they give examples of English words such as [sʌdŋ] and [medl] in which nasal [n] and lateral [l] are syllabic by making syllabic peak. On the other hand, only vowel makes a syllabic peak of syllable in PSE no other segment like consonant is allowed in the nucleus position. For example in PSE, sudden is pronounced as [sʌ.dən] and meddle as [mɛ.dəl].

Some syllable theories are presented by those who typologically study the syllable structure of word languages including English. In the typological study of syllable structure, phonologists try to find out what is 'unmarked', that is common, frequent and general in languages and what is 'marked', that is uncommon, specific and less frequent. Ian Maddieson (2005) discusses the 'canonical syllable pattern' which consists of string of consonants and vowels. One syllable structure which is norm and is present in every language is 'CV'. Languages in this study are classified into three groups according to the complexity of the syllable structure: (1) simple syllable structure languages contain no consonant clusters; (2) moderately complex syllable structure languages contain consonant cluster of two consonants at maximum on either side of vowel; (3) complex syllable structure languages have cluster of two or more consonants at either side of vowel. English falls in the third type which has canonical syllable pattern as:

(C) (C) (C) V (C) (C) (C) as in word 'strengths' when pronounced as [strenθs]. In this pattern 'C' is put in parenthesis because these are optional parts of the English syllable as English syllable can consist of just a vowel as an article 'a'. If we look at the canonical syllable pattern of PSE it is also complex but it has cluster of maximum three consonants on the right edge of the word as: (C) (C) (C) V (C) (C) (C) as in word 'strengths' which is pronounced as [strent^hs] in PSE.

Syllable structure is also discussed in the form of 'parametric variation in syllable type' Blevins (1995) presents following five binary-valued parameters to discuss various syllable types in different languages including English:

- I. Complex Nucleus: These languages allow 'VV' as a nucleus of a single syllable which is called tautosyllabic sequence as in word 'e.qua.tion' second syllable is tautosyllabic.
- II. Obligatory Onset: It determines whether a consonant in onset position is compulsory or not. Although there are many syllables which contain onset but it is not compulsory in PSE. For example, in word 'un.der.stand' first syllable is without onset.
- III. Complex Onset: It tells about the occurrence of consonants cluster on the onset position. In 'pre.prepare' first syllable contain complex onset with cluster of two consonants in onset position.
- IV. Coda: It is allowed in the language which has closed- syllable types. As in English many syllables are closed with the consonant in coda position such as in 'com.bine' both the syllables are close.
- V. Complex Coda: Some languages also have consonants cluster in the coda position of their syllable. This parameter is dependent on the setting of 'coda' parameter. PSE also allows complex coda as in second syllable of word 'per.cent'.

Other than these above given five parameters, which are binary in nature, sixth parameter is explained which shows exceptional syllable types at the edge of the syllabification domain.

- VI. Edge Effect: It shows the difference of occurrence of syllable types in the word 'initial' and 'final' position. Difference of this parameter can be seen below in

Table 5.2 which illustrates the difference of the parametric variation in syllable type of English and PSE.

Table: 5. 2 Parametric variation in syllable type of English and PSE

	Complex Nucleus	Obligatory Onset	Complex Onset	Coda	Complex Coda	Edge Effect
English	yes	no	yes	yes	yes	Yes/Final
PSE	yes	no	yes	yes	yes	Yes/Initial

It is obvious from Table (5.2) that English and PSE are similar in their syllable type in the first five binary parameters but vary in the sixth parameter that covers the exception of syllable type in the word initial or final position. English word 'extreme' is syllabified as [ek.strim] in English but it is syllabified as [eks.trim] in PSE. Although cluster of three consonants is possible in the syllable type of PSE as in word 'stream' or 'spring' but it is exception when this cluster of three consonants found in word-internally. So, PSE allows consonants cluster of three in the word initial position only, not word-internally.

Other than rules and parametric approach, syllable structure of English can also be seen in the framework of constraints-based approach discussed in OT. In Chapter 6 below, OT analysis of syllable structure of PSE is offered.

5.1.2 *Relevant Developments in the Concepts of Syllable*

After discussing internal structure of syllable of PSE in phonological theory above, this section presents other relevant concepts of syllable, i.e. syllabification, phonotactics, and syllable weight.

5.1.2.1

Syllabification

It is the process of dividing a polysyllabic word into number of syllables, that is deciding the boundaries of a syllable. Different principles and theories are presented to explain the process of syllabification. For instance, McCarthy (1979) presents following three parameters of syllabification in the theory of metrical syllabification:

- i. The labeling of the rhyme
- ii. The branching or nonbranching character of the rhyme
- iii. The major category features like [syllabic], [consonantal], and [sonorant]

(McCarthy, 1979, p. 456)

In these parameters, more focus is given to the rhyme part of the syllable, which contains nucleus followed by another vowel or consonant (if branching).

In Poly-syllabic words of English, it is easy to know the number of syllables but deciding the boundaries of the syllable is difficult. This division of syllables is even tough in words which have medieval consonants. The occurrence of consonants cluster in between two vowels in a word raises the question whether these consonant(s) should be the part of first syllable as coda or the onset of second syllable. For example in 'petrol' there are three possibilities of syllabification of this word: (1) pet.rol, in which medieval two consonants [tr] are divided into both of the syllables. (2) pe.trol, in which [tr] become the onset of second syllable (3) petr.ol, in which [tr] becomes the coda of the first syllable, but in this division SSG (discussed in section 5.1.1 above) is violated as SV of /t/ is less than SV of /r/; which indicates that this type of syllable is not possible in English.

Many theories posit a series of syllabification rules to syllabify sequence of consonants and vowels. Turk (1994) explains three rules of syllabification stated by Clements and Keyser (1983, p.38):

- i. V-elements are pre-linked to syllables.
- ii. C-elements to the left are adjoined one by one as long as the configuration resulting at each step satisfies all relevant syllable structure constraints.
- iii. Subsequently, C-elements to the right are adjoined in the manner described in (ii) above.

For example, the word 'extreme' [ekstrim] from PSE would be syllabified in the Figure 5.10 below.

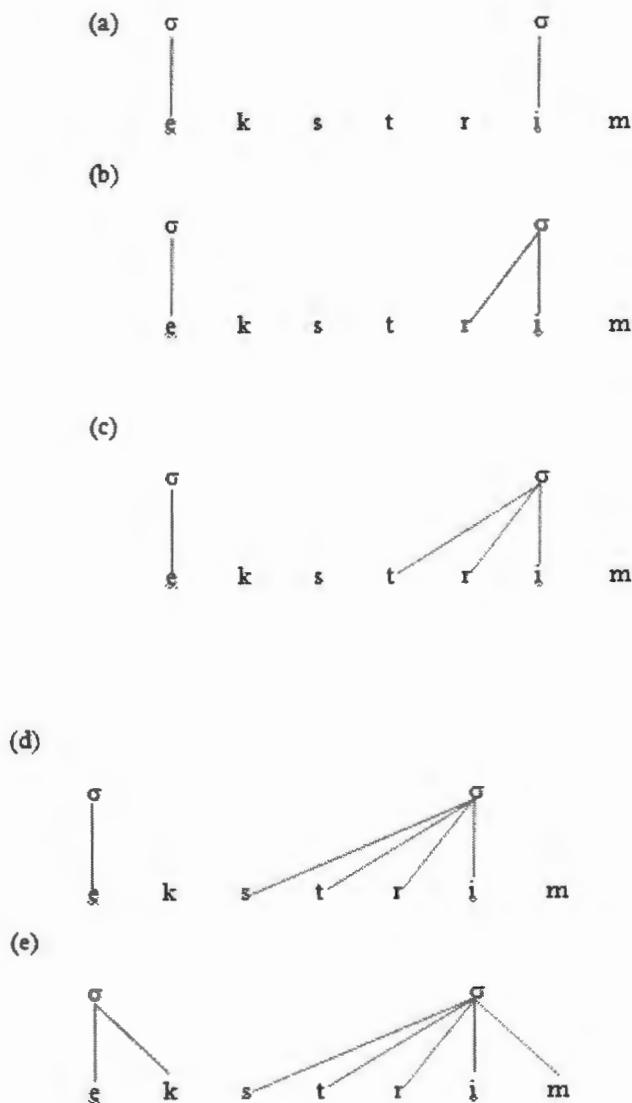


Figure 5.10 Syllabification of [ekstrim]

In Figure 5.10, representation of rule (i) which is about linking vowels with the syllable can be seen in (a); rule (ii) which is about the joining of consonants at the onset position as per allowed number and sequence of consonants [str] can be seen in (b)-(d); and rule (iii) which tells about the joining of consonants at the coda position is shown in (e).

Although [str] is allowed sequence in many of monosyllabic words of PSE for example, strict, stream, straight etc. but this cluster of three consonants is never found word internally as the onset of second syllable. So, unlike Figure 5.10 ‘extreme’ in PSE is syllabified as [eks.trim] instead of [ek.srtim]. It might be because of influence of Urdu in which cluster of three consonants at onset position is not possible (Hussain 2010).

This myth of division of intervocalic consonant cluster is discussed in different ways. Hogg and McCully (1987) explain it with the help of three principles. First is ‘Principle of Maximal Onsets’ which permits the maximum number of consonants in the onset position which are allowed in the template of syllable. It is similar to the rule (ii) of Clements and Keyser (1983) stated above. As discussed above, in PSE this rule is not applicable. Second principle is ‘Principle of Maximal Codas’ which allows maximum number of consonants at the coda position as are permitted by the syllable template. For example ‘petrol’ can be syllabified as [pet.rol] instead of [pe.trol] according to this principle but it can’t be divided as [petr.ol] because [tr] cluster is not possible in the coda position of English syllable (Phonotactics is discussed in detail in next section).

The third type of division is illustrated in ‘Principle of Maximal Codas and Maximal Onsets’. According to this principle intervocalic consonants are joined both to the coda of the first syllable and the onset of the second syllable, but by fulfilling the

syllable template conditions. For example, in [petrol] [t] segment will be assigned to the first syllable as coda as well as to the second syllable as an onset. This process of simultaneous link of one segment with two adjacent syllable is technically called 'ambisyllabicity'.

According to universal phonological approach, languages with complex syllable structure like English mostly follow the principle of maximal onset. But PSE does not follow this principle as discussed above that /ek.stri:m/ becomes /eks.tri:m/ in PSE. Similarly, many other words which contain cluster of three consonants in the onset position of second syllable in English such as /ek.spi.riəns/, /ek.skleɪm/, /ek.skruz/ become /eks.pi.riəns/, /eks.kleɪm/, /eks.kruz/ in PSE. This variety also behaves differently in the syllabification of some words having cluster of two consonants, such as word 'between' in PSE is syllabified as [bit.win] instead of [bɪ.twin] and word 'escapable' in PSE is [es.ke.pe:.bəl] instead of [ɪ.skeɪ.pəbl].

5.1.2.2 Phonotactics

In the language such as English, which form complex syllable structure by allowing consonants clusters on the onset and coda position, the sequence of consonants in the cluster is also very important concept to discuss the boundaries of syllable. Clark and Yallop (1995, p. 70) define the term 'distributional statement' as ' a statement specifying how segments are distributed within syllables, and syllables within words, etc.' . Hawkins (1984), Katamba (1989), Hansen (2006) also explain syllable as the basic 'Phontactic unit' to tell about language-specific sequences. It is because of the phonotactic rules of English syllable that [tl] sequence is not possible in one syllable. So, all words in English with this sequence divide these two segments into two syllables. For example, English

word 'little' is syllabified as [lit.l] in which [l] is syllabic and making a separate syllable.

It is also true in PSE but this word 'little' is syllabified as bi-syllable word but in PSE [l] is not syllabic as it is pronounced [li. təl]

Goldsmith (1995) also discusses the concept of 'Phonotactics' to tell about the possible sequence of consonantal segments on both sides of the vowel in a syllable. He also explains the notion of 'licensing' which restricts the combinations of various segments in a syllable.

According to McMahon (2002, p. 106) English allows two or three consonants at the onset and coda position with following 'phonotactic constraints'. In a CCC onset, C₁ must be /s/ only. The following phonemes do not form a part of onset clusters in English: /ŋ/, /v/, /ð/, /z/, /ʒ/. Similarly, /t d θ/ plus /l/ also do not make permissible onset clusters.

In case of codas, /h/ does not appear in codas. In coda clusters nasal and oral stop are only possible if the two stops are of the same place of articulation. So, /lg/ is not an acceptable coda cluster.

In Yule (2010), the sequence of the following maximum three consonants is possible in English syllable : C₃= [s], C₂= [t/p/k], C₁= [l/r/w] as in words splash, stretch, script etc.

These all above discussed phonotactic constraints are also occurring in the consonants cluster of the syllable of PSE. But one difference is found that is in the syllable of PSE cluster of three consonants i.e. /s/, /p or t or k/, /l or r/ is allowed only in monosyllabic words such as splash, strict, scrap. Whereas, word internally this cluster of three consonants is not permissible. So, [ek.sklɪud] becomes [eks.kliɪud] in PSE.

5.1.2.3 Syllable Weight

The internal structure of the syllable is discussed above and it is seen that syllable can consist of just one segment V as its nucleus, it may contain consonant(s) in its onset, i.e. CV, such syllable without coda is called 'open syllable' and according to Rocs and Johnson (1999, p.240) 'CV syllable is legitimately considered the core syllable' .

Whereas, those syllables which contain consonant(s) at coda position, i.e. VC, CVC or CVCC . are called 'close syllable'(Katamba, 1989; McMahon, 2002). This presence of consonant at coda position not only make different type of syllable but also affect the weight of syllable in 'quantity-sensitive languages' (detail of quantity-sensitive languages is presented in section 2.1 above)

There are two more subdivisions of syllable type which depend on the structure of rhyme. Branching rhyme of the syllable, i.e. with long vowel or diphthong (VV) or short vowel and coda (VC) make 'heavy syllable' and rhyme with one segment only, i.e. (V) makes 'light syllable'.

According to Goedemans and Hulst (2005), weight-sensitive languages are divided into five different types because of five weight factors:

- i. Long vowel: syllables containing long vowels are considered heavy for stress
- ii. Coda consonants: syllables closed with coda are considered heavy for stress
- iii. Long vowel and coda: Syllables having long vowel or diphthong or closed syllable are taken as heavy for stress
- iv. Prominence: other factors such as full or reduced vowel can form the basis for heavy- light syllable
- v. Lexical: lexical stress or diacritic weight

From the above mentioned weight factors, factor (iii) is most relevant in PSE.

Katamba (1989) categorizes all languages into following two types in terms of syllable weight: (i) languages having short vowel with or without onset in their light syllable and heavy syllable is made by branching rhyme, i.e. either one long vowel or short vowel followed by coda. In literature, it is stated as ‘branching rhyme hypothesis’ (ii) In this type of languages occurrence of coda has no effect on the weight of syllable. So, a syllable with short vowel with or without coda is light; and heavy syllable is made with long vowel or diphthong. According to this categorization, English falls in the first type. But syllable weight of PSE is a different case and is discussed below.

Goedemans and Hulst (2005) further discuss the cross-linguistic variability of coda weight in different languages. According to them, unlike English, it is not necessary that all types of consonants in coda position make syllable heavy; instead there are languages in which only some consonants such as sonorant at coda position are weightful.

Dobrovolsky and Katamba (1996) used a term ‘forcefully’ for the allophonic free variation of /p/ sound in the coda position of word /stop/ in some English variety. Similarly, it is also noted in PSE some consonants at the coda position are pronounced forcefully and this forceful production affects prominence. So, every type of consonant at coda position is not weightful but only that coda consonant which is pronounced forcefully is weightful in PSE.

5.2 Metrical Phonology

‘Metrical phonology is the branch of linguistic theory concerned with stress phenomena in natural language’ (Hammond, 1995, p.313). Various stress phenomena are discussed with different phonological approaches. This section presents four different

approaches to explain stress patterns of English given by Duanmu, Kim, and Stiennon (2005). It is divided into four subsections on the basis of these four approaches, section 5.2.1 deals with ‘the no-pattern approach’; section 5.2.2 tells about ‘the norm-and-exception approach’; ‘the loose-requirements approach’ is given in section 5.2.3; section 5.2.4 highlights ‘the inviolable-constraints approach’.

5.2.1 *The no-pattern approach*

This approach puts no emphasis on any pattern of stress in English. It focuses on the free stress without any attempt to find rules or generalizations about stress in English. Daniel (1972) is the proclaimer of this approach, who believes that English stress is absolutely free of all rules and systems, if any pattern is found in the English word stress that is just because of historical accidents.

5.2.2 *The norm-and-exception approach*

This approach discusses the word stress pattern which is ‘norm’ and some uncommon patterns which are ‘exceptions’ in a language. Many phonologists present their theories about word stress and foot patterns of English which come under this approach. The following four different versions of this approach are discussed below: (i) Linguistic Typology (ii) Language parameters (iii) Rule-based theory (iv) Optimality Theory.

In linguistic typology, languages are classified on the bases of similarities and differences in any linguistic feature. Goedemans and Hulst (2005) distinguish the following eight types of weight-sensitive stress patterns in various languages of the world:

- i. Left edge: stress is on the first or second syllable from the left.
- ii. Left-oriented: the third syllable from the left is involved.

- iii. Right edge: stress on ultimate, that is final or penultimate, i.e. second last syllable.
- iv. Right-oriented: the antepenultimate, i.e. third last is involved
- v. Unbounded: stress can be anywhere in the word
- vi. Combined: it involves both Right-edge and unbounded
- vii. Not predictable
- viii. Fixed stress (no weight-sensitivity)

From the above mentioned eight patterns, stress pattern of English is 'Right-oriented' because English has 'ultimate, penultimate and antepenultimate' stress patterns. Whereas PSE falls in 'Right edge' stress pattern (as in chapter 4 above) it is discussed that word stress pattern of PSE is either 'ultimate or penultimate'.

Like linguistic typology, languages are also described on the basis of language parameters. For different language features various parameters are discussed. Hayes (1981) states the following four parameters of stress system:

- i. Headedness: Right- headed vs left- headed
- ii. Boundedness: bounded vs unbounded
- iii. Directionality: left to right vs right to left
- iv. Sensitivity: quantity-sensitive vs quantity-insensitive

The first parameter explains about the foot type, if foot is right-dominant it contains (WS) pattern and if foot is left-dominant it has (SW) (S means strong and W stands for weak).

The second parameter highlights about the size of the foot. If foot consists of two syllables then it is called bounded foot but if it contains more than two syllables then it is known as unbounded foot. So, on the basis of first two parameters, languages may contain any of the

following four types of foot: (i) bounded left-headed foot which is also called trochaic (ii) bounded right-headed foot which is called iambic (iii) unbounded left-headed (iv) unbounded right-headed.

The third parameter, that is directionality is important for languages that have bounded stress system. It differentiates between languages which form their primary stress at the right edge or left edge of a word, which allows foot construction to start from the same edge.

The fourth parameter is about the effect of the weight of syllable on the stress. In quantity-sensitive languages, a heavy syllable carries stress and weak or light syllable is never dominant; whereas in quantity-insensitive languages weight of the syllable plays no role in the assignment of the stress.

Gussenhoven and Jacobs (p. 214, 1998) explained the following four types of bounded stress system based on three stress parameters after discarding the directionality parameter: (i) quantity-insensitive, left-dominant (QI-ld) (ii) quantity-insensitive, right-dominant (QI-rd) (iii) quantity-sensitive, left-dominant (QS-ld) (iv) quantity-sensitive, right-dominant (QS- rd).

In the light of above discussion on stress parameters, English stress and foot pattern is described as : 'bounded left-headed (trochaic), (QS-ld) with right to left directoinality'. On the other hand, stress and foot pattern of PSE is described as : 'bounded right-headed (iambic), (QS-rd) with right to left directoinality'.

Halle and Verganud (1987) also present a small set of stress parameters from which each language selects one parameter set, which defines the stress pattern of that language. They offer the following three different stress parameters: One is represented as [HT], which determines the constituent is head-terminal. Thus, it tells the position of head foot that can be either on left or right side of the

word. Second is represented as [BND], which tells whether or not a constituent is bounded. So, it explains the number of syllable in one foot. Third is about the position of the head, that is accented syllable in the foot. It expresses a type of constituent that whether it is left or right headed. A regular stress patterns of a language follows this chosen set of parameters and the only exceptions in a language violate the parameter settings of that language.

Another similar approach which discusses the 'parameters' as a selected set from the 'universal principles' to show language specific variations is the theory of government phonology (GvP). Two levels in GvP which decide the syllable structure of the language are already discussed in section 5.1. Here third level which is referred as 'nuclear projection government' by Carr (1993) is presented. This level tells the governing relation between the nucleus of the syllable which are heads of metrical structures known as feet. In it GvP claims that all phonological positions must be licensed, which means they are allowed by the universal principles of the government, except head. Then Kaye (1990) is referred who suggests that language may vary in licensing of two parameters i.e. 'empty nuclei' and 'branching rhymes'. Thus, according to this theory English licenses both of these parameters, whereas PSE allows 'branching rhymes' but it does not license 'empty nuclei' which means syllable without vowel as a nucleus. For example, in the English word [bʌt.n] second syllable is with 'empty nucleus' as no vocalic peak exists in it rather nasal [n] is syllabic. But this word is pronounced as [bʌt.ən] in PSE, which contains vowel [ə] as nucleus.

Third version of this approach is 'rule-based theories' which prefer grammar as a set of rules. In this notion a set of stress rules is presented to describe the stress patterns of

English. In this stream, four different adaptations are grouped together as metrical theory, i.e. linear theory of stress; theory of stress and linguistic rhythm; autosegmental theory of stress; theory of prosodic structure are discussed below.

The first and most important rule-based theory of stress is presented by Chomsky and Halle (1968) in 'The Sound Pattern of English' (SPE) which is known as 'linear theory of stress'. It is called linear because of the phonological representations of linear sequences of matrices of feature values. According to SPE, the purpose of the rules is to know the 'intuition' of the native speaker. Phonological rules fall into two different classes in it: (i) Phonological phrase (ii) words, including simple and compound words. The phonological rules on the words are applicable according to their grammatical categories. These rules are stated and explained with examples from English and they are also presented in the form of notation. For example:

A → B / X _ Y

It says that A becomes B, when A comes in the context (/), X to its left and Y to its right. To show boundary of any lexical category # is used.

Its approach is very much 'segmental' because of its claims that stress is a property of segments in terms of features. So, stress is not a different kind from other features, e.g. [sonorant], [nasal]. This [stress] feature, which is a property of [+ syllabic] segments, can be either binary or n-ary according to the stress levels of a language. Thus, unlike other features which are absolute, stress is a relative concept in English stress system. This relativity is shown in different degrees of stress, which are numerically encoded, for example [0 stress] marks an unstressed segment, [1 stress] shows a main stress, [2 stress] indicates a secondary stress, [3 stress] denotes tertiary stress etc. These

rules are suggested to be operated in ‘transformational cycle’ i.e. stress assignment rules operate within a cycle that they are cyclical and apply over and over again. Thus stress rules are cyclic in nature. For instance, in ‘noun phrase’ the stress is assigned cyclically from inner most to left one. The rules apply to the longest and maximal strings containing brackets, when all relevant rules are applied to them, brackets are deleted and process is completed after the deletion of all brackets. This process can be seen in Figure 5.11.

- (a) **NP[[[_Anational_A] [_Naccountability_N]] [_Nbureau_N]]_{NP}**
- (b) **NP[[_Nnational¹ accountability¹_N]] [_Nbureau¹_N]]_{NP}**
- (c) **NP[national¹ accountability² bureau¹]_{NP}**
- (d) **national² accountability³ bureau¹**

Figure 5. 11 ‘Bracket notation’ in Noun Phrase

In the above Figure (a-d) it is not only illustration of ‘transformational cycle’ and ‘Bracket notation’ in noun Phrase (NP) but also application of ‘Stress Subordination Convention’ (SSC), that is, when primary stress is placed in a certain position then all other stresses in the string under consideration at that point are automatically weakened by one.

The following are some more stress assignment rules of ‘word stress’ of English given in SPE, which are being applied on word stress patterns of PSE:

- i. Compound Stress Rule (CSR): It is for compound words. It says that the vowel becomes ‘primary stress’ in some specified context. It can be represented in notation form as below:

$V \longrightarrow [1 \text{ stress}] / _ x V^1 y]_L$

In the above notation, [1 stress] stands for primary stress and L demotes 'lexical item'. So, according to this rule about some dialect of American English the primary stress of the compound words fall on the left side.

However, in PSE it is not the case; primary stress falls on the right side of the compound word 'check-post'.

- ii. Nuclear Stress Rule (NSR): According to this rule, which is about the phrase, the vowel becomes primary stress in the following context shown in notation below:

$$V \longrightarrow [1 \text{ stress}] / V^1 x_y]_P$$

In this notation P is symbol of 'phrase'. It is clear from this rule that primary stress of the phrase category comes on the right side of this American English Variety.

- iii. Transformational Cycle within the Word: It assigns primary stress on the final vowel, if it is strong, otherwise on the preceding vowel. The notation form of this rule is given below:

$$V \longrightarrow [1 \text{ stress}] / x_C_0(w)]$$

In the above mentioned notation, C_0 shows the possibility of presence of any consonant and (W) is a weak cluster. This rule covers most of the verbs with heavy syllable in the final position; and nouns and adjective categories with penultimate strong syllable.

In SPE, many more stress assigning rules are discussed to tell the differences in stress patterns of lexical items from various grammatical categories and derivational forms. Different types of suffixes are also explained which do or do not affect stress position of their stems. Due to Chomsky and Halle's (1968) preoccupation with the rules,

metrical phonology in 1960s was also termed as the generative approach to phonology in which stress rules were generated.

Gussenhoven and Jacobs (1998, p. 210) summarize number of objections about SPE: 'the rules involved are purely descriptive... there is no explanation for the way the stress patterns are the way they are.' Although it is one of the most comprehensive theory of stress assigning rules but in it assignment of stress is based on the sequence of segments. However, stress is commonly considered as supersegental process. As concept of syllable is ignored in SPE so, it presents phonological strings as simply linear sequences by disregarding hierarchical organization based on syllable. Similarly, Basboll (1988) also criticises SPE that it treated stress as segmental phenomena and in more structured way.

The hierarchical based analysis of stress has been the focus of the theory presented by Liberman and Prince (1977) (hereafter LP). In this theory of stress, which is called 'theory of stress and linguistic rhythm', LP advocate about two important concepts in this theory: (i) a binary stress feature [+ stress] by introducing the idea of sister nodes; (ii) the hierarchical representation of the stress through the metrical tree or the metrical grid. LP (p. 263) represent the notion of 'relative prominence as a feature of constituent structure rather than of phonological segment'. By relational concept LP mean that stress is not an integral part of the vowel. LP (p.305) modify NSR and CSR of SPE as 'Lexical Category Prominence Rule (LCPR) these words: 'In the configuration $[N_1 N_2]$, within a lexical category, N_2 is strong iff (if and only if)

- A. it branches, or
- B. It immediately dominates [+F]

In this rule, $[N_1 N_2]$ are a pair of sister nodes. According to this rule, only a phrase can have stress on the final word if condition is met but compound word cannot carry final stress because it contain non-branching N_2 . For example, in the English compound word 'football' as 'ball' is non-branching N_2 , so it will be marked as 'W' i.e. weak so unstressed; whereas 'foot' as N_1 contains stress. But (LCPR) has certain exceptions, such as words with final heavy syllable carry stress at right edge. To tell the inner structure of words, LP present the concept of 'stress foot' or 'metrical foot' which is a string containing as its first element a stressed syllable which is followed by 0 or more unstressed syllables. LP suggest that in a word stress of English the feet are 'left headed or trochaic' The metrical tree representation of the word 'modest' can be seen in Figure 5.12.

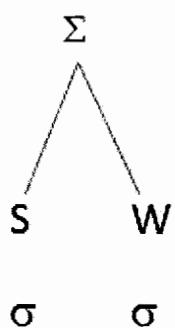


Figure 5. 12 Metrical tree representation of the word 'modest'

LP introduce "grids" in their theory. They termed it "metrical grids". This is done by representing information of the kind contained in a metrical tree as an array of asterisks. One asterisk is assigned to each syllable at the syllable tier, an additional asterisk is assigned to the stronger syllable in each foot and then at word level, a further asterisk is assigned to the strongest foot. Metrical grids of the word 'analysis' is shown below.

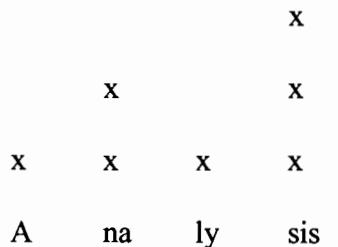


Figure 5. 13 Metrical grid representation of the word ‘analysis’

In Figure 5.13, it is illustrated by the most number of x’s that last syllable of ‘analysis’ is stressed in PSE and second dominated syllable is second from the left with two x’s.

LP also explain many stress rules about infixes. For example, they tell about syllables in prefix position of word: ‘light or heavy, typically reduce when followed by a more strongly stressed syllable’ (p. 287). Then they introduce the concept of ‘extrametrical syllable’ while discussing s suffix ‘y’ which according to them ‘does not take part in the metrical calculation’ (p. 293). In Metrical theory, the mechanism of “extrametricality” allows a syllable at the edge of the footed span to be skipped. It is noted that in many languages, syllables at word fringes are ignored by stress assignment rules. Such syllables are said to be “extrametrical”. In that case, the last syllable is invisible to the rules which assign stress.

In English, these extrametrical syllables are commonly found on the right edge of the tri-syllable words, if the stress is antepenultimate. On the other hand, in PSE no antepenultimate stress pattern is found as concluded after spectrographic analysis of stress patterns of PSE in section 4.3. Therefore in tri-syllable words extrametrical syllable is on the left edge if the ultimate stress is formed; or with penultimate stress extrametrical syllable occurs on the right edge. It instantiates the foot pattern of PSE, i.e. it makes ‘right-headed foot’. This theory is important in a sense that it does not only explain the stress

rules of English but also discusses the other levels in the hierarchy, i.e foot patterns.

Moreover, its structural representation of stress phenomena and prosodic process in the form of tree or grid is also more illustrative.

In the early 1970's, attempts to describe the phonology of tonal systems led to important changes in assumptions about representations, and a concurrent shift of attention on the part of phonologists. The development of multidimensional phonological representations in 1970's was largely motivated by the realization that the SPE framework, in which underlying representations (URs) consisted of linear (one-dimensional) segments, was not able to explain adequately certain properties of tone languages, nor in fact various aspects of prosodic phonology such as lexical stress in English. This reorientation of phonology in 1970's was termed as "autosegmental". The name "autosegmental" derives from the notion of "autonomous segment" referring to the relative independence of some features. Unlike generative approach, the autosegmental approach to phonology recognized the fact that URs may be multidimensional in which segments are arranged on separate or *autonomous* levels or tiers (hence the name *auto-segment*). It was stated that stress was not the property of a segment, rather it was something higher than the segment. Thus, Phonological rules could apply independently to the segments at these autonomous levels, although the segments always remain linked to each other. The tiers were linked to each other with the help of "association lines".

Based on autosegmental approach to phonological processes such as assimilation and tone ; Hagberg (1993) presents the autosegmental theory of stress which proposes that stress is strictly autosegmental so all feet are intrinsically headless, and stress is always assigned to a foot or any other domain by the application of the principles of autosegmental theory. This theory rejects the hierarchical nature of foot patterns which are

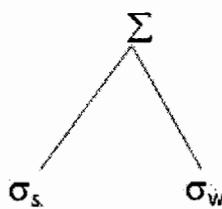
based on the stress patterns, but stress and metrical feet are claimed to be separate entities, where stress can be associated with the domain of foot.

‘Theory of Prosodic structure’ is another rule-based theory which discusses stress as one important level in the hierarchy of prosodic structure and it is ‘cycle-less theory’. Selkirk (1980, p. 568) proposes that the analysis of the stress system of any language, particularly English, consists of the following two factors:

First, in defining for that language a set of prosodic well-formedness conditions, which specify how well-formed syllables, stress feet, and prosodic words are constituted. Second, in specifying the syntactic domain within which these conditions obtain, that is, within which the segments of a phonological representation are grouped into well-formed syllables, the syllables into well-formed stress feet, and the stress feet into well-formed prosodic words.

She proposes two basic types of stress feet in English: monosyllabic, which contains one stress syllable; and bisyllabic, which consists of two syllables with stressed on the left and unstressed on right. On the other hand, in PSE bisyllabic stress feet has stressed syllable on the right and unstressed on the left. Bisyllabic stress feet of English and PSE are illustrated below in Figure 5.14 (a) and (b) respectively.

(a)



(b)

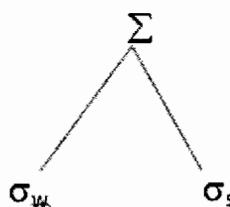


Figure 5. 14 Bisyllabic stress feet of English and PSE

In Figure 5.14 Σ represents foot, σ_w is used to show 'weak syllable' i.e unstressed and σ_s is illustrating 'strong syllable' i.e stressed syllable. Thus foot of English (a) and PSE (b) are different in the position of stressed syllable. In English foot stressed syllable is on the left, whereas PSE foot carries stressed syllable on its right.

The final version of this approach is demonstrated through constraints-based theory (OT). The detailed OT analysis of the stress of PSE can be seen in chapter 6 below.

5.2.3 The loose-requirements approach

Burzio (1994) presents the analysis of 'English word stress' under this approach which does not believe in any exception in the stress phenomena, instead formulates such adaptable patterns that cover every possibility and form normal stress patterns. This

analysis is based on previous theories of stress presented in section 5.2.2 above but with major disagreements which lead to the following proposal:

- i. English foot structure is flexible which allows not only binary foot with trochaic pattern but also ternary foot. This proposal covers not only all exceptions of the words which are proposed to have 'extrametrical syllable' on any edge of the word but also some of the word medially as well. For example: Phe(nò.me.no)ló.gic. On the basis of this proposition, the following two foot types are suggested, where H is for heavy syllable, L for a light syllable and ϕ for an empty syllable:

- a) Trochaic ($H\sigma$): It makes three possible structures (HL), (HH), ($H\phi$). It is interesting that in these structures, there is no monosyllable foot structure as ($H\phi$) contains empty structure; and there is no binary foot with two light syllables i.e. (LL). However (HL) is never proposed before as a possible English foot structure because 'trimoraic' trochaic foot is not allowed.
- b) Ternary ($\sigma L\sigma$): It makes four possible structures (HLH), (HLL), (LLH), (LLL).

In the light of above given proposed foot types, no ternary foot type is found as far as PSE is concerned. However, in binary foot type 'iambic foot' occurs with the following structures: ($H\phi$), (L \acute{L}), (L \acute{H}).

ii. Morphology and phonology are Interdependent which is maintained in a way that stress relies on the type of lexical organization. It is presented in the following hierarchical ranking:

- a) Metrical Well-formedness
- b) Metrical consistency
- c) Metrical Alignment

(Burzio, 1994, p. 313)

In the above given hierarchy, 'Metrical Well-formedness' is a condition which must be followed in every metrical structure within the designated range of possible feet. 'Metrical Alignment' refers to the group of supplementary conditions such as: the strong retraction condition, restricting feet binarity with preceding weak foot; Alignment of metrical structures with left and right edges. 'Metrical consistency' tells about the consistency in morphemes and incorporates a variety of phenomena such as: stress preservation, suffix consistency, stem selection.

In summary, to avoid any space for exceptions in the stress patterns of English, this approach allows flexible patterns of English foot that is it can be binary as well as ternary. While other approaches explained English foot strictly as 'binary' only by accommodating exceptions with the explanation of certain other stress relevant principles such as 'extrametricality', 'retraction' 'reduction of vowel'.

5.2.4 The inviolable-constraints approach

Duanmu, Kim, and Stiennon (2005, p. 57) introduced this new approach about the stress process by commenting on the 'violable' characteristic of the constraints in OT. Instead, they present 'inviolable phonological constraints that hold for all words'. They believe that this set of inviolable constraints is good for all and all forms satisfy the same

set. They present the following set of three constraints on foot structure and stress of English:

- a) A foot is obligatory to be bi-syllabic
- b) The possibility of occurrence of empty syllable \emptyset is only in final position of a foot.
- c) Stress must fall on heavy syllables

On the basis of these above given constraints, the following two types of foot are possible: moraic foot or 'moraic trochee' ($H\emptyset$) which consists of one heavy syllable with two moras; and syllabic foot which they call 'dual-trochee' consisting at least one moraic foot and one light syllable (HL) or two moraic feet (HH) in which both the syllables carry stress as in 'al.pine' (HH) $\acute{\sigma}\acute{\sigma}$. According to these foot types, there are three different degrees of stress found in English word stress patterns:

- a) H in the right edge of the foot carrying main stress as in *panda* (HL) $\acute{\sigma}\sigma$
- b) Other H which carries secondary stress as in *alpine* example above
- c) L which does not carry stress

However, in PSE as (LL) foot structure is found, so stressed L is possible. It is important to note that this inviolable-constraints approach presents only a very small set of constraints, which does not cover other important aspects such as directionality of foot formation, parsing of syllable. In this case, the proposed set of 'inviolable-constraints' is just like the 'un-dominating constraints' of OT; which are also not violable in all forms.

5.3 Conspectus

This chapter discusses the prosody of PSE in the light of phonological theory. Three important suprasegmental features such as syllable, stress and foot are

explained by discussing various phonological approaches to highlight the syllable structure, syllabification, phonotactics, syllable weight, stress patterns and foot patterns of PSE. Moreover, it focuses on the differences in the syllable template, stress patterns and foot patterns of English (American or British) and PSE. Some of the important differences are summarized below:

- In poly-syllabic words of PSE cluster of three consonants is not allowed word internally. It infers that this variety of English does not follow MOP.
- The weight of the syllable is not only based on the quality of vowel but unlike English also on the quality of consonant at the coda position, i.e. forceful production of consonant at coda position. So, heavy syllable is one with long vowel (V:) or diphthong (VV) or vowel followed by consonant(s) produced forcefully (VC[!])
- According to two parameters i.e. 'empty nuclei' and 'branching rhymes' of GvP English licenses both of these parameters; on the other hand, PSE admits only 'branching rhymes' but it does not permit 'empty nuclei' which means syllable without vowel as a nucleus. In PSE every syllable must contain vowel as a nucleus, none of the sonorant consonants like [l], [m], [n] etc. can be syllabic while they are syllabic in some other varieties of English.
- Weight-sensitive stress patterns of PSE is 'Right Edge' that is: stress on ultimate, i.e. final or penultimate, i.e. second last syllable; whereas English has 'Right-oriented' pattern in which the antepenultimate, i.e. third last syllable is also involved.

- The 'CSR' of SPE is about stress on the left edge of the compound (as Chomsky 1967 gave examples from American English); in contrast, right edge of the compound word is stressed in PSE.
- In term of parametric approach and metrical theory, PSE is also different in 'headedness' of its foot which is right-headed i.e. 'iambic' unlike English which forms 'trochaic foot'.
- PSE is also studied in term of constraint-based approach to know how it is different in syllable structure, stress and foot patterns from any other variety of English. The OT analyses of syllable structure and stress patterns are presented with the appropriate ranking of relevant sets of constraints in chapter 6 below.

CHAPTER 6

OPTIMALITY THEORY (OT) ANALYSES OF SYLLABIFICATION, STRESS AND FOOT PATTERNS IN PSE

After presenting spectrographic analysis, and the descriptive generalizations and general tendencies about the syllable structures, stress and foot patterns of PSE in Chapter 4; and explanation of prosody of PSE with the application of different phonological theories in Chapter 5; this Chapter (6) presents OT analyses to describe syllabification, stress and foot patterns in the framework of OT. OT, as a model of metrical phonological analysis, is discussed in detail in section 2.7. This chapter presents the application of OT and working on its architecture. It is divided into two main sections: the OT analyses of syllabification patterns, and word stress and foot patterns in PSE are presented in section 6.1 and 6.2 respectively.

6.1 OT Analysis of Syllabification patterns in PSE

This section deals with the description of syllable structures of PSE in the framework of OT. It provides details of universal syllable constraints ranking procedure and interaction with one another, competition of different candidates and development of OT grammar of syllabification patterns in PSE. All relevant constraints to describe syllable structure have been discussed in 2.7.1. above. The ranking procedure of these constraints according to the syllable structures of PSE is given in 6.1.1. OT model is applied on various inputs of PSE by forming Tableaus which is presented in 6.1.2. This section ends with the summary of OT grammar of syllabification patterns of PSE in 6.1.3.

6.1.1 *Interaction of Syllable Constraints and Ranking*

In OT analysis, important issue is to decide the grammar, that is hierarchy of constraints. For this purpose VCM is suggested as a useful method (discussed in section 3.4), the following table is prepared to show the dominance relation of the constraints for the ranking of these constraints on syllable patterns.

Table: 6. 1 Syllable constraints ranking via VCM

Syllables of PSE	Peak	Faith C	Faith V	Onset	*Complex	No-Coda	SLH	Son-Seq
1. V	✓	-	-	*	✓	✓	-	-
2. VV	✓	-	-	*	*	✓	-	-
3. CV	✓	-	-	✓	✓	✓	-	-
4. VC	✓	-	-	*	✓	*	-	-
5. CVC	✓	-	-	✓	✓	*	-	-
6. CVV	✓	-	-	✓	*	✓	-	-
7. CCV	✓	-	-	✓	*	✓	-	-
8. VCC	✓	-	-	*	*	*	-	-
9. CCVC	✓	-	-	✓	*	*	-	-
10. CVVC	✓	-	-	✓	*	*	-	-

11. CVCC	√	-	-	√	*	*	-	-
12. CCVV	√	-	-	√	*	√	-	-
13. CCCV	√	-	-	√	*	√	-	-
14. CCVCC	√	-	-	√	*	*	-	-
15. CVVCC	√	-	-	√	*	*	-	-
Total number of Violation s:	0	-	-	04	11	08	-	-

In this Table 6.1, the first column from the left shows syllables of PSE and eight syllable constraints are presented in the top row (detail of syllable constraints is given in section 2.7.1). Symbol √ indicates NO violation of a constraint at the intersection of the syllable row and constraint column and asterisk symbol * shows the violation of constraint. Whereas, the symbol - is used to show insufficiency of computing the (in)violation of constraint from the given data, which is general patterns of syllabification in PSE. It can be seen that in the above table four constraints i.e. 'Faith V, Faith C, Strict

Layer Hypothesis (SLH) and Son-Seq are filled with – mark. The reason for Faith V and Faith C is that these are faithfulness constraints and can only be evaluated in relation to input and output, whereas VCM computes violations of the input only but not focusing any output. While violation of SLH and Son-Seq constraints can be judged by looking at the affiliation of segment with the node in its hierarchy and sonority value of the segment respectively. So, violations for these constraints can be accessed with the help of ‘violation tableaus’ by providing words forming these syllabification patterns and by comparing optimal candidate with sub-optimal candidates (detail is presented in section 6.1.2). The bottom row of Table 6.1 illustrates total number of violations made by syllable structures of PSE with reference to each constraint.

Table: 6. 2 Syllable constraints' violations summary

Sr no.	Syllable constraints	No. of Violations in PSE
1	Peak	0
2	Onset	4
3	No-Coda	8
4	*Complex	11
5	Faith V	-
6	Faith C	-
7	SLH	-
8	Son-Seq	-

In Table 6.2 syllable constraints' violations summary is presented from top to bottom in order of increasing number of violations. After getting the summary of number of constraints violation, a relation of constraints violations and constraints ranking can be established by formula of VCM:

$$\text{No. of V} \propto \frac{1}{CR}$$

So, with the application of VCM the grammar of syllabification patterns of PSE can be described by the following syllable constraints hierarchy:

Peak » (undominated) Onset » No-Coda » *Complex

In this hierarchy Peak is higher in ranking and is undominated by other three constraints because it shows NO or '0' violation. Then comes Onset whose number of violations is '4' which is greater number of violation than that of higher-ranked constraint 'Peak' but smaller than No-Coda which shows '8' violations. The lowest-ranked constraint in this hierarchy is '*Complex' with highest number of violations i.e. '8'. Last four constraints in the Table are not included in the hierarchy because of inadequacy of computing their number of violations from the generalized syllabification patterns. Interaction of unranked syllable constraints is presented below.

After the first step of syllable constraints ranking through VCM, the following hierarchy is made:

Peak » (undominated) Onset » No-Coda » *Complex

Now, the interaction of the unranked constraints i.e. 'Faith V, Faith C, Strict Layer Hypothes (SLH) and Son-Seq can be done to finalize the complete domination relation of full set of syllable constraints. As it is obvious from the properties of syllabification

patterns in PSE that epenthesis and deletion of any segment from the syllable is not allowed, so, Faith V and Faith C constraints are also included in the undominated constraints. Then the ranking can be demonstrated like this:

Peak, Faith V, Faith C (undominated) » Onset » No-Coda » *Complex

After that, the interaction of remaining two constraints which are SLH and Son-Seq has to be made. To accommodate the string of segments such as 'str' as in 'straight' and many other such sequences in the onset as well as coda position of the syllable in PSE, SLH has to be dominated by Son-Seq. So, Son-Seq should be higher in ranking than SLH and their dominance relation can be represented like this:

Son-Seq » SLH

Finally, some logic is required to put these two constraints in the overall ranking. Before the issue of sonority sequencing rises there must be violation of *Complex constraint that is why Son-Seq constraint needs to be placed before *Complex. It is also noteworthy that every complex form does not need to violate SLH for the sake of avoiding violation of Son-Seq, therefore *Complex dominates SLH. Clusters in onset and coda position are allowed only if they follow 'phonotactic conditions' which are mostly favoring SSG, as discussed in chapter 5 above and if some allowed clusters (s, p/t/, r etc.) violate SSG then SLH will cover this violation, that is the reason to add Son-Seq as the undominated constraint. So, the final syllable constraints' ranking to represent the grammar of syllabification patterns in PSE follows:

Peak, Faith V, Faith C » Son-Seq (undominated) » Onset » No-Coda » *Complex »

SLH

6.1.2 OT Analysis of syllabification patterns in PSE

This section presents OT analysis of syllabification patterns of PSE which determines surface outputs by constraints; for a given Input. As a hierarchy of syllable constraints has been set up above, now it chooses the optimal form from a set of candidate outputs. This selection of the ‘harmonic candidate’ in the syllabification pattern of word ‘rehearse’ is illustrated in Tableau 6.1 below.

Tableau: 6.3 Syllabification pattern in ‘rehearse’

Input: / rɪ.hərs /	Peak	Faith V	Faith C	Son-Seq	Onset	No-Coda	*Complex	SLH
(a) → (rɪ.hərs) (CV.CVCC)						*	*	
(b) (rɪh.ərs) (CVC.VCC)					*			
(c) (rɪ.hə.rs) (CV.CV.CC)	*!							
(d) (rɪh.ərs) (C.VC.VCC)	*!							

In Tableau (6.1), constraints are arranged across the top of the tableau in domination order; each violation of a constraint is shown by an asterisk and the fatal violation of Peak constraint, which is un-dominated, is shown by asterisk and exclamation

mark; The symbol \rightarrow is used to pinpoint the optimal candidate by following OT Tableau tradition. Undominated constraints, which show no domination relation in the hierarchy, are presented in the columns with broken lines. Table 6.1 above shows that output (a) is selected as an optimal candidate with the violation of lower-ranked constraints. Whereas output (b) makes violation of higher ranked constraint Onset so cannot be selected as winning candidate. Candidates (c) and (d) are also looser candidates with fatal violation of higher-ranked constraint Peak.

It is discussed in section 5.2 that there is one difference in the syllabification patterns of PSE and native English variety that PSE does not allow cluster of three consonants in the onset position of syllable occurring word medially. For the OT analysis of syllabification patterns word internally in PSE, a Tableau of a word /eks.trim/ from PSE is made to know how grammar of PSE that is ranking of constraints selects one optimal candidate. The violation Tableau (6.2) below represents this analysis of word 'extreme', in which this word has different syllabification pattern in native variety of English, i.e. /ek.trim/ with cluster of three consonants in onset position word internally.

Tableau: 6.4 Syllabification pattern in 'extreme'

Input: <i>/eks.trim/</i>	Peak	Faith V	Faith C	Son-seq	Onset	No-Coda	*Complex	SLH
(a) (eks.trim)					*	**	**	*
(VCC.CCVC)								

(b) (ek.strim) (VC.CCCVC)				*	**	**	*
(c) (eks.tri.m) (VCC.CCV.C)	*!						
(d) (ekstr.im) (VCCCC.VC)				**	**	*	*

It is obvious from Table 6.4 that above given ranking of constraints is unable to choose one 'winning candidate'. Output (a) and (b) are equally harmonic by showing equal number of violations of same constraints. Interestingly, (a) is a real candidate of PSE and (b) is from native variety of English. It infers that above given syllabification pattern ranking is insufficient to analyze the difference of consonants cluster word medially of these two varieties of English. It means there is need of some more constraint(s) in the hierarchy to analyze this difference. From the above analysis it is clear that PSE does not allow complex onset of three consonants whereas native variety of English does so. To capture this difference there is need to add complex constraint with difference of preference in onset and coda position. As mentioned in the section 2.7.1 that *Complex can be further specified into two constraints: *Complex-Onset (*Comp-Ons) $CC\sigma$ or *Complex-Coda (*Comp-Coda) σCC . The symbol used for these constraints to be included in the ranking of PSE syllabification patterns are modified as $CCC\sigma$ and σCCC because it is proved from analysis of 'extreme' Table 6.4 that it is cluster of three

consonant which is prohibited in PSE cluster of two consonants and one consonant is allowed. So, these two constraints require to be ranked higher in the list of dominated constraints. Finally, the full constraint ranking for the syllabification patterns interactions studied in this section is given below:

Peak, Faith V, Faith C, Son-Seq (undominated) »

CCCσ » σCCC » Onset » No-Coda » SLH

Now re-evaluation of the word 'extreme' is presented with final full ranked constraints in Table 6.5

Tableau: 6. 5 Re-evaluation of syllabification pattern in 'extreme'

Input: <i>/eks.trim/</i>	Peak	Faith V	Faith C	Son-Seq	CCCσ	σCCC	Onset	No-Coda	SLH
(a) → (eks.trim) (VCC.CC VC)							*	**	*
(b) (ek.strim) (VC.CCC VC)					*		*	**	*

(c) (eks.tri.m) (VCC.CC V.C)	*!								
(d) (ekstr.im) (VCCCC. VC)					**	**	**	*	

This reanalysis of 'extreme' on the basis of syllabification patterns grammar of PSE with inclusion of modified constraints successfully chooses the most harmonic candidate (a) from all other outputs (b-d) which make violations of higher-ranked constraints.

6.1.3 *Summary of OT Analysis of syllabification patterns of PSE*

First, explanation of all syllable constraints is presented in section 2.7.1. By applying VCM method in section 6.1.1 on the general syllable structures of PSE, researcher gets an idea about the ranking order of the most of the syllable constraints then the dominance relation of some of the unranked constraints is evaluated by their interaction with other constraints in section 6.1.2. It is noted from the analysis of syllabification pattern of word 'extreme' that the general full ranking on the grammar of syllable structures of PSE is not sufficient to capture the difference of syllabification pattern of this word in PSE and any native variety of English. Hence, *Complex constraint is replaced by two modified constraints i.e. σCCC and $CCC\sigma$ to evaluate the

nonoccurrence of cluster of three consonants in the syllable of PSE word medially in section 6.1.3. It is seen in the grammar of syllabification patterns in PSE total nine constraints are relevant. From which, following four constraints are undominated: Peak, Faith V, Faith C, Son-Seq ; whereas remaining five has dominance relation given as follows:

CCCσ » σCCC » Onset » No-Coda » SLH

So, the overall grammar of syllabification patterns in PSE is formulated by the following full ranking of nine constraints:

Peak, Faith V, Faith C, Son-Seq (undominated) »

CCCσ » σCCC » Onset » No-Coda » SLH

6.2 OT Analysis of Word Stress Patterns of PSE

In this section, 6.2.1 provides discussions on the interaction of these constraints to rank them according to the stress patterns of PE; in 6.2.2, OT is applied on the word structures of PE to choose the Optimal candidate to describe the word stress patterns; and 6.2.3 presents the summary of OT analysis of word stress and foot patterns in PSE.

6.2.1 *Interaction of Constraints and Ranking*

To give proper ranking according to the stress patterns of PSE variety to the above mentioned constraints, the interaction of stress constraints is essential. For OT analysis of PSE stress patterns, ranking of ten constraints is included, which embody all of the substantive properties of Stress patterns of PSE and are originally suggested by founders of OT (Prince & Smolensky, 1993/2004). The first step ranking of the stress constraints with the help of VCM is presented.

A table for the computing of constraints violation and ranking of stress constraints with the help of VCM is prepared. The overview of dominance relation of stress constraints can be seen in Table 6.6 .

Table: 6. 6 Stress constraints ranking via VCM

Word Structures of PSE	Ft Bin	Lx≈Pr	Rh Type:I	WSP	Parse μ	Rh- Hrm	Align-L	Parse σ	Non-Fin	Edge-R
1. (LH̄)	✓	✓	✓	✓	-	✓	✓	✓	*	✓
2. (LL̄)	✓	✓	✓	✓	-	✓	✓	✓	*	✓
3. (H̄) L	✓	✓	✓	✓	-	✓	✓	*	✓	*
4. (LH̄)L	✓	✓	✓	✓	-	✓	✓	*	✓	*
5. L(LH̄)	✓	✓	✓	✓	-	✓	*	*	*	✓
6. (H̄)(LL̄)	✓	✓	✓	✓	-	✓	✓	✓	*	*
7. (LL̄)(LH̄)	✓	✓	✓	✓	-	✓	✓	✓	*	✓
8. (LH̄)(LL̄)	✓	✓	✓	✓	-	✓	✓	✓	*	*
9. L(LH̄)L	✓	✓	✓	✓	-	✓	*	*	✓	*
10. L(LH̄)(LL̄)	✓	✓	✓	✓	-	✓	*	*	*	*
11. (LL̄)(LH̄)L	✓	✓	✓	✓	-	✓	✓	✓	✓	*

12. (H̄)(L̄)(H̄) L	√	√	√	√	-	*	√	*	√	*
13. (H̄)(LH̄)(L L̄)	√	√	√	√	-	√	√	√	*	*
14. (L̄)(LH̄)(L̄L̄)	√	√	√	√	-	√	√	*	*	*
Total number of Violations:	0	0	0	0	-	01	03	07	09	10

This Table 6.6 contains all occurring fourteen word structures of polysyllable words of PSE in the first column from the left and all stress based constraints (total ten in number) in the top row (detail of stress constraints is given in section 2.7.2). Number of violations of Parse μ constraint cannot be computed in above given Table 6.6 because it is also faithfulness constraint and can be evaluated on the basis of actual word by knowing the number of segments in rhyme part of its syllable(s), number of mora μ and parsing of μ . Discussion and interaction of 'Parse μ ' with other constraints is presented in section 6.2.2 below. The bottom row of the Table shows the total number of violations of each stress constraint done by word structures in PSE. This simple process helps in deciding about the proper ranking of the stress constraints also. All those constraints (1-4) which are not violated by any word structure are considered as 'undominating' constraints, which are put as higher-ranked constraints. Similarly, remaining constraints are ranked in order

of increasing number of violations from right to left that is lesser the number of violations higher the constraint in ranking. So, by putting the calculated number of violations of constraints from the Table 3.3 above, stress constraints hierarchy can be made. A summary of the results of constraints' violations computed can be seen in Table 6.7.

Table: 6. 7 Stress constraints' violations summary

Sr no.	Stress constraints	No. of Violations in PSE
1	$Lx \approx Pr$	0
2	Ft-Bin	0
3	Rhythm Type: I	0
4	WSP	0
5	Rh-Hrm	1
6	Align-L	3
7	Parse σ	7
8	Non-finality	9
9	Edge-R	10
10	Parse μ	-

This Table 6.7 illustrates the summary of totalled number of violations in stress patterns from the data of PSE, in order of increasing number from top to bottom, and helps in finalizing the stress constraints hierarchy with the help of simple formula of VCM.

According to VCM, following constraints hierarchy fits to describe the grammar of stress and foot patterns of PSE:

Lx≈Pr, Ft-Bin, Rhythm Type: I, WSP (un-dominated) »

Rh-Hrm » Align-L » Parse σ » Non-finality» Edge-R

This hierarchy is further verified by processing the interaction of stress constraints with the help of violation tableaus below as suggested by Prince & Smolensky (1993/2004).

Following is the ranking of stress constraints done via VCM:

Lx≈Pr, Ft-Bin, Rhythm Type: I, WSP (un-dominated) »

Rh-Hrm » Align-L » Parse σ » Non-finality» Edge-R

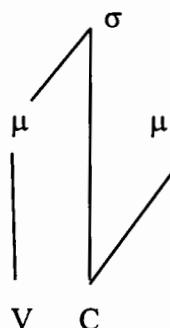
It can be seen from above given ranking that some constraints are un-violable and are un-dominated in the grammar of PSE; while other are ranked in order of dominance. Un-dominated constraints in PSE variety are discussed in Section 6.2.2.1 and dominated constraints are presented in 6.2.2. 2 dominance relation of all constraints (ten) is demonstrated in 6.2.2.3 below for further verification of VCM and to rank Parse μ which remained unranked in VCM.

6.2.1.1 Un-dominated Constraints

Some of the constraints mentioned above are un-dominated in PE. According to the data of PE, it is clear that every lexical word carries stress on any of the syllable which becomes head of the foot and all feet are binary in nature either at the level of μ or at the level of σ . For example in PE the word 'analysis'[ə, næ: . ɪ, ˈsiz] there is secondary

stress on the second syllable and primary stress on the final syllable of the word. It makes two feet which are binary at the level of σ . It is also clear from this example that both the feet are right headed, which shows that rhythmic type of PSE variety is 'Iambic'. As in phonetic transcription of word 'analysis' it is shown that primary stress is on the ultimate syllable of the word, which is heavy and secondary stress is on the second syllable from the left, which is also heavier than the syllable on its left; It is obvious that 'weight to stress principle' is fulfilled in PE.

Iambic foot pattern allows not only even foot structure i.e. (L \acute{L}) and (H \acute{L}) but also uneven one (LH \acute{L}); but Trochaic foot pattern allows only even foot structure i.e. either (L \acute{L}) or (H \acute{L}). Moreover, In English FT-Bin is allowed at μ level only So if (HL) structure occurs in Languages like English whose foot pattern is Trochee, It violates 'Parse μ ' constraint by making (H) as (H-) as 'unparsed syllable- closing Mora' shown below (Prince & Smolensky, 2004, P.78) to satisfy FT-Bin, which is un-dominated constraint in English.



Whereas, PSE variety allows FT-Bin at both the levels that is μ and σ (as discussed before). So, 'Parse μ ' is un-violated constraint in PSE. In the light of the above discussion following five constraints are considered as un-dominated in PSE:

1. $Lx \approx Pr$
2. Ft Bin
3. Rh Type = I
4. WSP
5. Parse μ

6.2.1.2 Dominated Constraints

In this section, dominance relation of remaining five constraints is presented. First, conflict between Rh-Hrm and Align- L is illustrated in the violation Tableau 6.1 below:

Tableau: 6. 8 Conflict between Rh-Hrm and Align- L

Mi.ti.gate: LLH	FT-Bin	Rh-Hrm	Align-L
a) $\rightarrow (L\acute{H})$ Mi.ti.gaté			*
b) $(LL) (\acute{H})$ Mi.ti.gaté		*	
c) $(L) (L\acute{H})$ ` Mi.ti.gaté	*		

It is obvious from Tableau 6.8 that the optimal candidate (a), which is marked with an arrow, is favored by Rh-Hrm but violated by Align-L. So Rh-Hrm is ranked on higher position than Align-L as shown below:

Rh-Hrm » Align-L

In Tableau 6.5 below conflict between Parse σ and Non-finality is presented.

Tableau: 6.9 Conflict between Parse σ and Non-finality

Input: LL LH LL	Parse σ	Non-finality
a) $\rightarrow (LL)(LH)(LL)$		*
b) (LL) L (H) (LL)	*	*

The conflict between two constraints can be seen from above Tableau (6.9), hexa-syllable word structure (LL LH LL) is shown as input on top of first column. Parse σ constraint supports an optimal candidate (a) but Non-finality constraint shows violation for optimal candidate. So, Parse σ is dominating Non-finality as shown below:

Parse σ » Non-finality

In the end, Edge- R constraint comes, which is mostly violable in PE variety as shown in stress constraints' violations summary Table above. Tableau (6.10) illustrates interaction of Edge-R and non-finality.

Tableau: 6. 10 Interaction of Edge-R and Non-finality

Input: LHL	Rhythm Type: I	Non-finality	Edge-R
a) $\rightarrow (L\acute{H})L$			*
b) $L(\acute{H} L)$	*		
c) $(L\acute{H} L)$	*		

The optimal candidate (a) of above given Tableau is favoured by other two constraints given in column 2 & 3 but Edge-R is violating optimal candidate.

6.2.1.3 Dominance relation of all stress constraints

After discussing all the constraints of stress, the following dominance relation of all constraints describes the location of main and secondary stress in PE along with its foot patterns.

$Lx \approx Pr, Ft\text{-Bin}, \text{Rhythm Type: I, WSP, Parse } \mu \text{ (un-dominated)} \gg$

$Rh\text{-Hrm} \gg Align\text{-L} \gg Parse \sigma \gg \text{Non-finality} \gg Edge\text{-R}$

From the above hierarchy it is seen that total five constraints are un-dominated in PE including $Lx \approx Pr$ constraint. FT-Bin is also undominated but in PE feet are binary not only at moraic level but also at syllable level with (LH) feet. The present study found iambic rhythm type in PSE (see section 4.3). So, Rh Type: I along with WSP are added as un-dominated constraints for PE stress patterns. Fifth un-dominated constraint in PE is Parse μ with many heavy or super heavy

syllables with two or three morae (μ) and every μ is parsed into syllable in PE which allows uneven Iamb i.e. (LH).

The rest of five constraints out of ten are dominated in PE which include: Rh-Hrm , Align-L , Parse σ , Non-finality, Edge-R . Rh-Hrm and Align-L are dominated constraint but true in PE as in BSE. Similarly, BSE as well as in PE Parse σ constraint is managed with the effect of extra-metricality. But it is violable constraint in PE.

In English Nonfin (σ) is true as English forms trochaic feet, which are left-headed; whereas PE does not support this constraint as formation of Iambic which is right-headed foot is explored and reported in this study in the previous chapter. So it is violable constraint in PE variety. Whereas, like BSE Edge-R is true in PE, as the main stress usually fall on the right most foot of the word.

6.2.2 *OT Analysis of Word Structures of PE*

As shown in Chapter 4, there are fourteen different word structures of PSE. This section presents OT analysis of all of these word structures. OT analysis of Bi-syllable word structures is given in (6.2.3.1), Tri-syllable word structures in (6.2.3.2), tetra-syllable word structures in (6.2.3.3), penta-syllable word structures in (6.2.3.4) and hexa-syllable word structures in (6.2.3.5) below. OT Analyses of all words are demonstrated in the form of Tableaus.

In all the tableaus, Constraints are arranged on the top row of the tableaus in domination order. On the top of the first column, Input is placed and outputs are shown below in the same column. Violation of any constraint is recorded with the asterisk mark (*), and the blankness denotes total success on the constraint. The optimal candidate is pointed with arrow mark (\rightarrow); the exclamation mark (!) indicates crucial failure for each

suboptimal candidate- the exact point where it loses out to other candidates. In each row, cells are shaded to show the failure of the candidate. These theoretically important conventions are from Alan Prince & Paul Smolensky (2004).

6.2.2.1 OT analysis of Bi-syllable word structures

After doing the spectrographic analysis of the bi-syllable words of PE, three different word structures are found in PE. Which are: (1) (LH) (2) (LL) (3) (H) L. Parsing of (LH) is presented in Tableau 6.11, (LL) in Tableau 6.12, and (H)L in Tableau 6.13 below with ranking of all ten constraints to select the optimal candidate.

Tableau: 6. 11 Parsing of LH

Input: LH	Lx≈Pr	FT-Bin	Rh Type: I	WSP	Parse μ	Rh- Hrm	Align-L	Parse σ	* Non-Fin	Edge-R
a) \rightarrow (L H)									*	
b) (LH)			*!							
c) L(H)							*			
d) (LH)	*!									

e) (L)H			*!								
------------	--	--	----	--	--	--	--	--	--	--	--

In Tableau 6.11, it can be seen that candidate (a) is the optimal candidate, which is pointed with an arrow. Candidate (a) violates only one (the low ranked) constraint that is non-finality (σ). This violation is mentioned by putting asterisk in front of candidate (a) under non-finality constraint column. The other four candidates make violation of highly ranked constraints like candidate (b) violates Rh-Type: I, which is un-dominated constraint in PSE. Similarly, candidates (d) & (e) also fatally violate un-dominated constraints $Lx \approx Pr$ and foot binarity (FT-Bin) respectively. Although candidate (c) violates Align-L which is violable constraint but higher in ranking than non-finality. So, candidate (a) knocks out all other candidates because of its minimal violation.

Tableau: 6. 12 Parsing of LL

Input: LL	$Lx \approx Pr$	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	Parse σ	* NonFin	Edge-R
a) $\rightarrow (L$ $L)$									*	
b) (LL)			*!							

c) (LL)				*!						
d) (L)L			*!							
e) L(L)			*!							

In the parsing of (LL), Tableau 6.12 demonstrates that candidate (a): (LL) is the optimal candidate with minimal violation; whereas other four candidates do fatal violation.

Tableau: 6. 13 Parsing of HL

Input: HL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	* Parse σ	NonFin	Edge-R
a) $\rightarrow(\bar{H}$)L										
b) (HL)				*!						
c) (H \acute{L})					*!					

d) H(L̄)		*!								
e) (HL)	*!									

Parsing of (HL) is shown in Tableau 6.13, in which candidate (a) is optimal with minimal violation of Parse σ and all other candidates are sub-optimal because of fatal violations.

6.2.2.2 OT analysis of Tri-syllable word structures

This section presents parsing of three different structures (LHL, LLH, HLL) of tri-syllable words. Parsing of each structure is presented in the separate Tableau. Tableau 6.14 illustrates parsing of LHL, Tableau 6.15 of LLH and Tableau 6.16 of HLL below:

Tableau: 6. 14 Parsing of LHL

Input: LHL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	* Parse σ	NonFin	Edge-R
a)→(L H)L										
b) L(HL̄)			*!							

c)		*!								
(LHL)										
d)				*!						
(LHL)										
e)			*!							
(LHL)										
f)							*			
L(HL)										
g)			*!							
L(HL)										

Output (a), (L¹) L, comes out as a winner candidate with the violation of Parse σ in Tableau (6.10) above. Candidate (f) loses out because of violation of Align-L, which is higher in ranking than Parse σ . Rest of the candidates are eliminated because of their fatal violations.

Tableau: 6. 15 Parsing of LLH

Input: LLH	Lx≈Pr	FT-Bin	Rh	WSP	Parse μ	Rh-Hrm	* Align-L	Parse σ	NonFin	Edge-R
a)→L(L H)										

b) (LL'H)					*				
c) (LLH)		*!							
d)(LL)(H)			*!						
e) (LLH)		*!							
f) (LL'H)				*!					
g)(L)(L H)		*!							

As shown in Tableau 6.15 Candidate (a) wins by satisfying maximum number of highly ranked constraints as compared to all other candidates, who either make fatal violations or violation of constraint higher in ranking than output (a).

Tableau: 6. 16 Parsing of HLL

Input: HLL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	AlignL	Parse σ	NonFin	* Edge-R
a) $\rightarrow(\acute{H})(\acute{L}\acute{L})$										
b) $(\acute{H}\acute{L})\acute{L}$			*!							
c) $(\acute{H}\acute{L})\acute{L}$				*!						
d) (HLL)	*!									
e) $H(\acute{L}\acute{L})$				*!			*			
f) $(\acute{H}\acute{L})\acute{L}$			*!							
g) $(\acute{H})(\acute{L}\acute{L})$				*!						
)										

Tableau 6.16 clearly announces the victory of candidate (a) which violates the lower-ranked constraint Edge-R, as rest of the outputs are knocked out because of their fatal violations.

6.2.2.3 OT analysis of Tetra-syllable word structures

This section displays three Tableaus (6.17, 6.18, 6.19) to illustrate parsing of three different structures of tetra-syllable words (LLLH, LHLL, LLHL) respectively.

Tableau: 6.17 Parsing of LLLH

Input: LLLH	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	Parseσ	* NonFin	Edge-R
a) → (LL)(LH)										
b) L(LL) H				*!						
c) (LLL)(H)		*!								
d) (LL)(LH)			*!							
e) *! (LLLH)										
f) (LL)(LH)				*!						
g) L(LL)(H)						*				

By following the tradition, Tableau (6.17) also places the winner candidate (a) on the top and violations of the remaining loser outputs are shown with customized marks and shading of the cells.

Tableau: 6.18 Parsing of LHLL

Input: LHLL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	Parseσ	NonFin	* Edge-R
a) $\rightarrow(L\grave{H})(L\grave{L})$										*
b) L(H \grave{L})L			*!							
c) L(H \grave{L})L				*!						
d) (L \grave{H})(L \grave{L})				*!						
e) (LHL)L	*!									

In Tableau (6.18) also there is one winner (a) with minimal violation as loser outputs are showing fatal violations of undominated constraints.

Tableau: 6. 19 Parsing of LLHL

Input: LLHL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	* Align-L	Parsec	NonFin	Edge-R
a) $\rightarrow L(L$ H̄L										
b) (L̄L)(H̄)L			*!							
c) (L̄L)(H̄)L					*					
d) L(LH̄L)		*!								
e) (LLHL)	*!									

Tableau (6.19) is also self-explanatory to demonstrate the optimal candidate (a) and rest of losers candidates (b, c, d, e).

6.2.2.3 OT analysis of Penta-syllable word structures

This section presents parsing of penta-syllable word structures LLHLL, LLLHL, HLLHL, HLHLL in Tableaus 6.20, 6.21, 6.22, 6.23 respectively.

Tableau: 6. 20 Parsing of LLHLL

Input: LLHLL	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	* Align-L	Parse σ	NonFin	Edge-R
a) $\rightarrow L(L\acute{H})(L\grave{L})$										
b) $(L\grave{L})(\grave{H})(L\grave{L})$				*!						
c) $(L\grave{L})(\acute{H})(L\grave{L})$)					*					
d) $L(L\acute{H}L)L$		*!								
e) $(L\acute{L}H)L$	*!									

It is clear from Tableau (6.20) that output (b) $(L\grave{L})(\grave{H})(L\grave{L})$ is making fatal violation of WSP by showing primary stress on the light weight syllable. Output (c) is also loser because of violation of Rh-Hrm which is higher constraint in ranking than Align-L. Output (d) violates foot binarity by putting three syllables in one foot. So the optimal candidate is (a) with minimal violation of Align-L.

Tableau: 6. 21 Parsing of LLLHL

Input: LLLHL	$Lx \approx Pr$	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	* Parse σ	NonFin	Edge-R
a) $\rightarrow (L\acute{L})(L\acute{H})L$								*		
b) $(L\acute{L})(L\acute{H})L$				*!						
c) $L(L\acute{L})(\acute{H})L$						*				
d) $L(LL\acute{H})L$		*!								
e) $(L\acute{L})L(\acute{H})L$								**		

In the above Tableau (6.21) Output (b, d) are losers because they fatally violate and candidate (c) loses out with violation of high-ranked Rh-Hrm. But there is interesting competition between candidate (a) and (e) because both violate same constraint but it can be seen that candidate (a) violates Parse σ only once, whereas candidate (e) has made double violation of Parse σ . So, candidate (a) is chosen as a winner according to the conventions of OT which allow only one candidate as an optimal.

Tableau: 6. 22 Parsing of HLLHL

Input:	$Lx \approx Pr$	FT-Bin	Rh Type:I	WSP	Parse μ	* Rh-Hrm	Align-L	Parse σ	NonFin	Edge-R
a) $\rightarrow (\dot{H})(LL)(\dot{H})L$										
b) $(\dot{H})(LL)(\dot{H})L$				*						
c) $H(LL)(\dot{H})L$				*						
d) $HL(L\dot{H}L)$		*								

Fatal violation of candidates (b, c, d) is obvious from Tableau (6.22) and proved to be sub-optimal. So, candidate (a) is the winner.

Tableau: 6. 23 Parsing of HLHLL

Input:	$Lx \approx Pr$	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	Parse σ	NonFin	Edge-R
a) $\rightarrow (\dot{H})(L\dot{H})(LL)$										
b) $(\dot{H})(L\dot{H})(L\dot{L})$								*	**	

c) H(LH̄)(LL̄)					*					
d) (HL̄)(H̄L)L				*						

It can be seen in Tableau (6.23) that in the structure of output (a) the head foot is on the second last position from right edge and this violation is shown with single asterisk (*); on the other hand output (b) has head foot on the third position from the right edge that is two feet away from the right edge so this violation is shown with double asterisk(**). The other two candidates fatally violate the un-dominated constraints. So, output (a) is selected as an optimal candidate with minimal violation.

6.2.2.5 OT analysis of Hexa-syllable word structures

Parsing of six-syllable words structure, the only structure found in hexa-syllable words, is given in Tableau (6.24).

Tableau:6. 24 Parsing of LLLHLL

Input:	Lx≈Pr	FT-Bin	Rh Type:I	WSP	Parse μ	Rh-Hrm	Align-L	Parse σ	* NonFin	Edge-R
a) \rightarrow (LL̄)(LH̄) (LL̄)									*	
b)L(LL̄)(H̄)(LL̄)					*					

c) (L \ddot{L})L(H \acute{L})(L \ddot{L})							*		
d) (L \ddot{L})(LH \acute{L})LL							**		

With the violation of the lower-ranked constraint that is NonFin, candidate (a) turns up as a winner. On the other hand, candidates (b, c) are eliminated because of violation of constraints higher in ranking than NonFin. Now next section (6.2.4) provides the summary of OT analysis of Stress patterns of PSE variety.

6.2.3 *Summary of OT Analysis of Word stress and Foot Patterns*

Some fundamental concepts of OT related to Stress have been applied in section 6.2. It is seen that after the interaction and then the proper ranking of the constraints, correct stress pattern of PSE can be described. In two types of constraints discussed in section 6.2.1 above, some are dominated and others are un-dominated. Among the markedness constraints, Ft-Bin, Rh-Type:I, and WSP are un-dominated; and in faithfulness constraints Lx \approx Pr, and Parse μ are un-dominated. Four conflicting constraints, Rh-Hrm, Align-L, Parse σ , and Edge-R interact with each other to correctly predict stress patterns. And NonFin is put in the last of the constraint ranking as it is mostly violated in PSE because of Iambic foot patterns. Then parsing of all fourteen word structures is shown with complete ranking of stress constraints in Tableaus; in which candidates that best satisfy constraints emerge as the optimal one. So, stress which is considered to be unpredictable by Jensen (1993) or as predictable field it is discussed with so many exceptions as often occur in rule-based approach including SPE (1968), Liberman & Prince (1977), Hayes (1980 and 1994); but in OT framework the descriptive generalizations of stress and foot

patterns of PSE variety are analyzed successfully without any exceptions as regularities but just with minimal violations of low-ranked constraints.

CHAPTER 7

CONCLUSIONS

This chapter discusses the findings in the light of other phonological theories and OT, and comparison of syllabification and stress patterns of PSE with native variety of English (section 7.1) and concludes with the future research perspectives (section 7.2).

7.1 Conclusions

This study embarked upon the topic of syllabification and stressing in PSE. It was found that the PSE stress system consists of three different levels of stress, which are major or primary stress, minor or secondary stress and zero or unstressed. It examines word stress in simple words, derivatives and compound words by identifying acoustic signals of prominent syllables and in the light of phonological theories. The study also investigated morphological/ syntactical and phonological interactions. It makes reference to morphological domain, that is affixes; syntactic domain such as words; and two kinds of prosodic domain: the syllable and the foot.

The word stress system of PSE differs from that of the native varieties of English; the strategies for stress placement are definable to a large degree. For example, about occurrences of secondary stress, it was noted that unlike BSE, in PSE, secondary stress is not placed on any of the bi-syllabic words. Some of these strategies reflect the speakers' knowledge of a few general rules of English stress, while others are autonomously caused by the indigenized variety of English of the Pakistani speakers (detail of Urdu stress patterns is given in section 2.3.3). The following examples are the direct outcome of the indigenization of PSE variety: no antepenultimate stressing in polysyllabic words, no

noun-verb stress alternation or no contrastive stress, right-headed foot, breaking of consonants cluster, no occurrence of syllabic consonants and gemination.

Roca and Johnson (1999) discuss segmental evidence for stress in the form of allophonic variation of /t/ which becomes /ɾ/ or /?/ in the unstressed syllables. It instantiates the weakening of consonant because of the effect of weak or unstressed syllable; while in PSE segmental substantiation for stress is seen in the form of presence of forceful production of consonants in stressed syllable, for example, in PSE in the stressed syllable /t/ may become /t'/ as in [in.vest.mént']. Hence, in this variety, two kinds of codas are found which phonetically behave differently, which is one with forceful production and other is weak. This difference is a phonetic correlate of lexical stress in PSE (see section 4.3 for detail).

In PSE, stress also affects vowels distribution in a syllable. Vowels of stressed open syllable are always tense and closed stressed syllable may have lax vowel with fortified coda. However, a syllable containing /ə/ as a nucleus never carries primary stress even if fortified coda is occurring.

The morphological structure of words also affects stress position in this variety. Primary stress is only occurring in roots of words; and affixes, prefix and suffix, are either unstressed or carry secondary stress. It is found that bisyllable suffixes such as 'i.ty, a.rry, o.ry' carry secondary stress on the final syllable.

In the syllabification pattern, PSE shows different behaviour in the division of consonants cluster word internally. It accepts cluster of three consonants in the syllable at the initial position or left edge of a word but disallows this cluster word internally, so breaking of cluster is done by placing maximum two consonants at the onset position of

second syllable. However, most of the syllable structures are similar to other varieties of English as PSE variety forms simple syllable structures such as V, CV, CVC but contains [C] as well as complex syllable structures with cluster of consonants at onset and coda position, for example: CCV, VCC, CCCVCC, CCVVCC. So, it also forms 'tautasyllable' which is a syllable with cluster of consonants or cluster of vowels; and in these complex syllables, the maximum number of segments is six.

However, in PSE it is noted that forceful production of coda plays a vital role in assigning stress, so in PSE heavy syllables H are those syllables which must contain any one of the following elements:

- One long vowel as a nucleus, i.e. V:
- Diphthong as a nucleus, i.e. VV
- One long vowel with coda in a rhyme, i.e. V:C
- One short vowel except ə with forcefully produced coda, i.e. VC[!]

The distribution of vowel in the light syllable of PSE is given as followed:

- Open syllable with short Vowel V or ə
- Close syllable with short vowel V but NO fortified coda (C[!])
- Close syllable with ə and fortified coda (C[!])

Open Syllable and close syllable having schwa /ə/ as nucleus, but without forceful production of coda are weak W in PSE, hence these weak syllables never carry any type of stress, whether primary or secondary.

In its foot patterns, PSE forms 'bounded right headed foot' in which uneven Iamb (LH) three morae $\mu\mu\mu$ is most frequently occurring in its word structures. It also has degenerate foot with heavy syllable and presence of extrametrical syllables on both the edges of words. In directionality, this variety shows no variation like other native varieties of English. Its directionality is also right to left.

It is also important to conclude issues about doing OT and its comparison with other phonological theories. After that differences of syllabification and stress patterns of PSE from native English varieties are highlighted.

Some of the important facts are realized in the application of optimality theoretic framework in this study. It is noted that comprehensive knowledge of the descriptive generalizations about that specific linguistic process is required to evaluate the key role of each constraint which it plays in the grammar of that language. These descriptive generalizations can be stated on the basis of all forms of possibly occurring structures or patterns of that particular linguistic process under study. In doing OT it is also crucial to decide which of the constraints better evaluate the input forms from the 'real' data of a language. Since OT analysis, the idea of constraint ranking is the basis of language variation, it requires beginning with the problem of learning a constraint hierarchy.

This problem of learning constraint hierarchies has also been handled in this study by introducing a new form of Table called 'computing Table' which does not represent OT analyses rather it is used in pre-analysis and is helpful for ranking procedure of constraints, which is essential to know the specific grammar of a particular aspect of a language for doing OT analysis. The whole procedure to learn the grammars of languages in the framework of OT, named as 'Violations Computing Method' (VCM). For this

method, there is need of universal constraints and real data of a language. It helps in knowing the number of violations made by each 'real' structure or pattern of a language.

In OT, all stress constraints are limited to the word stress patterns only. Some of the constraints consider the morphological structure of a word but none of the constraints show any concern beyond the word domain that is 'phrasal stress'. Whereas in other stress theories in metrical phonology such as linear theory of stress; theory of stress and linguistic rhythm; autosegmental theory of stress; and theory of prosodic structure discuss not only stress system of a word but also phrasal stress patterns. Another important difference between OT and other rule-based stress theories is that OT argues only the interface of phonology and morphology in the word stress system of English, whereas other theories also focus on interaction of 'syntactical category' of a word to explain word stress patterns of English (detail is given in Chapter 5 above).

It is also inferred from the analyses of prosody of PSE in phonological theory and OT that constraint ranking and rule ordering are not comparable. When in rule based theories any pattern or structure does not fit in rule-based grammar that is taken as an exception and many exceptions are discussed in these theories. On the other hand, every occurring pattern or structure is accommodated because of 'violable' quality of constraints in OT grammar; whose appropriate ranking in a language forms its grammar. Moreover, some particular processes of a language are adjusted in OT grammar by introducing or adapting some constraint(s). However, OT allows new constraints only when an outcome cannot be shown to result from the interaction of existing constraints and where introducing a new constraint(s) or adapting any constraint(s) is the only logical solution to the problem.

Spectrographic analysis, phonological theory analyses and OT analyses of syllable structure and prosody of PSE show that it is a different variety in terms of its syllabification and stress patterns from any other native or non-native variety of English. In these phonological phenomena PSE shows variations at both levels i.e. phonetic and phonological level. These differences are discussed below with reference to each type of analysis.

It is obvious from the spectrographic analysis of word stress patterns (see Chapter 4 for detail) that not only the high frequency, intensity and duration are phonetic correlates of stress in PSE but also forceful production of coda plays essential role in identifying stressed syllables.

In the light of various phonological theories discussed in detail in Chapter 5 above, following differences in syllable, stress and foot patterns of PSE from native varieties of English are summarized below. PSE shows similar behavior in the syllable structures, syllable template and phonotactics as most of the native English varieties behave but in syllabification unlike native English varieties, PSE does not follow 'Maximum Onset Principle' (MOP) instead it syllabifies word internal consonants clusters by equally dividing consonants into two syllables. For instance, in English extreme is syllabified as [ek.strim]; whereas in PSE it is syllabified as [eks.trim] (more examples are given in section 5.1.2.1). These two varieties also differ with respect to segmental properties of syllable. As consonants with high sonority values can be syllabic in many native English varieties as in [bʌt.n] but in PSE only vowels can be nucleus of a syllable. Different attributes of consonantal phonemes in PSE also affect its syllabification patterns; for example, PSE is described as 'rhotic' and it also shows occurrences of gemination (Afsar & Kamran, 2011).

In the weight of the syllable, role of consonants as coda is also different in both varieties. In PSE only forceful production of coda can add weight to the syllable but in native varieties of English any syllable closed with consonant in coda position is 'heavy'. It seems to be effect of L1, as Hussain (2010) argues that in Urdu lexical stress changes the phonetic properties of vowels as well as consonants. He also explains that stops in the coda position are released after longer duration of closure in stressed syllable.

PSE is also a different variety in its stress patterns. It allows only two types of stress patterns, ultimate and penultimate. There is no occurrence of antepenultimate stress pattern in it. This variation seems to be the result of some effect of L1 because Urdu also allows only 'ultimate' stress patterns (detail is given in section 2.3.3).

In case of foot types, PSE makes bounded foot as other native English varieties do but the headedness of a foot is different. Native English varieties make trochaic, that is left headed foot but PSE forms iambic, that is right headed foot. As foot pattern of PSE is iambic instead of trochaic so its stressed syllable is always on the right edge as the head of the foot in bi-syllabic foot. They are also different in foot patterns as native English varieties allow only bi-moraic foot that is foot either with one heavy syllable (H) or two light syllables (LL) but no foot contains uneven, which is heavy as well as light syllable. On the other hand, PSE allows the following three foot patterns:

- (i) (H)
- (ii) (LL)
- (iii) (LH)

For example, word ‘psychological’ [saɪ.kə.lɒ:.dʒɪ.kəl] form (H) (LH) (LÉ) . From these foot patterns, (LH) foot, i.e. tri-moraic foot unlike native English varieties is also possible in PSE.

In OT analysis, the variation in the grammar of syllables and stress patterns of PSE from any other native variety of English is shown below in the difference of syllable and stress constraints hierarchies:

Syllable constraints hierarchy of English:

Complex^{coda}, Son-Seq » Dep, Max» Onset, No-Coda, *Complex, SLH

(Roca and Johnson, 1999)

Syllable constraints hierarchy of PSE:

Peak, Faith V, Faith C, Son-Seq (undominated) »

CCCσ » σCCC » Onset » No-Coda » SLH

As discussed above, PSE does not allow cluster of three consonants word internally, so to capture this process CCCσ , σCCC constraints are added in the grammar of PSE; because ‘*Complex’ constraint prohibits occurrence of cluster of only two consonants.

Stress constraints hierarchy of English:

Ft-Bin, Rhythm Type: T, No Stress ə, WSP, (un-dominated) »

Lx≈Pr » Non-finality» Edge-R» Rh-Hrm » Align-L » Parse σ » Parse μ

(Lee, 1995)

Stress constraints hierarchy of PSE:

Lx≈Pr, Ft-Bin, Rhythm Type: I, WSP, Parse μ (un-dominated) »

Rh-Hrm » Align-L » Parse σ » Non-finality» Edge-R

Difference in foot types of these two varieties is mentioned in the hierarchies with the help of constraints: Rhythm Type: T, Rhythm Type: I; for English and PSE respectively. Moreover, tri-moraic foot in PSE is permissible, so unlike English Parse μ is un-dominated constraint. Whereas in English it is the lowest ranked constraint that is most violable constraint to avoid occurrence of tri-moraic foot. Tri-moraic foot are universally strictly prohibited in languages with 'trochaic' foot type (Roca and Johnson, 1999).

Although in PSE there is no example of stressed syllable with \emptyset as a nucleus without fortified coda (C[!]) found, yet 'No stress \emptyset ' is not included in the constraints for OT analysis of stress patterns of PSE. Because WSP captures this effect and it also refrains stress on weak syllable with \emptyset as its nucleus. So, it is sufficient to include only WSP in stress constraints; inclusion of 'No stress \emptyset ' seems redundant.

For the description of syllabification and prosody in PSE, OT proved to be the best model which covers all variations in syllabification, stress and foot patterns of this variety. Moreover, as a result of present study, it can rightly be claimed about OT that it is not only effective to describe linguistic features of a language but also varietal differences of any linguistic feature of two varieties of same language. However, for the uncomplicated and all-inclusive doing of OT, VCM is proposed in this study which provides guidelines in the following procedures of OT:

- (i) Selection of inputs or linguistic forms
- (ii) Selection of constraints to be included for OT analysis
- (iii) Ranking of constraints

This method suggests that include 'real' data which should contain all possible structures or patterns as a candidate or input. Because of this perception, VCM is characterized as 'all-inclusive'. This availability of all occurring compositions and patterns of 'real data' help in choosing constraints to be taken in for OT analysis; by means of occurrence of different processes and phenomena discussed in constraints can be perceived in the data. Then, all of these structures or patterns should be included in one table labelled as 'Violations Computing Table'. This table provides the number of violations made by each structure. Another table named as 'Violations Summary' table is important to give a summary of the violations by putting the number of violations in front of each constraint in the progressively increasing order from top to bottom. Then ranking of constraints can be done by applying a simple formula given below:

$$\text{No. of } V \propto \frac{1}{CR}$$

So, there is no need of making separate tables to show domination relation of two constraints at one time which is the most complex part of OT analysis and raises many questions about this process such as: which two constraints should be selected first to check their interaction? Which candidate is best to play decisive role in showing dominance relation of those constraints? How many tables are sufficed to examine interaction of all constraints?

To conclude, VCM answers and addresses all these questions.

7.2 Future Research Perspectives

The findings of this study highlight the main differences which present contrast of PSE with any native English variety. Although this study provides complete description of syllabification, stress and foot patterns of PSE; the space for exploration of remaining supersegmental features such as tone and intonation patterns is left.

In this study, the proposed method VCM for the purpose of constraints ranking has proved to be effective and simple in doing OT by verification of depicting grammar with the interaction method suggested by Prince & Smolensky, 1993/2004; McCarthy, 2002& 2008. However, in this study VCM is used for doing constraints ranking of only two phonological processes, i.e. syllabification and prosody of a single variety (PSE) to be proved as authentic method. Further research is required in testing an application of this method to check its efficacy for OT analyses of not only other phonological analyses but also morphological and syntactical processes of different languages.

Based on the findings of the current study, further research can be done to highlight the phonological differences of PSE and BSE for suggesting the better pronunciation teaching methods by focusing on the problematic areas.

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Appendices

Appendix A: Bi-syllable

Words

1. abase	38. amount	80. awkward
2. abstained	39. anger	81. backward
3. acclaimed	40. answers	82. banking
4. accordance	41. anthem	83. banned
5. according	42. antique	84. baseless
6. achieve	43. annoy	85. bases
7. achieved	44. anywhere	86. basis
8. acted	45. apart	87. batting
9. acting	46. apex	88. battle
10. address	47. appeal	89. bearers
11. adjourned	48. appealed	90. because
12. adjust	49. appoint	91. before
13. adopt	50. approved	92. begins
14. adult	51. arguments	93. begun
15. advance	52. armed	94. being
16. advice	53. army	95. believes
17. advised	54. arrange	96. belong
18. affect	55. arrest	97. benchmark
19. against	56. arise	98. besides
20. agreed	57. arrival	99. betterment
21. ahead	58. arrived	100. between
22. ailments	59. ascend	101. beyond
23. airlift	60. aspect	102. billions
24. airport	61. aside	103. biting
25. airstrikes	62. assaults	104. blindness
26. alight	63. assess	105. body
27. alleged	64. assets	106. bomber
28. allied	65. assert	107. bonfires
29. alliance	66. assist	108. boycott
30. alarm	67. assort	109. briefing
31. alert	68. assumed	110. broader
32. alike	69. assured	111. brochure
33. alive	70. attack	112. brothers
34. ambit	71. attempts	113. brutal
	72. attend	114. budget
	73. attract	115. building
	74. auction	116. builders
	75. augment	117. bullet
	76. avoid	118. burden
35. amend	77. award	119. bureau
36. amid	78. aware	120. business
37. among	79. awareness	121. campaign

122.	cameras	165.	commit	208.	crucial
123.	cannon	166.	common	209.	culture
124.	canteen	167.	compiled	210.	curfew
125.	capture	168.	complaint	211.	customs
126.	captured	169.	complete	212.	damage
127.	carbide	170.	compete	213.	damaged
128.	career	171.	concern	214.	data
129.	caring	172.	concrete	215.	dating
130.	cargo	173.	condemned	216.	daughters
131.	carried	174.	conduct	217.	deadline
132.	carrying	175.	conferred	218.	deadlock
133.	cartoon	176.	conflict	219.	deadly
134.	cases	177.	conflicts	220.	debate
135.	casting	178.	congress	221.	decade
136.	ceasefire	179.	contacts	222.	decree
137.	celsius	180.	contempt	223.	deepest
138.	centers	181.	contest	224.	deepening
139.	central	182.	contrast	225.	defects
140.	chairing	183.	control	226.	defend
141.	chairman	184.	controlled	227.	defense
142.	chalking	185.	conveyed	228.	deficit
143.	chamber	186.	cordoned	229.	defrost
144.	champion	187.	corner	230.	degree
145.	changing	188.	correct	231.	delay
146.	channel	189.	cosmic	232.	delight
147.	checking	190.	costing	233.	demand
148.	childhood	191.	council	234.	denied
149.	chooses	192.	counsel	235.	deployed
150.	cigarette	193.	counted	236.	deposed
151.	cities	194.	counter	237.	deprived
152.	city	195.	counterpart	238.	derail
153.	civil	196.	countries	239.	desires
154.	clashes	197.	country	240.	desirous
155.	classroom	198.	courier	241.	despite
156.	clearly	199.	created	242.	destroy
157.	climax	200.	creating	243.	detached
158.	closing	201.	creation	244.	detained
159.	coastal	202.	credit	245.	deter
160.	coldest	203.	cricket	246.	deviate
161.	collapsed	204.	crippling	247.	dialogue
162.	combat	205.	crises	248.	diesel
163.	comment	206.	crisis	249.	discount
164.	commerce	207.	crossing	250.	disease

251.	distress	294.	ethnic	337.	foolproof
252.	different	295.	event	338.	footage
253.	direct	296.	evoked	339.	football
254.	directs	297.	exchange	340.	forcing
255.	discuss	298.	exists	341.	foreign
256.	discussed	299.	exit	342.	format
257.	disease	300.	expert	343.	former
258.	dispersed	301.	experts	344.	fortune
259.	display	302.	explore	345.	forty
260.	dispose	303.	exports	346.	forum
261.	dispute	304.	expressed	347.	forward
262.	district	305.	extend	348.	founder
263.	diverse	306.	extent	349.	foundries
264.	dollar	307.	extra	350.	fourteen
265.	dolphins	308.	facing	351.	fragile
266.	drafting	309.	fainted	352.	freedom
267.	dreadful	310.	famous	353.	friendly
268.	dual	311.	fearful	354.	fueling
269.	during	312.	falcons	355.	function
270.	duty	313.	family	356.	functional
271.	dwellers	314.	farewell	357.	functions
272.	earmarked	315.	farmers	358.	further
273.	earthquake	316.	farmers	359.	future
274.	efforts	317.	fastest	360.	gathered
275.	eighteen	318.	father	361.	gathering
276.	electric	319.	fervor	362.	gender
277.	elites	320.	fifteen	363.	given
278.	elsewhere	321.	fifty	364.	global
279.	empires	322.	fighter	365.	golden
280.	enable	323.	fighting	366.	granted
281.	enclave	324.	figure	367.	graphite
282.	enforced	325.	final	368.	greater
283.	enhance	326.	finance	369.	greeting
284.	enjoy	327.	finished	370.	grenade
285.	enrolled	328.	firing	371.	grieving
286.	ensure	329.	firings	372.	guidance
287.	enter	330.	fiscal	373.	gunman
288.	entire	331.	fissures	374.	gunners
289.	entry	332.	flourish	375.	halted
290.	envoy	333.	focus	376.	hampered
291.	equal	334.	foiling	377.	handful
292.	erupt	335.	foggy	378.	hardships
293.	escaped	336.	followed	379.	hawkers

380. headed	423. issues	466. maintain
381. hearing	424. itself	467. major
382. heartbreak	425. jackets	468. making
383. heating	426. jointly	469. mangement
384. heavy	427. journey	470. mandate
385. helping	428. judges	471. margin
386. hiding	429. judgment	472. marking
387. highlight	430. judgments	473. martyred
388. hijack	431. junior	474. masses
389. hikers	432. justice	475. matchless
390. hockey	433. killers	476. matter
391. holding	434. killing	477. matters
392. holdovers	435. knowledge	478. meanwhile
393. homage	436. laden	479. measure
394. homeless	437. landings	480. media
395. honor	438. landmark	481. meeting
396. hosted	439. landslide	482. meetings
397. houses	440. language	483. megawatt
398. housing	441. laptop	484. megawatts
399. human	442. larger	485. member
400. humid	443. latest	486. members
401. hundred	444. launched	487. memo
402. hungry	445. laundering	488. menace
403. hurdles	446. lawyers	489. mentioned
404. hydro	447. leader	490. merger
405. ignored	448. leaders	491. message
406. image	449. leadership	492. metals
407. imposed	450. leading	493. metric
408. impressed	451. leaving	494. minute
409. improve	452. lengthy	495. minutes
410. increase	453. leopards	496. miscreants
411. increased	454. letter	497. missile
412. index	455. level	498. mission
413. informed	456. levels	499. misty
414. injured	457. license	500. misuse
415. injury	458. lifestyles	501. money
416. innings	459. likely	502. morning
417. install	460. likened	503. mountain
418. installed	461. lions	504. mourning
419. instead	462. listening	505. moving
420. invest	463. local	506. movement
421. issue	464. locals	507. mummy
422. issued	465. mainly	508. murder

509.	Muslim	552.	parties	595.	process
510.	mutual	553.	partner	596.	products
511.	nabbing	554.	partners	597.	profit
512.	nation	555.	party	598.	program
513.	national	556.	patrol	599.	progress
514.	nations	557.	paying	600.	project
515.	native	558.	peaceful	601.	projects
516.	navy	559.	pensions	602.	promise
517.	nearly	560.	people	603.	promote
518.	needed	561.	percent	604.	prompted
519.	network	562.	period	605.	protect
520.	newsmen	563.	persons	606.	protest
521.	northern	564.	pilot	607.	provide
522.	nothing	565.	pipeline	608.	province
523.	nuclear	566.	places	609.	provoked
524.	number	567.	placing	610.	public
525.	observed	568.	placement	611.	punish
526.	occurred	569.	planted	612.	pursued
527.	offence	570.	player	613.	quashing
528.	offer	571.	pledging	614.	question
529.	offered	572.	poetry	615.	radio
530.	offers	573.	point	616.	railways
531.	office	574.	points	617.	raising
532.	oilfield	575.	police	618.	rallies
533.	oldest	576.	polling	619.	rangers
534.	open	577.	portion	620.	ranking
535.	opened	578.	power	621.	reaches
536.	opening	579.	powers	622.	reaffirmed
537.	opponents	580.	practice	623.	realms
538.	order	581.	practices	624.	reasons
539.	ourselves	582.	prayer	625.	rebels
540.	outage	583.	premier	626.	rebuild
541.	outlets	584.	prepared	627.	rebuked
542.	outside	585.	present	628.	recall
543.	outskirts	586.	presence	629.	recast
544.	over	587.	preserve	630.	receive
545.	overcome	588.	pressure	631.	recent
546.	owners	589.	prevail	632.	recover
547.	package	590.	prevent	633.	recovered
548.	panthers	591.	prices	634.	reduce
549.	paper	592.	prison	635.	reflect
550.	papers	593.	private	636.	reform
551.	parade	594.	problems	637.	reforms

638.	refrain	681.	rival	724.	shower
639.	refuse	682.	roadside	725.	shutdown
640.	regime	683.	rocket	726.	sidelines
641.	region	684.	rockets	727.	silenced
642.	relate	685.	rooted	728.	sirens
643.	relaxed	686.	routes	729.	sitting
644.	release	687.	ruling	730.	sixty
645.	released	688.	running	731.	slogans
646.	relief	689.	rupees	732.	smartly
647.	remain	690.	salute	733.	smuggling
648.	remark	691.	sanctions	734.	snooker
649.	remote	692.	scientists	735.	snowfall
650.	remove	693.	searcher	736.	social
651.	rendered	694.	searching	737.	soldiers
652.	renew	695.	second	738.	southern
653.	renowned	696.	section	739.	sparked
654.	report	697.	sector	740.	sparkles
655.	reports	698.	sectors	741.	speaking
656.	required	699.	secure	742.	special
657.	rescue	700.	seeking	743.	speedy
658.	research	701.	segments	744.	spinner
659.	reserved	702.	senate	745.	spirit
660.	resolve	703.	sending	746.	spiritual
661.	resolved	704.	senior	747.	spokesman
662.	respect	705.	separate	748.	spotlight
663.	respects	706.	select	749.	stable
664.	respond	707.	series	750.	standard
665.	response	708.	service	751.	standing
666.	restrict	709.	session	752.	standoff
667.	results	710.	setback	753.	starting
668.	resume	711.	setting	754.	stated
669.	retired	712.	settle	755.	statement
670.	return	713.	settling	756.	statements
671.	reverse	714.	seven	757.	stations
672.	review	715.	several	758.	status
673.	reviewed	716.	shaky	759.	steady
674.	revise	717.	sharing	760.	stigma
675.	revised	718.	shedding	761.	stolen
676.	revive	719.	shelter	762.	stopping
677.	revolt	720.	shipping	763.	stranded
678.	ribbon	721.	shootout	764.	stranding
679.	riots	722.	shortage	765.	straying
680.	ripples	723.	shortfall	766.	strengthen

767.	strengthend	810.	thrilling	853.	upper
768.	stressful	811.	throughout	854.	upward
769.	striking	812.	thunder	855.	urban
770.	striving	813.	title	856.	urgent
771.	strongly	814.	today	857.	urges
772.	students	815.	tolerance	858.	urging
773.	stumbling	816.	tolerant	859.	utilized
774.	subdue	817.	tonight	860.	vaccine
775.	subject	818.	topping	861.	values
776.	submit	819.	torcher	862.	venture
777.	suburbs	820.	tourist	863.	verdict
778.	success	821.	traders	864.	verdicts
779.	suffered	822.	trading	865.	victims
780.	sufferings	823.	traffic	866.	violence
781.	suicide	824.	tragic	867.	virtue
782.	summit	825.	training	868.	vision
783.	summon	826.	transform	869.	visit
784.	summoned	827.	transport	870.	vistas
785.	supplied	828.	trapped	871.	vital
786.	support	829.	trawler	872.	volume
787.	supreme	830.	treasures	873.	voted
788.	survey	831.	treated	874.	voting
789.	system	832.	tremble	875.	warning
790.	taken	833.	trial	876.	warrants
791.	taker	834.	tribal	877.	wary
792.	takers	835.	tributes	878.	weakness
793.	taking	836.	tricky	879.	wealthy
794.	talent	837.	truly	880.	weapons
795.	target	838.	trying	881.	wearing
796.	targets	839.	turning	882.	weather
797.	technique	840.	twenty	883.	weekend
798.	temples	841.	unarmed	884.	welcomed
799.	tension	842.	unfurled	885.	welfare
800.	tenure	843.	unhurt	886.	wellknown
801.	termers	844.	union	887.	well-paid
802.	tested	845.	unite	888.	western
803.	thirteen	846.	units	889.	wickets
804.	thirty	847.	unknown	890.	widespread
805.	thousand	848.	untapped	891.	winning
806.	thousands	849.	until	892.	wireless
807.	thrashing	850.	upgrade	893.	wisdom
808.	threatened	851.	uphold	894.	withdrawal
809.	tricky	852.	uplift	895.	within

896. without	901. workers	906. written
897. witness	902. working	907. yearning
898. witnessed	903. worldwide	908. zero
899. women	904. worthwhile	
900. woolens	905. writing	

Appendix B: Tri-syllable Words

1. abandon	34. allotted
2. abolished	35. already
3. absolute	36. amateur
4. absorbing	37. amendment
5. abysmal	38. amnesty
6. accepted	39. analyze
7. accident	40. animals
8. accidents	41. announce
9. accordance	42. announced
10. accorded	43. announcement
11. according	44. annual
12. achievement	45. another
13. achievements	46. antelopes
14. activists	47. appeared
15. addition	48. appreciates
16. additional	49. apprised
17. addressing	50. approval
18. adequate	51. approved
19. adherence	52. aptitude
20. admitted	53. area
21. adopted	54. argument
22. adoption	55. arising
23. advantage	56. arrangements
24. activism	57. arrested
25. affected	58. artifact
26. aftermath	59. assembly
27. afternoon	60. assistance
28. agencies	61. assistant
29. agency	62. assumptions
30. agreement	63. assurance
31. alignment	64. atmosphere
32. allegedly	65. atomic
33. allotment	66. attaches

67. attended	110.	chemicals
68. attention	111.	Christians
69. attitude	112.	cigarette
70. attorney	113.	citizen
71. auspices	114.	citizens
72. authorized	115.	civilian
73. avalanche	116.	civilians
74. avenues	117.	coalition
75. aviation	118.	collective
76. awaiting	119.	collided
77. balloting	120.	collision
78. battalion	121.	comedian
79. beginning	122.	comfortable
80. benefit	123.	commencement
81. betterment	124.	commended
82. bilateral	125.	commercial
83. biometric	126.	commission
84. blasphemous	127.	commitment
85. bombarded	128.	committed
86. bottlenecks	129.	committee
87. boundaries	130.	commodore
88. boycotting	131.	communist
89. brigadier	132.	companies
90. broadcasting	133.	competed
91. brotherhood	134.	complexes
92. brotherly	135.	comprises
93. bulletin	136.	comprising
94. bulletins	137.	compromised
95. businessman	138.	concerning
96. butterflies	139.	concluded
97. cabinet	140.	concluding
98. candidate	141.	concurrent
99. candidates	142.	condemning
100. capital	143.	conditions
101. caravan	144.	conducive
102. caretaker	145.	conducted
103. celebrates	146.	conference
104. cellular	147.	confidence
105. centigrade	148.	confronting
106. centuries	149.	connection
107. challenges	150.	connections
108. championship	151.	conscious
109. chandelier	152.	considers

153.	consignment	196.	declaring
154.	consistent	197.	defeated
155.	conspiracy	198.	defeating
156.	constituent	199.	defenders
157.	construction	200.	delaying
158.	constructive	201.	delegates
159.	consulting	202.	demanding
160.	contagion	203.	demonstrate
161.	contagious	204.	department
162.	containers	205.	departure
163.	contested	206.	depicting
164.	contesting	207.	depletion
165.	contingent	208.	deployment
166.	continue	209.	deposits
167.	continued	210.	deputy
168.	continues	211.	deserving
169.	contraction	212.	desirous
170.	contractual	213.	destroying
171.	convening	214.	determine
172.	convention	215.	developing
173.	corporate	216.	development
174.	corrected	217.	deviation
175.	corruption	218.	devices
176.	counterpart	219.	devotees
177.	coverage	220.	dictator
178.	covering	221.	differences
179.	cowardice	222.	dignity
180.	credible	223.	diluting
181.	criminal	224.	dimension
182.	criticized	225.	dimensional
183.	cultural	226.	diminished
184.	currency	227.	diplomats
185.	currently	228.	directed
186.	custody	229.	direction
187.	cylinder	230.	director
188.	damaging	231.	disabled
189.	dangerous	232.	disaster
190.	dastardly	233.	disastrous
191.	database	234.	discharging
192.	debating	235.	discussing
193.	decided	236.	discussion
194.	decision	237.	disgraceful
195.	decisions	238.	dismissal

239.	dispensing	282.	equipment
240.	disputed	283.	erupted
241.	disruptions	284.	escalating
242.	dissolving	285.	essential
243.	distressing	286.	establish
244.	distribute	287.	established
245.	destruction	288.	every
246.	disturbing	289.	evidence
247.	dividend	290.	excavation
248.	division	291.	excellence
249.	divisions	292.	exception
250.	documents	293.	exchequer
251.	domestic	294.	execute
252.	dominance	295.	existence
253.	effective	296.	expanding
254.	efficient	297.	expansion
255.	elected	298.	expected
256.	election	299.	expedite
257.	elections	300.	expedite
258.	elements	301.	expertise
259.	elephants	302.	exploded
260.	eleven	303.	exploit
261.	embassy	304.	exploited
262.	embezzled	305.	exploring
263.	emphasized	306.	explosion
264.	employees	307.	explosions
265.	encircle	308.	explosive
266.	encounter	309.	expressed
267.	endeavors	310.	expressing
268.	endemic	311.	expressway
269.	enemy	312.	extension
270.	energy	313.	external
271.	enforcement	314.	extortion
272.	enforcements	315.	extremist
273.	engagement	316.	factories
274.	engagements	317.	families
275.	engineers	318.	family
276.	enhancing	319.	federal
277.	enjoyment	320.	federation
278.	enriching	321.	finalize
279.	ensuring	322.	finally
280.	envisioned	323.	flotilla
281.	equalized	324.	following

325.	forecasters	368.	impressions
326.	forefathers	369.	impressive
327.	forensic	370.	imprisoned
328.	forgiveness	371.	improvement
329.	formula	372.	improving
330.	formulate	373.	inaugural
331.	forthcoming	374.	incentives
332.	fortunate	375.	incident
333.	foundation	376.	incidents
334.	fraudulent	377.	including
335.	frustrated	378.	incumbent
336.	fulfilling	379.	industry
337.	fulfillment	380.	infection
338.	funeral	381.	infested
339.	furniture	382.	inflaming
340.	gathering	383.	influence
341.	general	384.	initial
342.	generation	385.	innocent
343.	government	386.	insisted
344.	governments	387.	inspector
345.	governor	388.	insurance
346.	grievances	389.	intending
347.	guarantees	390.	intensify
348.	handicapped	391.	interact
349.	harmony	392.	interest
350.	headquarters	393.	interim
351.	hearing	394.	interior
352.	herbivores	395.	internet
353.	heritage	396.	interview
354.	history	397.	introduced
355.	hoisting	398.	intrusion
356.	homeowners	399.	investment
357.	horizon	400.	investors
358.	horrendous	401.	invited
359.	ideals	402.	islamic
360.	ignited	403.	issuance
361.	illegal	404.	jeopardize
362.	illicit	405.	journalists
363.	illiterate	406.	judgments
364.	immunity	407.	judicial
365.	implement	408.	kerosene
366.	importance	409.	kidnapping
367.	important	410.	kilogram

411.	kilogram	454.	mobilize
412.	laborers	455.	mobilized
413.	languages	456.	momentum
414.	lamented	457.	monitor
415.	laureate	458.	monitored
416.	leadership	459.	mosquito
417.	legitimate	460.	motorway
418.	liberation	461.	musician
419.	lieutenant	462.	myanmar
420.	lingering	463.	narcotics
421.	liquefied	464.	national
422.	literacy	465.	natural
423.	literature	466.	necessary
424.	livelihood	467.	neighboring
425.	load-shedding	468.	newspapers
426.	longstanding	469.	nobody
427.	lucrative	470.	numerous
428.	machinery	471.	obeisance
429.	magazine	472.	objective
430.	magnitude	473.	observing
431.	maintaining	474.	observer
432.	maintenance	475.	observers
433.	majestic	476.	obstacle
434.	management	477.	occasion
435.	martyrdom	478.	occupied
436.	massacre	479.	offensive
437.	material	480.	officers
438.	maximum	481.	official
439.	measuring	482.	officials
440.	mechanism	483.	ongoing
441.	membership	484.	operation
442.	messages	485.	operations
443.	militants	486.	opponents
444.	military	487.	organized
445.	million	488.	original
446.	millions	489.	outstanding
447.	minimum	490.	overcome
448.	minister	491.	overseer
449.	ministers	492.	ownership
450.	ministry	493.	pandemic
451.	miscreants	494.	paragraph
452.	miseries	495.	paralyzed
453.	mitigate	496.	parliament

497.	partition	540.	processions
498.	partnership	541.	producing
499.	performance	542.	productive
500.	permanent	543.	professional
501.	permission	544.	progressive
502.	persistent	545.	prohibits
503.	personal	546.	prominent
504.	personnel	547.	prominence
505.	pertaining	548.	promoting
506.	pesticide	549.	promotion
507.	petition	550.	properties
508.	petitions	551.	property
509.	petroleum	552.	proposal
510.	pictorial	553.	prosperous
511.	plantations	554.	protection
512.	poisoning	555.	protested
513.	policeman	556.	protesters
514.	policies	557.	provided
515.	policy	558.	providing
516.	politics	559.	provinces
517.	pollution	560.	provincial
518.	portraying	561.	provision
519.	position	562.	publishing
520.	positions	563.	punishing
521.	positive	564.	pursuing
522.	possible	565.	qualifying
523.	potential	566.	quality
524.	poverty	567.	rampaging
525.	precious	568.	reaction
526.	premises	569.	reaffirms
527.	preparing	570.	recently
528.	presented	571.	reception
529.	presently	572.	recessions
530.	presided	573.	recognized
531.	president	574.	recommend
532.	presiding	575.	recorded
533.	pressurized	576.	recover
534.	previous	577.	recovered
535.	principal	578.	recurrence
536.	principles	579.	reducing
537.	prisoners	580.	references
538.	procedure	581.	referring
539.	proceedings	582.	refugees

583.	regaining	626.	seminar
584.	regarding	627.	senator
585.	regional	628.	senators
586.	registered	629.	sending
587.	regretted	630.	senior
588.	reiterate	631.	sentiments
589.	rejected	632.	separate
590.	rejoices	633.	seriously
591.	related	634.	services
592.	relations	635.	settlement
593.	remaining	636.	settlements
594.	remarkable	637.	seventeen
595.	remember	638.	seventy
596.	removal	639.	situation
597.	renewal	640.	socially
598.	reported	641.	society
599.	reporters	642.	solution
600.	represent	643.	sovereignty
601.	republic	644.	specialize
602.	requesting	645.	specialists
603.	requirements	646.	specified
604.	researcher	647.	spokesperson
605.	researching	648.	spokeswoman
606.	residents	649.	sponsorship
607.	resolute	650.	sporadic
608.	resources	651.	stakeholders
609.	respective	652.	stallions
610.	responding	653.	steadfastly
611.	restrictions	654.	stereotypes
612.	retired	655.	straightforward
613.	retirement	656.	strategies
614.	retrieval	657.	strengthening
615.	reviewer	658.	stuttering
616.	revision	659.	substandard
617.	safeguarding	660.	substantial
618.	sanctity	661.	successful
619.	scheduled	662.	successor
620.	scientific	663.	sufficient
621.	scrutiny	664.	suicidal
622.	secretary	665.	supervise
623.	sectarian	666.	supporters
624.	securing	667.	suppression
625.	selflessly	668.	surrounding

669.	surveillance	699.	triangle
670.	survivors	700.	tribunals
671.	suspected	701.	triggering
672.	suspended	702.	twentieth
673.	suspending	703.	unbeatable
674.	sympathy	704.	undermine
675.	symposia	705.	understand
676.	targeted	706.	undertake
677.	targeting	707.	underway
678.	technical	708.	uneaten
679.	telecom	709.	united
680.	telephone	710.	unity
681.	televised	711.	unresolved
682.	temperature	712.	upcoming
683.	temporal	713.	upgraded
684.	terrible	714.	uprising
685.	terrorism	715.	uranium
686.	thunderstorm	716.	utilized
687.	together	717.	various
688.	tomorrow	718.	vehicle
689.	tornadoes	719.	venerate
690.	tournament	720.	versatile
691.	tradition	721.	veteran
692.	traditional	722.	villages
693.	trafficking	723.	violator
694.	tragedy	724.	visiting
695.	transforming	725.	Wednesday
696.	transition	726.	widening
697.	transparent	727.	wonderful
698.	transmission	728.	workplaces

Appendix C: Tetra-syllable Words

1. absolutely	11. aggravated
2. academic	12. agricultural
3. accompanied	13. agriculture
4. accomplishment	14. arrogated
5. accuracy	15. allegations
6. acknowledging	16. alleviation
7. activities	17. allocations
8. activity	18. alternation
9. advisory	19. ambassador
10. affidavit	20. ambassadors

21. amenities	64. consequences
22. ammunition	65. conservation
23. animated	66. consideration
24. anniversary	67. conspiracies
25. appearances	68. conspiracy
26. appreciated	69. constitution
27. appreciates	70. constitutional
28. archeologists	71. consultations
29. architecture	72. consultative
30. artillery	73. contiguous
31. aspirations	74. continuing
32. austerity	75. contributing
33. authorities	76. contribution
34. authority	77. contributions
35. authorizing	78. controversial
36. autonomy	79. convocation
37. autonomous	80. cooperation
38. bicentenary	81. coordinated
39. calamities	82. corporation
40. capacity	83. correspondent
41. castigated	84. correspondents
42. casualty	85. corresponding
43. category	86. criticizing
44. celebrated	87. culminated
45. celebrations	88. declaration
46. centenary	89. dedicated
47. ceremonies	90. delegated
48. ceremony	91. delegation
49. circulation	92. deliberated
50. coalition	93. delicacy
51. combination	94. democracy
52. commemorate	95. democratic
53. commentary	96. demonstrating
54. commentator	97. demonstration
55. commissioner	98. demonstrations
56. communities	99. deprivation
57. community	100. destabilize
58. comprehensive	101. developmental
59. condemnation	102. diplomatic
60. confederation	103. discovered
61. confiscated	104. discrepancies
62. confrontation	105. disparity
63. consecutive	106. disqualified

107.	distribution	150.	financial
108.	distributing	151.	formulated
109.	dominated	152.	formulating
110.	dominating	153.	fundamentals
111.	economy	154.	generation
112.	economic	155.	generations
113.	economies	156.	helicopter
114.	education	157.	hesitating
115.	effectively	158.	historical
116.	elaborate	159.	hospitalized
117.	electoral	160.	hydropower
118.	electricity	161.	identified
119.	electronic	162.	identity
120.	eligible	163.	immediate
121.	emergency	164.	immortalize
122.	empowering	165.	immunity
123.	empowerment	166.	impediments
124.	encompasses	167.	implemented
125.	encouraging	168.	improbable
126.	encouragement	169.	inaugurate
127.	engineering	170.	inaugurating
128.	entrepreneurs	171.	incitement motivation
129.	environmental	172.	independence
130.	epidemic	173.	independent
131.	especially	174.	industrial
132.	essentially	175.	inexpensive
133.	establishment	176.	information
134.	estimated	177.	infrastructure
135.	evaluating	178.	inheriting
136.	eventually	179.	initial
137.	excavation	180.	initiate
138.	execution	181.	institution
139.	executive	182.	institutions
140.	exemplary	183.	instrumental
141.	exhibition	184.	insurgency
142.	expenditures	185.	integrated
143.	exploitation	186.	integrity
144.	exterminate	187.	intelligence
145.	extremism	188.	intensified
146.	extremists	189.	intensify
147.	facilities	190.	interference
148.	federating	191.	inter-language
149.	federation	192.	international

193.	intervention	236.	participate
194.	intolerant	237.	patriotic
195.	introduction	238.	perpetrator
196.	irrespective	239.	perpetrators
197.	irritable	240.	perpetuate
198.	irritated	241.	petroleum
199.	isolated	242.	phenomenon
200.	isolation	243.	philanthropist
201.	journalism	244.	philanthropists
202.	judiciary	245.	photographic
203.	jurisdiction	246.	physically
204.	legislation	247.	political
205.	legislators	248.	politicians
206.	luminaries	249.	population
207.	magnificent	250.	preferential
208.	majority	251.	presentation
209.	manifesto	252.	presidency
210.	materialize	253.	presidential
211.	mausoleum	254.	priority
212.	memorialize	255.	profitable
213.	metropolis	256.	prohibited
214.	militancy	257.	propaganda
215.	militants	258.	prosecutor
216.	minorities	259.	prosecutor
217.	motivated	260.	prosperity
218.	motivating	261.	provocation
219.	motorcycle	262.	publication
220.	necessary	263.	realization
221.	negotiated	264.	recognition
222.	negotiator	265.	recommencement
223.	nominated	266.	recommendations
224.	obligation	267.	reconsider
225.	occupation	268.	rededicate
226.	operation	269.	rediscovered
227.	operator	270.	references
228.	opposition	271.	referendum
229.	optimistic	272.	registration
230.	ordinary	273.	regulations
231.	overcoming	274.	reimbursement
232.	overseeing	275.	reiterated
233.	overturned	276.	relaxation
234.	paramedics	277.	religious
235.	participants	278.	renewable

279.	repeatedly	306.	television
280.	reservations	307.	territories
281.	resignation	308.	territory
282.	resolution	309.	terrorism
283.	responsible	310.	testifying
284.	restoration	311.	transitional
285.	retaliate	312.	transportation
286.	revolution	313.	trilateral
287.	sacrifices	314.	unabated
288.	sacrificing	315.	unacceptable
289.	satisfaction	316.	unaffordable
290.	secretary	317.	unanimous
291.	security	318.	underdeveloped
292.	seriousness	319.	understanding
293.	significant	320.	undertaking
294.	situation	321.	unfortunate
295.	solemnity	322.	unspeakable
296.	sovereignty	323.	upgradation
297.	speculation	324.	utilization
298.	stability	325.	utilizing
299.	stimulation	326.	vegetable
300.	subsequent	327.	vegetables
301.	substantially	328.	vicinity
302.	suffocation	329.	vindication
303.	supervisor	330.	violations
304.	sustainable	331.	violating
305.	technology	332.	violators

Appendix D: Penta-syllable Words

1.	accidentally	14.	authoritarian
2.	administration	15.	casualties
3.	affiliation	16.	certification
4.	affiliations	17.	civilization
5.	agricultural	18.	collaboration
6.	anniversary	19.	communications
7.	appreciated	20.	comprehensibly
8.	appreciating	21.	congratulated
9.	appreciation	22.	consideration
10.	appropriated	23.	consolidation
11.	archeological	24.	constituencies
12.	associated	25.	coordinated
13.	association	26.	coordination

27. counterproductive
28. deregulation
29. determination
30. disabilities
31. disability
32. disappearances
33. dishonorable
34. disobedience
35. dissemination
36. educational
37. elaboration
38. electricity
39. empowerment
40. entrepreneurship
41. enumerating
42. experiences
43. facilitated
44. felicitation
45. hospitality
46. humanitarian
47. immediately
48. implementation
49. inaugurated
50. inauguates
51. inaugurating
52. indiscriminate
53. industrialists
54. inexcusable
55. influential
56. information
57. initiatives
58. international
59. interpretation
60. investigated
61. investigation
62. involuntary
63. justification
64. laboratories
65. legitimacy
66. liberalization
67. manipulated
68. manufacturers
69. meritorious
70. military
71. modernization
72. multifaceted
73. negotiated
74. negotiations
75. notifications
76. observatory
77. operationalize
78. ophthalmologist
79. opportunities
80. opportunity
81. oppositional
82. organization
83. organizations
84. overwhelmingly
85. paramilitary
86. parliamentary
87. parliamentarians
88. particularly
89. personality
90. pharmaceutical
91. possibilities
92. preparatory
93. professionalism
94. qualification
95. regulatory
96. representative
97. residential
98. retaliation
99. insecurity
100. irresolution
101. solidarity
102. technological
103. temporarily
104. territorial
105. unacceptable
106. unanimously
107. uncertainty
108. unilaterally
109. university
110. unprecedented
111. unpredictable
112. unprofitable

Appendix E: Hexa-syllable Words

1. accessibility	27. internalization
2. accountability	28. interrelationship
3. admissibility	29. investigatory
4. availability	30. involuntarily
5. categorically	31. irreconcilable
6. characteristically	32. irregularities
7. constitutionally	33. irritability
8. differentiation	34. mispronunciation
9. discontinuity	35. multi-dimensional
10. disqualification	36. non-participating
11. economically	37. non-technological
12. electrification	38. optimistically
13. exemplification	39. recapitulation
14. expeditiously	40. reconciliation
15. experimentation	41. regularization
16. extraordinary	42. rehabilitation
17. familiarity	43. reliability
18. impossibility	44. responsibilities
19. indiscrimination	45. responsibility
20. indistinguishable	46. revolutionary
21. individualism	47. simultaneously
22. individualistic	48. sustainability
23. inferiority	49. unexceptionable
24. intercontinental	50. unconventionally
25. interdepartmental	51. unimaginative
26. inter-ministerial	52. unsystematically