Department of Music
University of Dhaka

Analyzing the Stress Pattern of Bangla Songs through Metrical Phonology

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by
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Researcher's Declaration

I hereby declare that this thesis entitled **"Analyzing the Stress Pattern of Bangla Songs through Metrical Phonology"** has been composed solely by myself and it has not been previously submitted for the award of any degree.

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Supervisors' Declaration

I hereby declare that this MPhil research has been carried out by Shohail Rayhan Muhammad Tarek and the thesis is entitled **"Analyzing the Stress Pattern of Bangla Songs through Metrical Phonology".** It has been completed under our direct supervision at the Department of Music, University of Dhaka. This thesis has not been previously submitted for the award of any degree.

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Abstract

Indicating the relationship between language and music as musical linguistics, the current study investigates three main stream Bangla songs regarding the devotional aspect of music to explore how one domain interacts with another. A theoretical framework based on metrical phonology as well as Generative Theory of Tonal Music (GTTM) has been used to reveal how a lyric achieves musical virtue through transforming its built-in stress pattern or speech stress of language. In particular, the data analyzing parameters have been taken from linguistic and musical aspects. The parameters of those aspects have been designed considering metrical phonology as fundamental theoretical background. In case of linguistic aspect, the lyrics of the selected songs have been tested through the prosodic hierarchical structure, feet structure inventory and parameters of metrical constituents. In addition, acoustic phonetic evidences of stress transformation have been shown from the linguistic aspect. Whereas, grouping structure, metrical structure, time-span reduction and prolongational structure of GTTM have been selected as parameters from the musical aspect. However, both domains have been considered as autonomous hierarchical systems.

Taking qualitative method the entire study has been proceeded by finding answers of some questions since this is a non-numeric, exploratory investigation. Basically, the prime query of this research is to find out the causes behind transforming the stress pattern of Bangla songs through melodic insertion. Three Bangla songs of Tagore, Nazrul and Lalon have been selected as popular devotional songs for the experiment in this study. In case of analyzing lyrics of these songs without melody linguistic investigation solely has been shown primarily. Though Bangla is a stress-accent quasi-sensitive language and trochaic feet prevail in the majority of the syllabic structures of Bangla words, this study observes remarkable violations of those norms. Besides trochaic structure iambic and mixed structure have also been found in linguistic analysis of lyrics. On the other hand, musical analysis of the entire songs (e.g. lyrics with melodies) reveals different types of feet

structure as well as metrical structure unlike the same of lyrical investigation. This structural deviation has been addressed as transformation of stress pattern in our study. From metrical grids to prolongational tree structures, all our experiments of GTTM firmly show that putting melodies causes transformation of the regular stress pattern of speech.

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List of acronyms and abbreviations

DB	Decibel
ERP	Event related potential
GTTM	Generative Theory of Tonal Music
GWFR	Grouping Well Formedness Rules
IPA	International Phonetic Alphabet
L-to-R	Left to Right
LOC	Locative case
MWFR	Metrical Well Formedness Rules
MPR	Metrical Prominence Rules
POSS	possessive case
Q-sensitive	Quantity Sensitive
Q-insensitive	Quantitative insensitive
R-o-L	Right to Left
SPE	Sound Pattern of English
SUB	subjunctive mood
Hz	Harz
1st PER	1st person

Chapter 1
Introduction

This research is an interdisciplinary study of language and music regarding processing of complex sound as well as hierarchical structures as shared features of both communicative medium. Although systematic investigation of exploring the relationship between those domains are rarely found, scholars (Bernstein, 1976; Bright, 1963; Brown, 2001; Livingstone, 1983) from various academic arena from musicology to linguistics discuss those domains from basically macro level[1] interest. The prime concern of this research is to show how the stress pattern of language transforms into melody in a song. In other words, the tunes of songs achieve musical virtue through transforming the natural or regular stress pattern of language in particular lyrics. In order to show this transformational phenomenon Bangla songs have been analyzed in this research. Through structural subtle investigation this study has drawn the connection between language and music. Especially, this relationship has been built by generative perspective as well as metrical phonology of language and music. However, the tendency of showing direct analogy between language and music of both systems was very attractive in the late 70s. Nevertheless, this kind of analogical postulation did not last by ruthless criticism of systematic research of cognitive as well as generative studies. This study is an endeavor to construct a bridge between those two domains by taking Bangla songs as samples.

1.1. Background of the problem

The theoretical inception of building connection between language and music was begun with evolutionary as well as anthropological aspects. The scholars (Darwin, 1871; Fogany, 1983; Brown, 2001; Molino, 2013; Rousseau, 1966) of those fields generally

[1] Emphasis on holistic discussion

took contradictory sides in case of depicting their relationship such as, one domain developed without the aid of other domain or both developed from a shared proto faculty. Thinkers (Darwin, 1871; Livingstone, 1983; Rousseau, 1966) obstinately tried to propose that the beginning of human language was totally musical, thus human could sing before they could talk. Nevertheless they could not present strong scientific evidence to support this hypothesis, though the theories of separation process from music to language is more promising. For example, the double articulation process of speech (Fonagy, 1983). This process refers to the sonic division of a language which have no intrinsic meaning in themselves but can be combined into new units of meaning whereas, this duality of patterning is absent in music.

However, analyzing the hierarchical structure as well as the phonological one of music and language, a common ancestral stage or 'musi-language[2]' stage is impressive from this perspective (Brown, 2001). The gap in knowledge of evolutionary aspect has been overcome by cognitive explanation of their relationship.

From cognitive point of view those two domains have been considered as two autonomous cognitive abilities which share some basic identical features since all sorts of cognitive activities contain some common cognitive characteristics (Jackendoff, 2009). For example, each and every cognitive activities such as, from the act of throwing a ball to playing a sitar follow a general syntax which construct the capacities to combine elementary sequences (Calvin, 1990). Moreover, challenging neuropsychological research[3], neuroimaging studies[4] explore that these are some sort of overlaps between those domains. For instance some neural resources are shared between linguistic and musical association (Patel, 2012,p. 5-6). However, the focal point of this study is to show

[2] Musi-language proposes that music and language evolved from a common ancestral stage, such that their shared ancestral features evolved before their distinct properties.
[3] Neuropsychology is the study of the structure and function of the brain as they relate to specific psychological processes and behaviors.
[4] Neuroimaging study is a combination of various techniques which image the structure, function of the nervous system.

how one sequential structure like music influences other sequential systems like, language or lyrics. In addition it is noteworthy that our methods of analysis have been more or less influenced by cognitive theories of phonology and music.

The structural analogical hypothesis (Bernstein, 1976) was completely rejected by further generative analysis of music and language in particular, Generative Theory of Tonal Music (GTTM). Basically, structural dissociations are as prominent as they express themselves as individual systems. For example, language possesses some constraints and sequential operations such as, parts of speech or phrasal hierarchical projection which are not possible in instrumental music at all. On the other hand, solely different mechanism of sequence processing prevail in musical structure which is entirely absent in language like, interval, musical harmony, consonance and dissonance do not occur in speech. To elaborate, phonemes of language are not determined mathematically as notes of music through interval.

In order to analyze music structure basically, musicologists and linguists design combined theoretical framework and they build up theories directly from linguistics especially, from generative aspects of structural hierarchy as well as metrical phonology (Lerdahl and Jackendoff, 1983). In fact this time the interface between language and music is not analogical at all rather, GTTM is more interested in showing how music differs from language or how one domain influences the other.

According to the architects of GTTM, the model has been constructed following generative model of linguistics completely, yet some fundamental discrepancies are observed between those two models. For instance, regarding generative linguistics lexical items are assembled by the syntax into hierarchically structured larger complex units by the recursive operations. Moreover, information as well as phonological interpretation is transferred from syntax to semantics (Lerdahl and Jackendoff, 1983). But, the reverse operation is not possible in linguistic system. On the contrary, the hierarchical interpretation in the various components is characterized in both bottom to

top and top to bottom terms in GTTM. Thus, unlike linguistic system GTTM accepts reverse information flow among the modules. As a consequence some confinements may be appeared while analyzing songs since the data contain linguistic as well as musical information.

In this study syntax is considered as a hierarchical organization of strings of discrete objects in case of music and language. Analyzing songs through prosodic tree structure is a significant investigation in this research. Linguistic tree construction contains rigid rules and phrasal projections whereas, music possesses different objects than language does. In fact musical theory strictly refuses the psychological levels like linguistics and it perceives pitches, chords, rhythm as its elementary objects. Musical objects are referred to as pitch events as larger level units consist of grouping of events. However, in this research syllable and note have been considered as the basic correspondence between language and music. Basically, it is yet to be explored how the grouping strings[5] act in case of analyzing songs. For example, regarding Grouping Well Formedness Rules 1 (GWFR1) of GTTM, the contiguous elements have not been defined certainly. Like, whether a specific paradigm accepts to include the elements from out of the context in the structure. If it does then GWFR1 has not indicated any process of including the outer elements in the system (see section 2.5.1.2) and this notion might be problematic in case of linguistic objects as well.

On the other hand, some challenges can be faced in analyzing language-music assimilated form like, song in order to show metrical grid system and prolongational structure. For example, whether Metrical Well Formedness Rules (MWFR 3) and 4 (see section 2.5.1.2.2) work properly after inserting melodies into lyrics. Thus, the musical rhythm might be influenced by the linguistic rhythm to some extent in songs. If it happens, those rules would not work exactly. Contrary to linguistic prosodic intonational tree as strong versus weak nodes, the opposition is head vs elaboration in the time-span

[5] Grouping strings of GTTM expresses the hierarchical segmentation of the musical piece into motives, phrases and sections.

reduction [6] and prolongational structure [7] in GTTM (see section 2.5.1.2.3). As a consequence, there is not any feet level projection in those trees. Therefore, it seems that obscurity may occur in case of analyzing songs from hierarchical perspective. For this reason, all prosodic trees have been translated into prolongational tree structures. It is noteworthy that similar process of analysis has been found in the previous studies (Lerdahl, 2013) of music language intertwining explorations.

In case of selecting the parameters of the metrical constituents four most prominent parameters have been chosen in this study, though there are more or less fourteen metrical parameters (Apoussidoou, 2007, p. 15). Since it is well established from the previous studies that Bangla is a stress accent, quasi-sensitive language (Chatterji 1921; Goswami 1944; Ferguson & Chowdhury 1960; Anderson 1962; Ray, Hai, & Ray 1966), these parameters are sufficient for our study.

From the previous study of the transformation of stress pattern, Lerdahl (2013) showed that word stress or speech stress can be changed through strong beats of melodic stress pattern. Nevertheless, the intensity of transformed stress pattern of song has not been shown. Thus, in order to show the transformational evidence of stress, acoustic phonological information have been presented in this study.

However, in case of selecting songs, three prime genres have been considered as the most prominent streams of Bangla songs. As a matter of fact, the evolutionary process of Bangla songs dates back to one thousand years along with Bangla language. Therefore, a variety of Bangla songs ranging from *Charyapada* to *Nazrul sangeet* have been found in the 19th and 20th century (Goswami, 1993). On the other hand, Baul's songs are another main stream Bangla songs which are often called folk songs. In this study the

[6] Time-span reduction assigns to the pitches of the musical notes a hierarchy of structural importance with respect to their position in grouping and metrical structure.
[7] Prolongational structure assigns to the pitches of hierarchy that expresses harmonic and melodic tension, continuity and progression.

songs of Lalon Shai are taken as the main stream Bangla of *Baul-Fakir-Shahajia* genre. In the evolution and development of Bangla songs, it is seen clearly that devotion helps to build fundamental emotion of lyrics and tunes. Therefore, this significant aspect of Bangla song has been taken seriously in this study. It is noteworthy that we are not going to concentrate on the modern or contemporary Bangla song.

1.2. Purpose of the study

The primary goal of this research is to explore the most significant tendencies of stress pattern of Bangla songs by applying relevant analyzing tools of metrical phonology as well as Generative Theory of Tonal Music (GTTM). Since it has been already mentioned in the above sections that showing the analogical structural relationship of music and language is not as convincible as this study is conducted following this notion. Here the point of separation between both systems has been taken as the focal point.

First of all, the lyrics and tunes have been considered separately and then the research has been governed in a holistic approach. Therefore, this is an attempt to show how stress patterns of Bangla songs work without tune. Second stage is to investigate the stress structures of tunes without lyrics and finally the overall stress pattern have been revealed which is created by both lyric and tune. The lyric of song expresses certain sort of meaning other than tune, whereas if tune is put in the same lyric then it would achieve extra semantic quality. For example, some special emotional state may be expressed by adding tune in a lyric. In fact the process of adding tune in lyric is completely controlled by the transformation of stress pattern. Therefore, tune provides special ‘musical virtue’ to language by transforming the stress pattern.

Overall, the ultimate goal of this research is to show the eventual relationship between language and music through analyzing Bangla songs and this is an endeavor to show how Bangla song achieves this virtue by transforming stress pattern.

1.3. Significance of the study

Since any research work regarding fundamental structure of Bangla language and music is not found, this work will play a vital role in describing the phonological structure of Bangla language and music. Almost all the scholars (Karunamaya, 2007; Tagore, 1978) who are interested in Bangla musicology wrote a lot on history and evolution of Bangla songs, but music has not been considered as a communicative system from interdisciplinary aspect. Consequently music-language interface has not been discussed theoretically from any academic interest. This study is the beginning of describing their connection in respect of structural investigation through Bangla songs.

Although a vast amount of research work on various aspects of Bangla phonology are found (Chatterji 1921; Goswami 1944; Ferguson & Chowdhury 1960; Anderson 1962; Ray, Hai, & Ray 1966), the stress features of Bangla is rarely analyzed from hierarchical perspective. For instance, the Bangla words in which the most prominent tendencies of Bangla stress system are prevailed have not been depicted through prosodic tree structure. As well as Bangla words have not been tested by parameters of metrical constituents yet. Prior to investigate the stress pattern of Bangla song it is a requisite to analyze the stress pattern of Bangla words by using the mentioned phonological tools otherwise, the analysis of songs will be incomprehensible. In this work complete characteristics of stress feature of Bangla have not been described rather, the words of the selected songs have been analyzed. Though the stress pattern of Bangla language have been investigated according to the necessity of this research work in a limited range, this work will be a vital addition to Bangla musical phonology.

In western academia the reciprocal relationship between music and language has been defined as ‘musico-linguistics’, ‘musi-language stage’ and so on (Bernstein, 1976; Brown, 2001). In this research the term ‘musical linguistics’ has been taken to address

the relationship. Moreover, a new terminology has been introduced in Bangla linguistics and music arena through this research.

1.4. Research design

For being a qualitative study this research has been proceeded by solving some research questions. Thus after raising a prime questions, several sub questions have also been formed simultaneously in order to find answer(s) of the first question. These questions may be raised from two types of aspects like, linguistic and musical aspects. Basically, by solving these questions, this study has been accomplished.

Three songs have been selected from the most prominent streams of Bangla songs in respect of the aspect of devotion.

First of all, the lyrical and musical presentations of the songs have been provided. In this case morpho-syntactic glossing as well as staff notation with lyrical glossing have been given for linguistic and musical descriptions respectively. Then the first stage of analysis is the linguistic analysis of lyrics solely. Regarding linguistic investigation prosodic hierarchical structures, prosodic tree diagrams, feet inventory and formation of feet structure and tests through the parameters of the metrical constituents of the songs have been shown.

After that each song has been described with the selected tools of GTTM. The songs have only been explored by using the theories like, strings and grouping structure, metrical structures and prolongational structures in this study. Since grouping as well as metrical structures do not show the hierarchical mechanism of the elements, prolongational diagram is eventual in this case. Moreover, the acoustic phonological evidence of the songs have been analyzed in this section and after getting the acoustic information it has

been observed whether the stress of songs being changed for melodic insertion. After that, the metrical representation of transformed stress grid of lyrics of songs have been presented. Once the transformed metrical stress pattern is revealed, it is easy to depict the time span reduction structures of the songs. In this case firstly the prosodic form of the words of the lyrics have been translated into time span reduction tree diagram. The second stage is to rewrite these translated tree diagram with transformed stress assignment for inserting tunes. Finally a complete prolongational structure of songs with transformed stress assignment have been depicted. In this way the stress transformation of Bangla songs have been sketched out.

1.5. Assumption and limitation of the study

Though the songs have been selected concerning the feature of devotion of Bangla song, these three songs contain a variety of musical as well as linguistic features. As a consequence various syllabic structures, feet inventories and prosodic structures have been found through analyzing the songs. Moreover, various combination of parameters of metrical constituents are also predictable among the words of the songs.

Furthermore, since linguistic software praat has been used in order to analyze acoustic phonological features, nearly accurate measurement have been found. On the other hand for writing the staff notation of the music musical software musiscore 2.2 has been used. In this case the skeletons of the melodies of the songs has been constructed.

However as Bangla music possesses some characteristics different from western tonal music, it cannot be written up in a subtle way through staff notation. For example, the ascending and descending pattern of notes of Bangla songs are very different from western songs. In this case in order to correspond to those features ornamental symbols like, trill, mordent or crescendo might not be appropriate.

In case of the cognitive explanation of the relationship between language and music any Event Related Potential (EPR)[8] test cannot be done due to the lack of sufficient neurological equipment.

In this study only three Bangla songs have been selected for the sake of economic analysis. If songs from all genres were taken for the analysis, an overall picture of stress transformation of Bangla song could be drawn.

1.6. Chapters outline

This thesis has been divided into seven chapters such as, Chapter 1: Introduction, Chapter 2: Theoretical background, Chapter 3: Revisiting the previous studies, Chapter 4: Methodology, Chapter 5: data analysis, Chapter 6: Comparative discussion and Chapter 7: Conclusion.

In the chapter 2, the theoretical framework of this study has been constructed in order to analyze the songs and the previous relevant studies have been provided in the chapter 3. Next, the research method, questions and the design of the whole study is provided in the chapter 4. Basically the research has been done in the chapter 5, as this chapter contains the complete analysis of the study. A concise comparative discussion on the findings of this investigation has been provided in the chapter 6. Final discussion and findings are provided in the chapter 7.

[8] ERP is a test which measures brain responses of a specific cognitive, sensory or motor event.

Chapter 2

Theoretical background

The prime focus of the theoretical discussion in this chapter is to develop the foundation of analyzing methods and framework as well as to reveal how speech stress transforms into musical stress in Bangla songs. In order to sketch out the conceptual basement of the theoretical framework and tools, it is necessary to explore the eventual relationship between language and music. For this reason, after providing the introductory discussion of the theoretical guideline, some light has been shed on showing the intertwining connection between them. For example, all possible scopes of association ranges from direct analogy to systematic structural comparison have been discussed primarily. After that the applicable tools of Generative Theory of Tonal Music (GTTM) which is established inspired by metrical phonology have been provided. Then, the basics of metrical phonology and the parameters of feet structures inventory are sorted out. In addition the acoustic phonetic features, which have been examined in this study have been mentioned at the end of the chapter.

Even though the descriptive and structural aspects of music and language are the principal concern of this chapter, multidisciplinary (i.e. cognitive, evolutionary) aspects regarding language-music relationship are relevant and have been given equal importance to strengthen the theoretical foundation of this study. Prior to build up an analytical base of this research, it is necessary to review the possible point of views that have been figured out by many thinkers over the years. The reciprocal relationship between those two communicative medium has been developed from three aspects: Evolutionary aspect of language and music, Cognitive aspect of those two domains and Structural framework of those two hierarchical systems. First of all the theoretical basement of this study by which the analyzing methodologies and tools of this study are designed is discussed briefly.

2.1. Metrical Phonology: a theoretical guideline of this study

Metrical theory of phonology is generally concerned with organizing phonological segments into groups of relative prominence. The segments, which are incorporated into syllables, syllables into metrical feet, feet into phonological words and words into larger units. This entire association of phonology is often represented by hierarchical tree structures and grids. Though the theories of metrical phonology has been developed as non-linear theory of stress, the domain of this theory has been extended to other phenomenon (Hulst, 1995). The theory of the representation of nonlinear stress is introduced by Liberman (1975) and Liberman and Prince (1977) is a direct reaction to the linear analysis of stress proposed within the sound pattern-framework developed by Chomsky and Halle (1968). In metrical phonology stress is seen as a relational property among the phonological segmental constituents which are manifested by tree structures expressing binary relationship between sister nodes which are labeled strong and weak. Further elaboration of this stress theory such as, the metrical stress assignment, types of stresses and parameters of metrical constituents have been provided in the section 2.6.

Since this is a twofold study which contains the aspects of showing the linguistic stress assignment of lyrics and melodic stress pattern, the theoretical basement has to be constructed by taking a common field. In this regard considering metrical phonology as theoretical guideline, prime data analyzing tools have been designed from Generative Theory of Tonal Music (GTTM) whose core foundation has been built inspired by not only generative theories of linguistics but also metrical phonology. Moreover, it is noteworthy that the melodic stress pattern develops by modifying the natural stress pattern of language (e.g. lyric) in a song and this research is an endeavor to show how this change is occurred. For this reason, metrical phonology has been taken as the theoretical background since the basic components of GTTM are developed by following the prosodic hierarchical segmentation and rules of linguistic stress (see section 2.4.1.1.). The connection between the theoretical guideline and the analyzing tools of this study can be shown by a diagram,

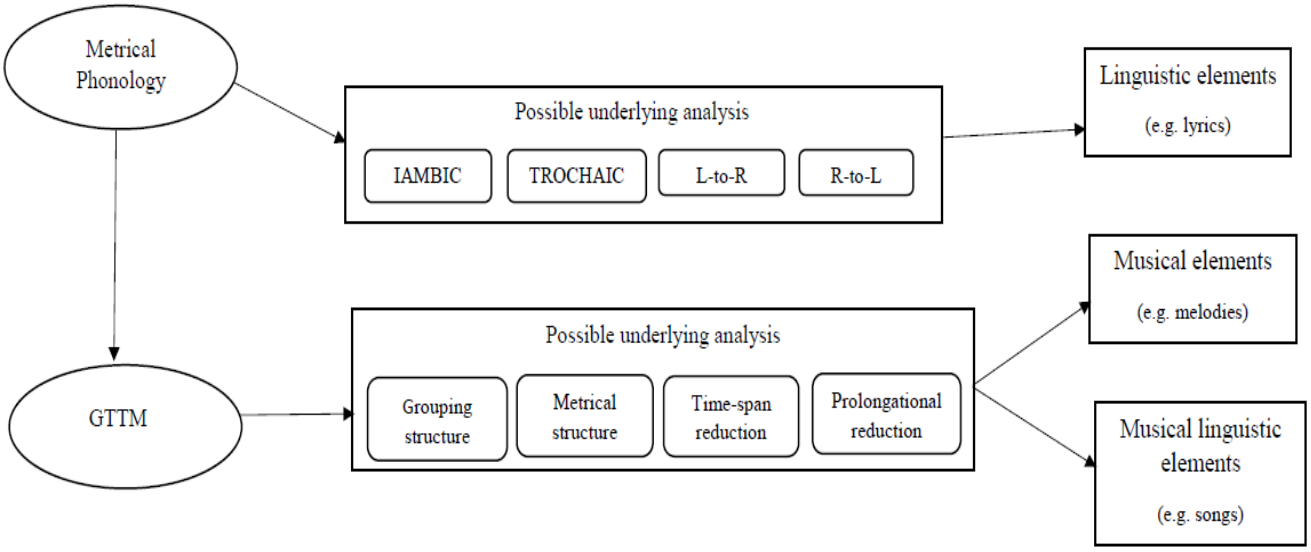


Figure 2. 1: Model of the Connection between theoretical guidelines and tools

The figure 2.1 depicts that the possible underlying analyzing tools of GTTM have been integrated by direct influence of metrical phonology, though the forms of both methodologies are quite different. The linguistic elements like, lyrics without melodies require metrical parameters whereas, musical and musical linguistic elements such as, melodies and songs need analyzing tools of GTTM. The possible underlying analysis of GTTM and metrical phonology have been discussed elaborately in section 2.5 and 2.6.

Before start discussing the aspects (e.g. evolutionary, cognitive and structural) mentioned at the beginning of this chapter, it is important to go through a general outline of music-language relationship.

2.2. A general outline of the Relationship between language and music

The parallel and non-parallel (Jackendoff, 2009) between music and language have been systematically discussed by biologist, anthropologist, musicologist, semioticians and linguists from their own point of views using different methodologies. According to the linguist William Bright (1963) "language and music are the two most important ways in which man use sound" (p. 26). Though sign language does not take sound as a way of expression, music is quite dependent on sound. Nevertheless, the most significant point of connection between language and music is that they both rely on the analysis of complex sound. It is the most eventual feature of both systems that builds up a connection between them. In this stage, it is relevant to ask a question like, what do music and language have in common and how are they different? In order to answer this question Coker (1972), in his work of music aesthetics, provides a list of characteristics particular to language, suggesting in some senses the comparison between the two,

1) "A language consists of a complex set of symbols.
2) The set of significations for each symbol is shared in common, at least to some extent by the members of the linguistic community.
3) The symbols can be interpreted and usually produced by the normal members of a community.
4) The set of significations for each symbol is conventionally fixed.
5) A language has or in principle is capable of having a dictionary listing each symbol and its synonyms or the set of its signification.
6) A language has a syntax: it has a structural rules for the kinds, the ordering, and the connection of symbols into permissible combinations" (p. 07).

Coker's attempt to define common points joining language and music is a representation of important developments in the linguistics of the twentieth century which is known as structuralism. For example, the core unit of both system has been indicated as sign and it is clear from his listed characteristics that both medium consist symbolic signs.

Furthermore, signification of these signs require minimal conventionality by certain group of people to convey meaning. The phoneme and morpheme which are structural units of human languages are particularly important in this regard as those notions provide linguists a set of units which could be codified and classified. Some attempts of musicologists as well as linguists to find a comparable form of codification similar to the linguistic system of phonetics for the syntax of music are noteworthy. Bright (1963) comments in this case that "musicology has perhaps been slower in identifying its formal units, but some of the most interesting advances in this task specifically explore parallel between music and language and suggest musical analogies to the linguistic phonemes and morphemes" (p. 29).

Direct correspondence between musical units and linguistic units was first introduced by Leonard Bernstein. In his Norton Lectures which were delivered at Harvard University in 1973, presented a self-styled quasi-scientific exposition. The lectures were both recorded on video and printed as a book titled *The Unanswered Questions: Six Talks at Harvard*.

2.2.1. Musico-linguistics: a Bernsteinian approach of music-language relationship

Bernstein (1976) is the first musicologist who suggests an interdisciplinary approach triggering music and language. In this regard he strongly proposes that linguistic theories, methodologies as well as analyzing tools might be applied in order to describe musical structure. These lectures he titled, 'Phonology', 'Syntax' and 'Semantics'. Each of them dealing with a distinct but linked branch of linguistic study like, the first one deals the system of relationship between the speech sounds constituting a given language; the second one deals with the structure arising from those sounds and the last one the natural result of adding phonology and syntax together. The final three talks were concerned about the

implication of theories of phonology and syntax for the future of western tonal music. Moreover, he proposes an overall term 'musico-linguistics' regarding this twofold study. Though his theory confronted ruthless criticism by later musicologists and linguists (Lerdahl and Jackendoff, 1983), it is beyond question that his Norton Talks were an inception of discussing the reciprocal relationship between music and language.

2.2.1.1. Bernsteinian musical phonology and syntax

First of all Bernstein proposes that starting on a phonological level it is necessary to seek 'substantive universal' within the musical text through transformational generative methodologies. He compares musical note arrangement to sound system of speech. For doing this analogy he indicates the feature of 'worldwide inborn musical grammar' which he takes from innate linguistic capacity. It has been referred from his self-reported discovery of 'musical germ[9]' which has been originated from Aron Copland's Piano variation (1937)[10]. This musical germ is pointed out as substantive universal of all music. As a matter of fact musical germ is a combination of four musical notes like, E, C, D# and C#. These four notes in another order can also be found as a form of subject of the Bach's C# minor fugue, Spanish rap city and even in Indian Raga music (Bernstein, 1973, p.09). He assumes that there were some primal reasons which is why these four notes prevail in a variety of musical examples regardless of cultural barriers. For this reason it is postulated that this is the substantive universal of musical phonology.

On the other hand, he describes musical syntax by linguistic syntactic rules of speech. Musical syntax may be analyzed by showing musical equivalent to grammatical description. He proposes that musical motif can be equated to grammatical substance or parts of speech. For example, Wagner's fate motif contains three notes and these notes act as phoneme or morpheme that make up a word which is a noun or substantive. This substantive is not a

[9] Musical phonological universe

[10] The Piano Variations of American composer Aaron Copland were written for piano solo from January to October 1930

literal linguistic noun but a musical noun. He equates a chord or harmonic entity with a modifier such as grammatical adjective. When this harmonic entity add to the fate motif then it modifies the motif. Then the modified motif may express some extra meanings like, cruel motif, kind motif etc. (Bernstein, 1976, p.58).

A further example involved Chomskian 'Jack loves Jill' paradigm (Chomsky, 1957). Here a deep structure underlying strings of E major triad is equated with the transformational rules of the given sentence. For instance, Bernstein showed examples from musical triad in which not only each triad consists of three notes that could correspond to linguistic parts of speech but also they functioned like subject, verb and object in a musical passage. To elaborate, E major triad has three notes, E, G# and B. And E can function as subject whereas G#, B can act as a verb and an object respectively. These three notes can be expressed as same as the underlying process of simple sentence such as, Jack loves Jill. On the other hand, by adding cord with triad notes these simple proposition can be changed which can be compared to the interrogative transformation. In the same way other transformational productions are possible by adding different chords with triad notes in an E major progression.

Since these analogy theory was not examined with a vast amount of data cross-culturally as well as systematically, it was roughly criticized by later generative theorists and musicologists (Lerdahl and Jackendoff, 1983; Keiler, 1978).

2.2.2. Prevailing shared common capacities in language and music

At this stage of discussion it is relevant to illustrate basic similarities and contradictions between those two domains. In doing this we need to sort out fundamental distinctive features of both domains. In this case a fundamental question raised by Jackendoff in defining parallel and nonparallel between language and music can be mentioned: what does

language share with music that makes them different from other human activities (Jackendoff, 2009)? Basically this question emphasizes on the similarities between language and music, sometimes to the point of people coming to believe that they are almost the same thing (Patel, 2013). The parallel between these two activities are therefore not superficial: music and language may be two expressions of the same competence for human communication. The divergence between language and music are quite striking, therefore it is needed also to ask further questions like, a) how are music and language different? And b) if music and language are the same, are they genuinely distinct from other human activities? (Jackendoff, 2009, p. 195).

In order to get answers of these questions it is necessary to make a list of similar characteristics between music and language and dissimilar as well.

2.2.2.1. Parallel features between language and music

a) First of all both domains appear to be uniquely human. Although many animals have communicative system, no nonhuman has either language or music in human sense, and in particular there are no obvious evolutionary precursors in nonhuman primates. On the other hand there is a deep parallel between those domains in the course of evolutionary journey (Jackendoff, 2009, p. 196). Evolutionary aspect has been discussed later.

b) Both domain consist of organized sound production which have already been mentioned by Bright's (1963) quotation. To elaborate the minimal unit of structures is phoneme which does not have any meaning like, the phonemes of 'language' /l/, /a/, /n/, /g/, /u/, /a/, /g/ do not make any sense but there is not any other way to utter the word without using sound system. Yet, gesture and sign language have some correspondence to speech in expressing similar concept that is not dependent on sound system. On the contrary music is quite impossible without sound system. Like,

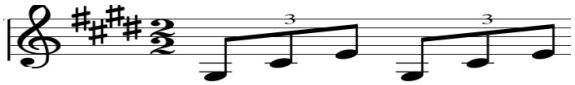


Figure 2. 2: Staff notation of moonlight sonata

These particular notes G, C, E of Beethoven's moonlight sonata cannot be expressed any other way except sound organization. Though music conducting arranges the musical composition by sign language, there is not any direct correspondence of melody to gestural sign.

c) Every culture has a local variant of language and every culture has a local variant of music, thus both domains are culturally universal. In this case the indigenous community called Piraha from Amazon is noteworthy (Everett, 1988). They do not have any number concept, specific words for color, recursion process in language, creation myth, concept of god but they have systematic verbal language and they also have systematic musical system (Patel, 2007). Moreover, in every culture language and music can be combined in song (Jackendoff, 2009)

d) The most prominent features of both domains are that both are complex, communicative, expressive and meaningful activities. Now the question can be, how could the notion complexity defined? For generative theorists in language the base of complexity is recursion process in producing sentences. Recursion is a process by which human being use language or achieve language creatively. But, the mentioned indigenous community Piraha does not have any recursion process (Everett, 2008). Despite this feature prevail in the most of the languages in the world. On the other hand musical recursion can also be analyzed by reduction and prolongational theory of GTTM which will be discussed in detail in the GTTM section.

e) Another significant and primal similarity is both domains employ rhythm as well as contour. In fact, the ultimate endeavor of this research is to investigate how linguistic rhythm in particular stress system is transformed into musical stress system. Therefore, rhythmic pattern of both domains have been discussed elaborately later.

f) The two domains come together in poetry and song. In particular, it has been already discussed that linguistic and musical transformation are quite different from one another. After reaching surface structure or prose level language has further step to achieve super surface structure by which aesthetic expression is embodied, such as poetry. On the other hand, music does not have any prose level representation instead, by metaphorical leap it reaches to the super surface structure directly. For example musical notes and melodies do not convey any denotative meaning as language do. Since the conventionality of symbolic signs of music are not as rigid as they refer any concrete idea, they do not have any linguistic type surface level.

g) From generative point of view both domain produce infinite output through finite input. For example by using a limited amount of or a set of underlying strings a speaker of a language can produce millions of sentences in her/his life. In the same way music has infinite production process but this process is quite different from language. Instead of Bernsteinian musical generative theory which is the direct analogy of linguistic style, Generative Theory of Tonal Music's (GTTM) approaches in particular, preference rules, time span reduction, metrical rules, prolongational structure etc. have been focused later in this study.

h) Some linguists and musicologists postulated that the principal parallel of both domain is that both are organized hierarchically (Jackendoff and Lerdahl, 1983). The most significant and eventual similarity is that both maintain structural hierarchies in order to create structures. For example,

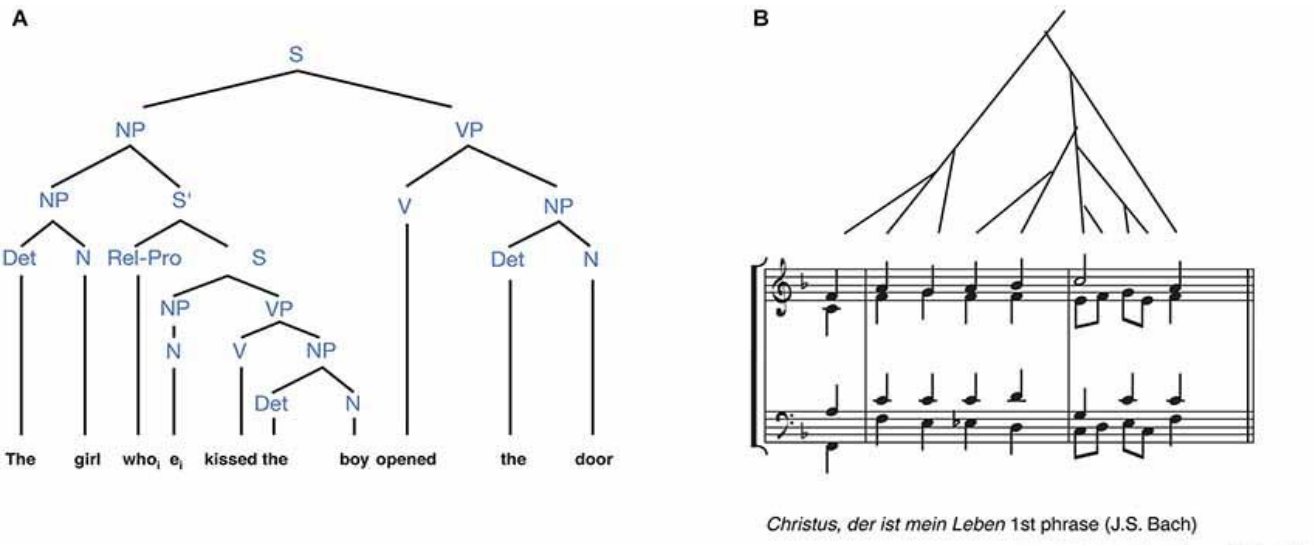


Figure 2. 3: Hierarchical systems are shown by linguistic and musical tree diagram

Those features of both domains have been discussed in the section 4 and 6.

2.2.2.2. Nonparallel features between language and music

a) Music does not have anything like word meaning of language.
b) Music does not have semantics in a linguistic sense such as, reference, synonyms, truth condition, entailment etc.
c) Music does not have parts of speech or phrasal categories like, noun, verb, adjective, Noun Phrase, Verb Phrase etc.
d) Music does not have a system of phonological distinctive features.
e) According to Jackendoff (2009) “the gist of linguistic utterance can be translated from any language into any other (p. 197-198).” This function is not satisfactory in music. In particular, suppose one can translate Japanese to Swahili or English, it makes no sense to think of translating from Indian raga music to western classical music

On the other hand Lerdahl (2013) mentions some musical features which are totally absent in language

a) “There is not any musical pitches and intervals in language.

b) The degree of consonance and dissonance are not found in language
c) Language does not have scale harmony or counterpoint.
d) Hierarchical pitch relation is not possible in language.
e) Tonal tension and attraction are not available in language." (p. 271-272)

From the functional aspect Lerdahl showed what is possible and impossible in Language and music. As a matter of fact that both domains possess some unique qualities as well as capacities which are not only shared by each other, but also help them to establish as a distinct system. To elaborate these characteristics mentioned above first of all it is clear that Lerdahl completely rejects Bernstein's analogy theory (Lerdahl, 2013). Parts of speech of language which refer object, person, place, time, emotion directly is totally impossible in music. For instance there is not any note in any type of music in the world that directly refer to the words 'river', 'dog' and so on. However, Wagner's fate motif that was modified by Bernstein later as 'cruel fate' or 'kind fate' do not refer to the word 'fate' or the concept 'fate'. Similarly,

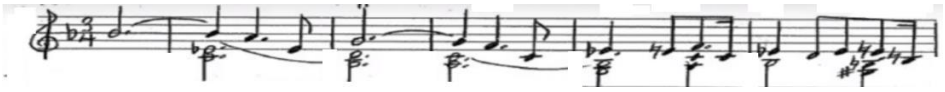


Figure 2. 4: staff notation Wagner's love motif

The combination of B, A, E of G melodic minor does not directly correspond to word 'love' or concept 'love', like these notes do not have any synonymous notes which express synonymous words of love like, affection, devotion etc. Great poet and musician of Bangla literature Rabindranath Tagore also was not convinced with the direct analogy of musical semantics from his own point of view regrading Indian Raga music. Like, certain types of raga indicate certain feelings or emotion. These raga have to be played or sung in specific time of the day and night. For example, *Bhairavi* has to be played or sung in the morning as it interprets morning mode, likely *Puravi*, *Gauri* indicate the evening mode. Tagore suggests that there is not any direct connection between any specific raga and any specific time or concept or mode like,

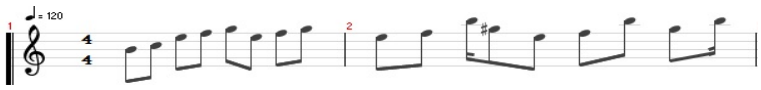


Figure 2. 5: staff notation of raga

There is not any connection between the combination of quarter notes of B, C, E, F, G, E, F and G and the mode of morning. Moreover, Tagore proposed that these notes or Raga can also be played in another time like night or evening other than morning and it may convey some meaning of evening as well (Tagore, 1985, p.10).

However in case of distinctive features these are the most basic units of the phonological structure by which phonemes construct unique sound. Like the phoneme /m/ has some distinctive features that make it different from other phonemes like /b/, /p/. There are approximately 12 distinctive features and some features are found in each phoneme of a language and rest of the features are absent. Such as, /m/ contains some features like, [+anterior], [+labial], [+nasal], [+sonorant], [+voiced]. These kinds of features are entirely impossible in music. Rather, musical notes are build up through supra-segmental features like, loudness, pitch and timbre. Therefore, there is not any parallel of these features for music.

In the same way talking about the unique features of music which are not found in language, first of all pitch interval does not prevail in speech. In music interval is the distance between notes. Interval determines in which order and manner notes are arranged in a melody, and intervals are identified with numbers. These numbers are determined by counting letter names from one note to the next. There are set of intervals in music like, perfect vs diminished and major vs minor intervals such as,

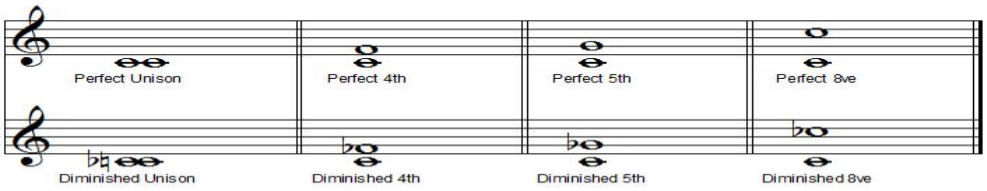


Figure 2. 6: musical intervals

Therefore if there is a distance of four, five and eight whole notes between two notes then a perfect interval will be created whereas two, three, six and seven gap will produce major interval. These kind of mathematical equations cannot be found in language. For example, in the case of constructing words no such scientific evidence has been found yet that phonemes merge to each other in a mathematical equation. Like, if we pronounce 'music' there is not any method in linguistics for measuring the distance between /m/ to /s/ and /s/ to /c/

CONSONANTS (PULMONIC)

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k g	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap				ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

Figure 2. 7: International Phonetic Alphabet (IPA) chart

(https://www.internationalphoneticassociation.org/content/full-ipa-chart.25.10.2018)

This consonant phoneme chart is arranged according to the place and manner of articulation of speech sounds. We can provide number for each articulation such as 1 for Bilabial in the same way chronologically 11 for glottal. Now the articulation number of 'music' can be like, Music= bilabial+ vowel /u/+ Alveolar+ Vowel /i/+ Palatal= 1+Vowel /u/+4+vowel /i/+7. Does the numeric interpretation as 1+4+7 of the word 'music' indicate any common pattern of sound organization? Since any research has not been done on linguistic intervals of phoneme, it has not been revealed yet. Nevertheless it is clear that musical interval does not function in language.

Secondly, in music consonance and dissonance are categorization of simultaneous or successive sounds and the first one is associated with sweetness, pleasantness on the contrary later is associated with harshness, unpleasantness. For example, from interval figure perfect 5^{th} is a strongly consonance sound and perfect 4^{th} is dissonance. On the

contrary we cannot say in the word ‘frustration’ the phonemes /f/, /t/ etc. are dissonance sound and in the word ‘ecstasy’ the phonemes /s/, /y/ etc. are dissonance.

Thirdly, it is completely impossible to produce harmonic arrangement of phonemes in speech which is one of the fundamental base of tonal music for example,

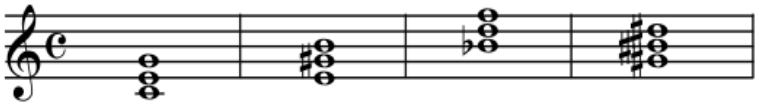


Figure 2. 8: Harmonic arrangement of musical notes

These types of vertical arrangement of sound production is beyond human capacity. Like, one cannot pronounce /m/ and /r/ sound simultaneously. However in case of music the entire grammar of note arrangement can be found in the circle of fifth like,

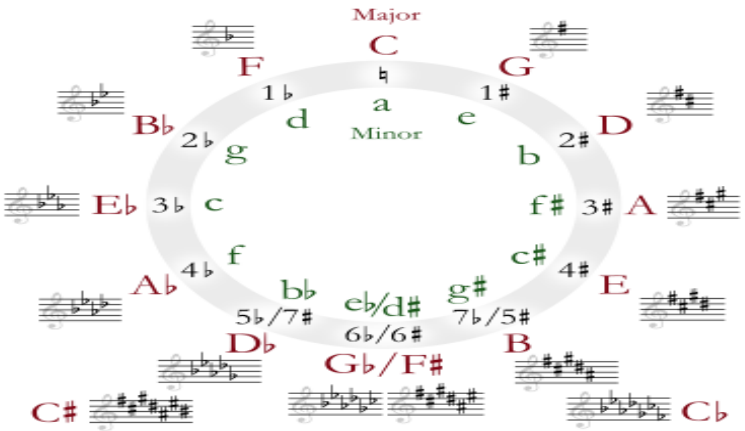


Figure 2. 9: Circle of fifth

(https://www.musical-u.com/learn/how-to-use-circle-fifths/.25.10.2018)

In this diagram we could find all kinds of note arrangement of music through major and minor progression of notes regardless of all cultures. On the contrary any single complex circle cannot be postulated in which all grammatical arrangement are contained.

Now the three aspects of language-music relationship which have already been mentioned at the beginning of this chapter have been discussed below to develop the theoretical foundation of this research. In fact among these three aspects the structural discussion has been sketched out the theoretical framework of our study.

2.3. Evolutionary aspect of language-music development

Blacking (1973) defines music as sound that is organized into socially accepted pattern. Furthermore he argues that every piece of music has its own inherent logic, as the creation of an individual brought up in a particular cultural background. However he claims that patterns of sound reflect patterns of social organization. On the other hand, some ethnomusicological studies (Kubik, 1969; Livingstone, 1983; Fogany, 1983; Brown, 2001; Levman, 2009) indicate more subtle phenomenon than Blacking's postulation. For example, in one study it has been proved that music is a voluntary act thus, music is the acoustic result of action (Kubik, 1969). In this case Kubik (1969) pointed out that "African music is not just sound but action is an intrinsic part of their musical performance" (p. 35-49). This strong correspondence between music and action is even reflected in language. In this study the evolutionary connection of developing language and music are discussed to reveal their common genesis or identical emerging source.

Thinkers ((Brown, 2001; Livingstone, 1983; Levman, 2009; Fogany, 1983) have taken three prime positions regarding this evolutionary relationship. First, language and music were developed in separate path and were constructed two completely different faculties. Second, music developed out of language or at least was chronologically later than language and language developed out of music and third, both developed from a common proto faculty. The first mentioned position is always seen in the work of the most

Glossogenetic[11] scholars who work on evolutionary aspect of language. It happens may be because these scholars are usually linguists, anthropologists, psychologists, and philosophers. They are reluctant to investigate the evolutionary structural parallel of both domains. Even though without positing any evolutionary connection they often make the point that language can carry semantic meaning in intonation (Levman, 2009, p. 147-148).

Since this study is an endeavor to reveal how phonological changes occur for putting melodies in lyric different aspects of connecting those domains have not been elaborated vastly. Rather we are just going to have a look at the evolutionary aspect which indicates the common shared property(s) of both language and music. In this regard the propositions of some thinkers related to this idea have given below,

Rousseau (1966) was the first strong advocate of this view that music and language share some common ancestor and that language evolved out of music for the sake of a rational organization of human society. For Rousseau the first words expressed the feeling of love, hate, pity and anger. Therefore language was originally vital and passionate before it become simple and methodical (Rousseau, 1966). Rousseau (1966) proposed that "primitive language was sung, not spoken, its accent, quantity and rhythm articulating the passions in an imitative iconic fashion. Eventually language become more regular and less passionate. Substituting ideas for feelings, accent diminishes and consonantal articulation increases: language become more exact and clearer, but more prolix, duller and colder" (p. 16). A revolutionary scholar Charles Darwin (1871) assumed that "music became firmly associated with passion in addition, music probably came before language" (p. 337). Yet, neither Rousseau nor Darwin did not draw any clear evolutionary link between those faculties.

[11] Glossogenetics focuses on the biological basis of the development and functions of human language

It is noteworthy that for the first time, Linguist Ivan Fonagy (1983) provided linguistic explanation of the common source of language and music. His view is that humankind's first language was clearly musical or the musical or prosodic elements carried the meaning directly (Fonagy, 1983). Fonagy explains this idea by double articulation process. Basically, present speech systems were later development of double articulation which evolved to express more complicated concepts of pitch variation. Double articulation or duality of patterning refers to the sonic division of a language into individual sound particles and, which have no intrinsic meaning in themselves but can be combined into new units of meaning as morpheme. For example, the phonemes /d/, /o/, /b/, /l/, /e/ do not make any sense unless it associated in a morpheme like, double or do. The development of double articulation indicates the exact point where language started to become symbolic than isomorphic. As well as, it is also the point where music and speech began to separate and develop their different ways. Nevertheless, even after their separation music and language connected intimately by their common frequency component.

However analyzing the phrase structure and phonological properties of linguistic and musical utterance Brown (2001) suggests that "music and language evolved from a common ancestor something he refers to as 'musilanguage stage' (p. 271). From this point of view many structural features shared between music and language are the result of their emergence from a joint evolutionary precursor rather than from accidental parallelism. In addition, significant evidence from brain functions have been found that both music and language developed along separate evolutionary path. Yet neurological studies show that their functions are so closely interrelated that there must have been a closer evolutionary connection. Therefore the discussion of the cognitive aspect of both domain is relevant in order to show their structural connection.

2.4. Cognitive aspect of music language development

The focus of this section is to describe how language and music act as unique communicative system and how cognitive resources or modules make them intertwined.

2.4.1. Shared cognitive capacities of both domains

Molino (2001) hypothesized that "music, language, dance, chant, poetry and play all have a partly common origin" (p.167). One of the most significant modules is rhythmic modules which is responsible for these activities among the neural modules. This rhythmic modules come into play in behavior such as, throwing, constructing or using tools. Neurophysiologist Calvin proposed that the preparation and organization of throwing movement is the source of a general syntax, the capacities to combine elementary sequences freely (Calvin, 1990). Therefore it is assumed that all types of cognitive activities have a common cognitive platform or all activities share some common cognitive features. In particular cognitive capacities of language and music will be emphasized here. Jacendoff (2009) identified seven types of capacities which are responsible for acquisition of language and music as well as are also shared with other cognitive domain. Among them five significant capacities have been given below,

a) Language and music require substantial memory capacity for storing representations of words in language and recognizable melodies in music.
b) In order to account for perception and combination both domains need the ability to integrate stored representations combinatorically in working memory by means of a system of rules or structural schemata.
c) The processing of both language and music involves creating expectation of what is to come. For example presumption is essential in order to merge different elements in a syntactic sequence.
d) Producing both language and music requires an ability to achieve voluntary control of vocal production. No other faculty demands similar vocal production.

e) Learning to produce language and music depends on the ability to imitate other's vocal production. This the ability to incorporate others inventions that enable both language and music to build a culturally shared repertoire of word and songs. (Jackendoff, 2009, p. 196-197).

2.4.2. Resource sharing framework: an explanation of inevitable connection of both domains

Though it is clear from the previous section that the cognitive faculty of both domains developed independently, some neuroimaging studies have pointed out some sort of overlap between those domains (Patel, 2012). By neuropsychological research it is evident that music and language are largely independent cognitive functions (Marin and Perry, 1999). By revealing significant overlap in certain aspects of musical and linguistic processing, neuroimaging has challenged this view. For example the processing of one aspect of musical grammar such as, the harmonic structure of chords and linguistic syntactic processing involves same brain operation. This truth has been proved in an Event Related Potential (ERP)[12] study (Patel, 2012).

In this study participant was given a reading task on computer screen. They controlled the timing of phrases by pushing a bottom to get the next phrase. In such studies, the amount of time spent viewing a phrase is assumed to reflect the amount of processing difficulty associated with that phrase. This "self-paced reading" paradigm has been used often in psycholinguistic research. The new aspect of this study was that each phrase was accompanied by a musical chord so that the entire sentence made a coherent, chorale-style chord progression. The sentences contained either a linguistic syntactic or semantic manipulation. In the syntactic manipulation

[12] Event Related Potential (ERP) is the measured brain response that is the direct result of a specific sensory, cognitive or motor event

sentences included either a full or reduced sentence complement clause such as, including or omitting the word “that”. Like,

The scientist | wearing | thick glasses | confirmed (that) | the hypothesis | was | being | studied | in his lab.

On the other hand, the chord played during the critical word (underlined) was either harmonically in-key or out-of-key. Out-of-key chords were drawn from keys 3-5 steps away on the circle of fifths from the key of the phrase. For example, a chord progression in C major might have an E-major chord as the out-of-key chord. The primal finding was an eventual interaction between linguistic manipulation type (syntactic or semantic), linguistic expectancy, and musical expectancy. Syntactically and semantically unexpected words were read more slowly and a simultaneous out-of-key chord caused substantial slow reading. Consequently, processing a harmonically unexpected chord interfered with the processing of syntactic relations in language (Patel, 2013). Therefore, this result support the claim that neural resources are shared between linguistic and musical structural integration.

At this stage from the evolutionary and cognitive aspects of both domains it is utterly clear that there is not any absurdity in finding deep connection between themselves.

From now our discussion has been proceeded not only to show the basic common structural platform of both domains but also to demonstrate common structural analyzing tools in order to examine one of their specific module for this study. As a consequence our experiment is needed to be confined in phonological aspect only. Since this is an endeavor to explore how Bangla song achieve musical virtue like, tune by developing transformed stress pattern from the lyrical stress, it is eventual to reveal the borderline of phonological separation of music and language. Consequently we need to select the theories and experimental tools which are not biased by any of them overtly. Rather it is necessary to take pertinent theories by which the phonological connection between them can be explained. For this reason

the metrical aspect of phonology has not only been focused but theoretical basement of this study has also been constructed through the aspect. In addition analyzing tools of GTTM have been implemented which are entirely inspired by metrical phonology.

2.5. Structural aspect and data analyzing tools of this study

It is now clear from the sections 2.1.1 that the direct analogy of musical phonology or musical syntax are entirely hypothetical and utopian to some extent as Bernstein did. In the same way this theories of Bernstein is not suitable for our current study. Therefore it is more significant in this study to figure out the theories which do not seek the direct parallel between the domains rather, explain how common features of those domains overlap. In addition it is also important to find out the theories which draw the lines between language and music such as, phonological connection or dissociation. In order to analyze data of our present study we need to limit our discussion through explaining the following issues which are assumed as common platform of defining the relationship in this study,

a) Generative Theories of Tonal music (GTTM)

b) Metrical phonological rules

2.5.1. GTTM model: a systematic structural explanation of language and music

Inspiring chomskian revolution in linguistics as well as in the intellectual landscape in the early 1970, Ray Jackendoff and Fred Lerdahl postulates that music might be studied in similar fashion. Their interest was not a literal transfer of linguistic to

musical concepts as Bernstein attempted. Rather they adopt the broad goals and methodologies of generative linguistics. The goal is to characterize the musical capacity by means of a rule system and structural description. Lerdahl (2009) comments that "it was Chomsky's way of framing issues that is the most attractive, the supposition of specialized mental capacities, the belief that they could be studied rigorously by investigating the structure of their output, the idea of limited set of principles or rules that could generate potentially infinite set of outputs (p. 188-189). In their book *A Generative Theory of Tonal Music* which was published in 1983 described the principles and parameters of GTTM model.

2.5.1.1. The overall model of GTTM

Though the overall model proposes in GTTM seems unlike linguistic generative model in some respect, the model is established adopting Generative theory of linguistics. In fact, several GTTM's structural representations resemble generative structural rules of linguistics directly. As lerdahl and Jackendoff themselves note, GTTM's hierarchical representation of metrical structure is formally identical to the representation of linguistic stress proposed by Liberman and prince (1977) and developed in much subsequent work of Hayes (1995). This particular point of contact is the focus point of our study as the goal of this study is to explore the stress pattern of language and music. They also pointed out the similarity between a component of their model called "time-span reduction" and the system developed by Selkirk (1980) and others as model of prosody in language such as, how sentence level phonology and syntax interact. In our later discussion it has been seen that both time-span reduction and linguistic representation of prosodic structure are characterized by hierarchically nested phrasal domains. In both systems the property of being a head involves some notion of rhythmic prominence, associated with the percept of stress in language, and with rhythmic and harmonic properties in music. Another

component of GTTM model, prolongational reduction which is a features binary-branching hierarchical structures are also headed.

Despite these point of similarity many of the properties of the GTTM are different from the generative linguistics sharply. The GTTM model has four major components: a) metrical structure b) grouping c) time-span reduction and d) prolongational reduction (Jackendoff and Lerdahl, 1983). Though the analyses presented in GTTM are sometimes showed as unidirectional mapping from representation in one component to other, the official representation of the model posits a more complex pattern of information flow among the four components.

Moreover, the hierarchical representations in the various components is characterized in both bottom to top and top to bottom terms. In contrast, language is characterized as having three major components that interact in a strictly unidirectional fashion. For example, lexical items are assembled by the syntax into hierarchically structured complex larger units by the recursive operation merge. At a particular point in the assembly of syntactic structures, information relevant to semantic interpretation and phonological interpretation is transferred from the syntax to the semantics and to the phonology. There is very limited information flow from the phonological and semantic components back to the syntax, and the bottom to top assembly of syntactic structures is strictly mirrored in the compositionality of semantics and phonology (Chomsky and Halle, 1968). Since theories are developed regarding the nature of system, GTTM explorer could not follow generative theory of linguistics entirely as language and music are different medium.

2.5.1.2. Basic component of GTTM model

In both language and music there are four abstract aspects of syntactic hierarchy like,

a) A string of objects
b) Nested grouping of these objects
c) A prominence grid assigned to the objects
d) Headed hierarchy of the grouped object

Regarding these notions GTTM theorists proposed four components for their model such as,

1. Strings and grouping structure: expresses the hierarchical segmentation of the piece into motives, phrases and sections.
2. Metrical structure: expresses the intuition that the event of the pieces are related to a regular alternation of strong and weak beats at a number of hierarchical levels.
3. Time-span reduction: assigns to the pitches of the pieces a hierarchy of 'structural importance' with respect to their position in grouping and metrical structure.
4. Prolongational structure: assigns to the pitches of hierarchy that expresses harmonic and melodic tension and relaxation, continuity and progression. (Lerdahl and Jackendoff, 1983, p. 8-9)

The GTTM theorists stated that generative music theory, unlike generative linguistic theory, must not only assign structural descriptions to a piece, but must also differentiate them along a scale of coherence, measure them as more or less preferred interpretations. Thus the rules of their theory are divided into two distinct types:

a) Well-formedness rules: which specify the possible structural description.
b) Preference rules: which designate out of the possible structural descriptions those that correspond to the listeners. (Lerdahl and Jackendoff, 1983, p 8-9)

It is noteworthy that those rules have been formed inspired by prosodic segmentation rules, prosodic well formedness rules and prosodic rules of prominence. These linguistic phonological rules are established by Liberman and prince (1977). Each of the above mentioned component produces candidate representations whose

properties are characterized by a set of well-formedness rules. Among the class of well-formed representations for a particular piece within each component, only a subset are normally preferred by a listener. A collection of soft constraints or preference rules for each component picks this subset. The preference rules of each component make reference to the properties of the other components. In GTTM the functions of the components and the assignment of the rules have been shown through a diagram. Here the diagram has been given,

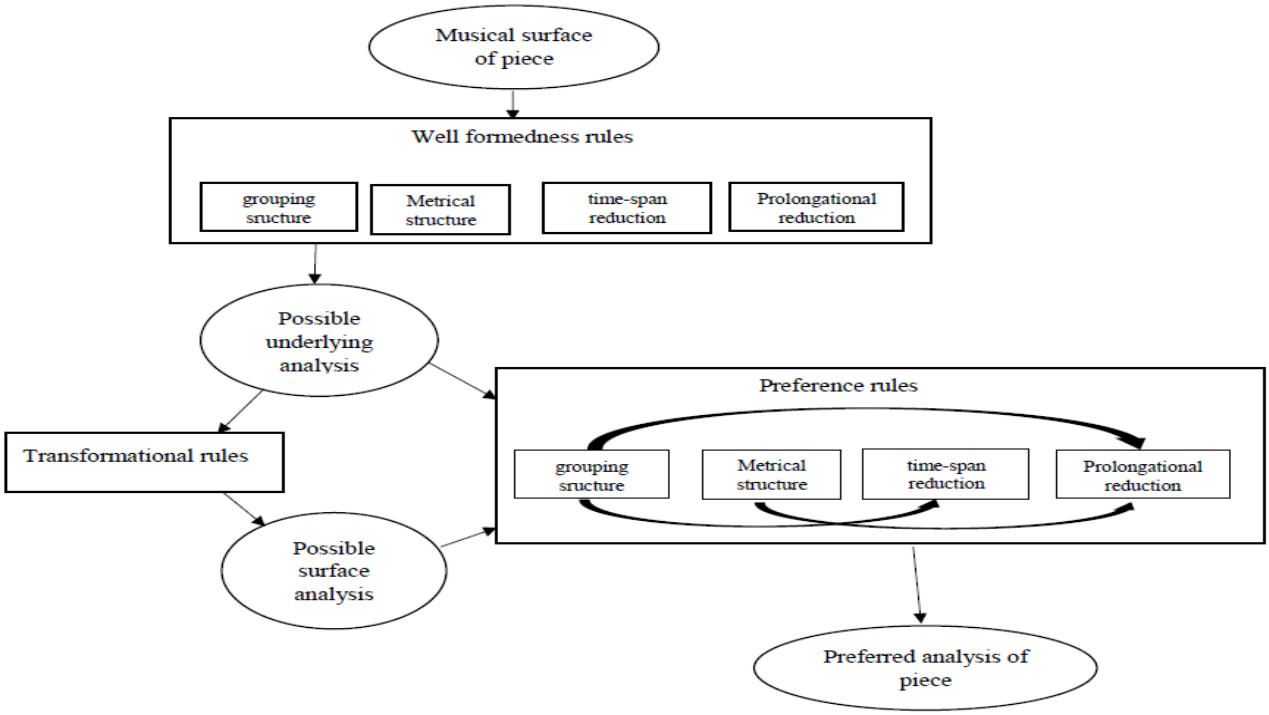


Figure 2. 10: Illustration of the GTTM model

(Lerdahl and Jackendoff, 1982, p. 10)

In order to understand stress assignment in music which is one of the most significant queries in this research, it is important to describe the above components of GTTM. Since it is not possible to find the transformed stress pattern of tune unless know stress types of music. The components are described here,

2.5.1.2.1. String and grouping structure

First of all it is necessary to define the term ‘syntax’ as the definition of syntax of traditional grammar is not sufficient for our present study. In this study syntax in both language and music is the hierarchical organization of strings of discrete objects or of features belonging to the objects. The constitution of a string of objects varies according to component and level within a component. In linguistic phonology, the object at the segmental level is a phoneme, syllable, word whereas, at the supra-segmental levels it is pitch, loudness and prosodic units. In linguistic syntax the low level object or constituent is a lexical item with discrete features and at higher level it is an X-bar phrase. For example, in a syntactic phrase whole principal constituent or head is an X such as, a verb phrase is a constituent headed by a verb and then a sentence (Chomsky, 1965). Music has different constituents. Music theory tends to ignore the psychological level which corresponds more or less to that of phonetics in linguistics (Lerdahl, 2013, p. 260) and treats perceived pitches, chords, and rhythms as its elementary objects. These can be referred to as pitch events and, then at larger levels units consist of grouping of events.

However, the basic correspondence between language and music regarding grouping is syllable and note. In a text setting single syllable is usually set as a single note. At a sub-object level syllable typically break down into a corresponding roughly to the sustained pitch of a note. Syllables group into polysyllabic words and clitic phrases, which group into phonological and intonational phrases. These levels correspond more or less to the musical levels of motives, sub phrase and phrase respectively. It is noteworthy that this correspondence is between music and linguistic phonology rather than music and linguistic syntax. In both domains grouping are assembled by contiguous objects. An illustration is given below,

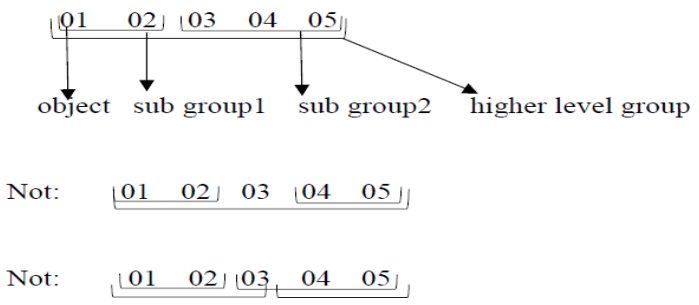


Figure 2. 11: Grouping structure (Lerdahl, 2013: 261)

From the illustration it is seen that higher level group are made up of contiguous groups at the next lower level. For example, there are five objects 01, 02, 03, 04, 05 and each sub group may have two or three objects like [01 02] and [03 04 05]. It is noteworthy that they must belong to a higher level group but one object cannot create a group as well as higher level group cannot be break down. Thus, grouping structures like [01 02] [03] [04 05] or [01 02 03] [03 04 05] are not acceptable since in those structure one single object [03] create a group and the same identical object is shared between two sub groups respectively.

In GTTM assigning a set of well-formedness as well as prominence rules objects are constructed in a variety of groups. These rules are called Grouping Well Formedness Rules (GWFR). Some of the Grouping Well Formedness Rules (GWFR) have been given here,

GWFR1: Any contiguous sequence of pitch-events, drum beats or the like can constitute a group and only contiguous sequences can constitute a group. For example, in music using this rules the first phrase of Mozart's G minor symphony has been given,

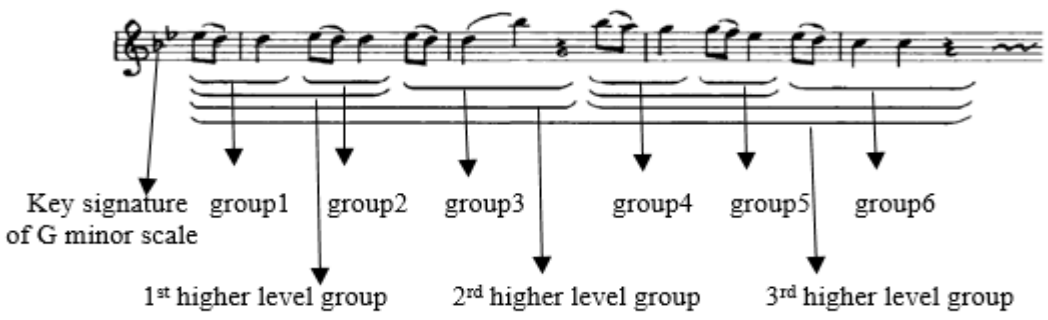


Figure 2. 12: Staff notation of Mozart's G minor symphony

From the figure 2.12 it is seen that GWFR1 permits all groups of the sort and prevents certain configurations from being designated as groups. For example, GWFR1 prevents all the eight notes in figure 2.11 from being designated together as a group such as, this rule prevent the structure: [E D D E D D E D D B B A G G FA E D C C] from being a single group. Rather, it permits several sub groups which construct further higher level groups gradually like, in the figure 2.11 it is seen that all groups are contiguous such as, [E D D], [E D D], [E D D B], [B A G], [G F A], [E D C C] are $G^{13}_{1,}$ $G_{2,}$ $G_{3,}$ $G_{4,}$ $G_{5,}$ G_6 respectively. Each of this groups act as sub group and they gradually build higher level group like, within 2nd bar [E D D]/ (G_1) and E D D/ (G_2) function as one sub group and both build 1st higher level group which is also a part of 2nd higher level group. Whereas, the other part of the 2nd higher level group is [E D D B] which acts as G_3 in this structure. Similarly, the next 1st higher level group consist of two groups: [B A G]/ G_4 and [G F A]/ G_5. Along with [E D C C]/ G_6 those groups construct the next 2nd higher level groups. Finally, all these sub groups create this specific melodic structure of Mozart's G minor symphony by constructing 3rd higher level group.

GWFR3: A group may contain smaller groups

[13] G_1 = Group 1

GWFR4: If a group G_1 contains part of group G2, it must contains all of the G_2. This rule prohibit grouping structure like,

Figure 2. 13: unaccepted grouping structure

In this example G_1 contains part of G_2 which is not supposed to happen in grouping structure.

GWFR5: if a group G_1 contains a smaller group G_2 then G_1 must be exhaustively partitioned into smaller group. (Lerdahl and Jackendoff, 1982, p. 37-38)

Using this group rules a Bangla song of Tagore *aɟi dʰaner kʰẹ̱te roḏro cʰayae* can be shown by the below figure,

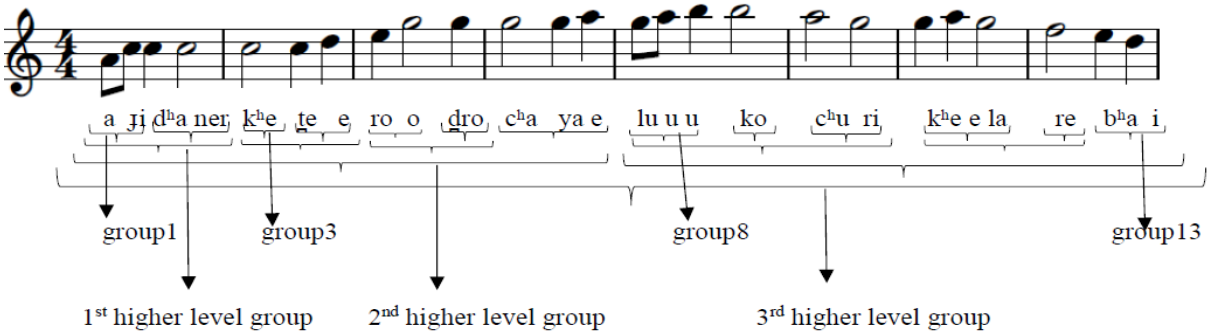
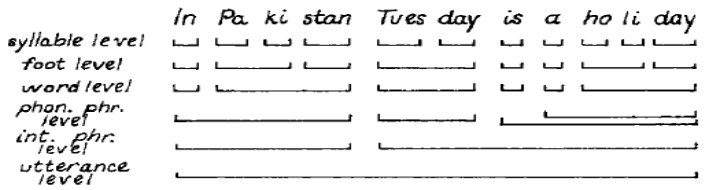


Figure 2. 14: grouping structure of *aɟi dʰaner kʰẹ̱te roḏro cʰayae*

It is important to mention that these same grouping constructions can also be found in hierarchical phonological process which is developed by Liberman, prince and Selkrick (Liberman and Prince 1977, Selkrick, 1978). In fact their phonological theory has been influence to develop the group structure, well formedness rules of grouping of GTTM. Here an example of linguistic phonological grouping is given,



(Lerdahl and Jackendoff, 1982, p. 318)

Figure 2. 15: Grouping in linguistic phonology

Similarly here G_1 to G_{11} have been assembled from lower level group to higher level group such as syllable level to utterance level.

2.5.1.2.2. Metrical structure and Grid

Since the discussion of this section is purely GTTM, linguistic aspect of metrical structure has been discussed later elaborately. The fundamental component of metrical structure is grid in any system. First of all, there are two kinds of grid in both language and music: 1) stress grid and 2) metrical grid. A stress grid in phonology represents relative syllabic stress. However, it is confusing called metrical grid in literature (Liberman and prince, 1977). On the contrary a linguistic metrical grid represents strong and weak periodicities in a poetic line in which stresses may or may not align. Stresses in ordinary speech are usually too irregular to project meter (Patel, 2008). The beats of musical meter are more periodic and consequently a musical metrical grid has many levels. Stress in music are less ruled governed than in phonology and act less important in music theory. Much more important in music theory is ‘pitch space stability’ for which there is no linguistic equivalent, thus it is not our topic of discussion. Here the abstract form of grid is given,

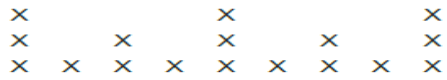


Figure 2. 16: Metrical grid of music

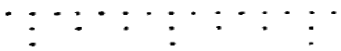
The grid X's belong to the syllable in language or pitch in a music event. Similar to the grouping structure well formedness as well as preference rules are also assigned to the metrical construction in GTTM and in the same way some of those rules have been taken from prosodic phonological rules. Here the Metrical Well Formedness Rules (MWFR) and Metrical Prominence Rules (MPR) which have linguistic phonological equivalence have been given below,

MWFR3: At each metrical level strong beats are spaced either two or three beats apart.

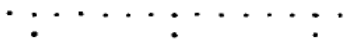
MWFR4: Each metrical level must consist of equally spaced beats. (Lerdahl and Jackendoff, 1983, p. 69)

For example,

(a)



(b)



Here example (a) is well formed metrical construction in which MWFR3 and 4 have been assigned and, on the other hand example (b) is ill formed as the rules have not been assigned there. In case of Metrical Preference Rules (MPR),

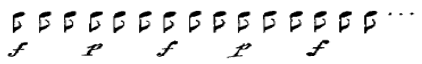
MPR4 (Stress): Prefer a metrical structure in which beats of level L_i that are stressed are strong beats of L_i.

For example,

In this example 2nd, 4th and 6th beats are stressed thus, according to the rules they are strong beat.

MRP5 (Length): Prefer a metrical structure in which relatively strong beats occur at the inception of notes of relatively long duration.

For example,



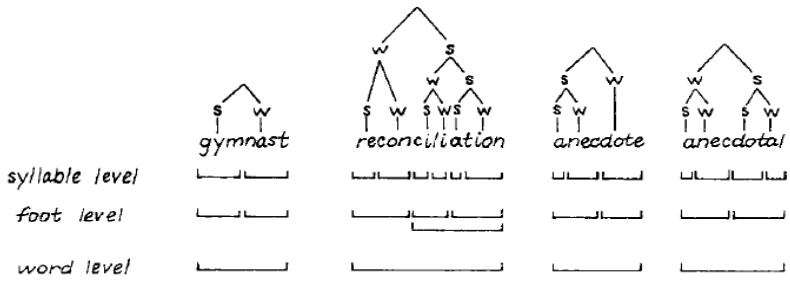
In this example, Forte (*f)* beats or louder or strong beats always comes first than piano (*p*) beats.

Parallel rules of prosodic prominence in linguistics Same kinds of prominence rules which have been described above for music are found in prosodic prominence rules like,

Prosodic Prominence Rule1: a. In a foot that immediately contains two syllables, the first syllable is strong.

b. In a foot that immediately contains a foot and a syllable, the foot is strong.

For example, assigning those rules four English word ‘gymnast’, ‘reconciliation’, ‘anecdote’ and ‘anecdotal’ have been shown,



(Liberman and Prince, 1977)

In these four words prosodic rules of prominence have been assigned explicitly. It is clear that every first syllables as well as foots are strong.

2.5.1.2.3. Headed hierarchical explanation: time-span reduction and prlongational structure

It is seen from the above discussion is that grouping structure and metrical grids do not show the hierarchical relationship of musical and linguistic objects. Yet both language and music are strictly hierarchical system. Grids and group do not form dominating-sub dominating constituencies. Strings of words and musical pitch event form headed hierarchies. Therefore emergence of new theory(s) is eventual to analyze this notion. In this regard time-span reduction and prolongational structure have been implemented in order to describe musical hierarchical objects. It has been already mentioned in 2.5.1.2 that time-span reduction describes hierarchies of structural importance of objects with respect to their position and metrical structure whereas, prolongational structure expresses harmonic or melodic tension, relaxation, continuity and progression. In this study time-span reduction will be focused to show music language stress assignment.

In GTTM, by showing the construction of reduction, tree notation has been developed systematically and this idea of tree notation has been directly borrowed

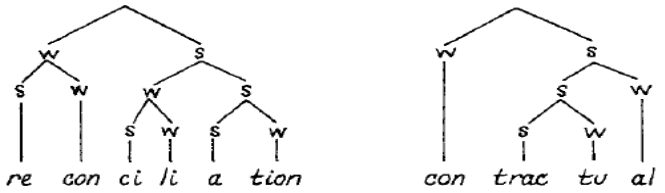
from linguistic hierarchical tree diagram. Though Schenkerian (1932) music notation is also attractive is this regard but it is not explicit enough (Lerdahl and Jackendoff, 1983). It typically combines a number of levels at one putative and often does not show what the elaboration of what is, moreover it utilized too many signs like, beams, slurs and so on to express same relationship. Therefore it is convenient to borrow from linguistics the notion of tree notation (Lerdahl and Jackendoff, 1983, p.112). Nevertheless, since linguistic syntactic tree diagram is related to the grammatical categories, this notion cannot be transferred directly as music does not have these categories. This is the fundamental difference between language and music. All natural languages have part of speeches and a linguistic tree is a representation of relationship like, a noun phrase followed by a verb phrase is a sentence, a verb followed by a noun phrase is verb phrase, and so forth. There is no musical equivalent for this relationship. Rather, the fundamental hierarchal relationship among pitch-events is that of one pitch-event being an elaboration of another pitch-event, the latter is the structurally more important event of the two (Lerdahl and Jackendoff, 1982, p. 113).

In this case of musical tree notation, the event that is elaborated is retained along with the event that elaborates it and the structural beginning of phrase do not disappear. On the contrary, in language grammatical categories are not retained in the tree structure from level to level but, breakdown into a verb plus a noun phrase, which in term may break down into an article plus a noun and so on. With this consideration adopting linguistic tree a purely musical representation of tree construction has been developed. In fact constructing musical time-span reduction notation, linguistic prosodic structure and prosodic tree notation have been influence more. Thus, it is necessary to discuss about prosodic segmentation,

2.5.1.2.4. Influence of Linguistic prosodic segmentation

Lerdahl comments that time-span reduction is a notational; variant of a formalism in linguistics called prosodic structure and these theories are closely related in form but not in substances (Lerdahl and Jackendoff, 1982, p. 314). The theory of phonology has assumed that sound pattern of language is determined simply in terms of the linear string of phonological segments or phonemes.

Under this assumption (Chomsky and Halle, 1968) many phenomenon of stress placement, stress subordination, vowel harmony and syllable are remained less important. Later research proposed by Liberman and Prince (1977) developed a theory of prosodic tree structure, sometime also called metrical structure concentrate on these mentioned issues. It is well established in linguistics that there are two simultaneous kinds of organization in the phonetic string: morphological and syllabic string and those two do not divide up into phonetic string in the same way. For example the word originality divides up morphologically as origin+al+ity but syllabically as o+ri+gi+na+li+ty. It is noteworthy that the syllable ‘na’ and ‘li’ cut across the morpheme boundaries. The syllabic rules determine position of word stress in various language. We have discussed linguistic stress system in metrical phonology section (see section 2.6) later. Those rules suggest that stress should apply not to the simple phonological string or to the morphological structure but to the syllabic structure. However the existence of numerous languages that places stress on every second or third syllable of a word suggests that in these languages syllables are themselves organized into larger units, which have been termed feet. The accumulation of feet together results a complete prosodic organization. Liberman and prince (1977) developed a tree notation which expresses the aggregation of syllables into feet and feet into words. In their notation each node of the tree dominates either a surface syllable or two other branches, one strong (S) and one weak (W). For example the illustration of tree notation of ‘reconciliation’ and ‘contractual’ have been given,



(Liberman and Prince, 1977)

Here the purpose of the s and w is to express relative degrees of stress. From the illustration in the word ‘reconciliation’ the main stress falls on the penultimate syllable or immediate syllable next to the last syllable whereas, the subsidiary stresses fall on ‘re’ and ‘ci’ and the remaining syllables are unstressed. Therefore the tree notation clearly represents relationship of stress that is in term of hierarchical operations of SS and WS.

Now the time-span reduction notation tree will be discussed as well as compare to the prosodic notation tree. First of all in time-span reduction tree the opposition is head versus elaboration on the contrary, in the prosodic tree the opposition is strong versus weak. This is the fundamental difference between those two notational systems. In GTTM, taking the time-span reduction notion of head as parallel to the prosodic notion of strong, equivalent structure for musical objects have been built up like,

In this illustration prosodic trees have been converted into time-span trees through elaborating the strong notes. Like, if the right mode is strong or stressed the node has to be elaborated. Alternatively reverse conversion is possible such as, conversion of time-span reduction to prosodic notation. Like,

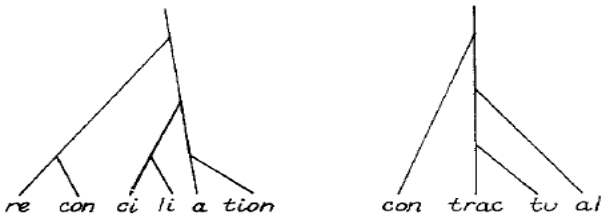


Figure 2. 17: Conversion of time-span reduction to prosodic notation

(Lerdahl and jackendoff, 1982, p. 317)

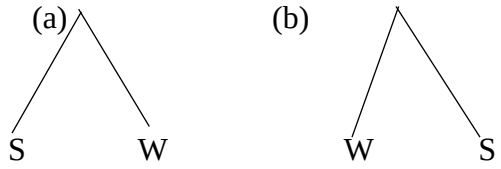
The prosodic tree construction can be described entirely by this musical notation such as, for 'reconciliation' the most stressed syllable is 'a', which is a penultimate syllable of the word and the node of this strong syllable is elaborated. Same operation is occurred in 'contractual'.

2.6. Exploring stress pattern of language through metrical phonology

Since from the previous discussion it is evident that the transformation of stress types are significant point of separation of language and music, it is important to investigate the stress pattern of language solely. For this reason, in this section the basic notions of metrical phonology which are relevant in order to analyze stress pattern of Bangla songs have been discussed. Though basically the theories of metrical phonology was developed as a theory of stress, the domain of this theory was extended to other phenomena which has not been focused here. Fudge (1969) argues that there are two types of hierarchical organizations imposed on each linguistic expression and both take segments or the elements of the segmental skeleton as their starting points. One is the morpho-syntactic hierarchy in which segments are organized into morphemes, morphemes into words, words into phrases and so forth. The other is the phonological hierarchy in which segments are grouped

together into syllables, syllables into feet, and feet into phonological words and so on. Metrical phonology is a theory about the nature of this phonological hierarchy which contains internal organization as well as plays role in the application of phonological rules, moreover there is a deep connection between the phonological hierarchy and the morpho-syntactic hierarchy.

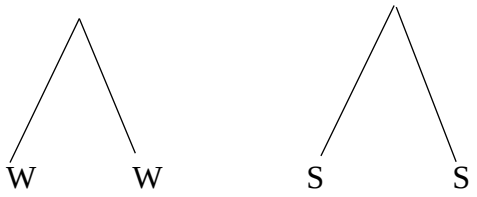
The theory was originally proposed by Mark Liberman (1975) and elaborated by Liberman and Prince (1977), halle and Vergnaud (1978), Selkirk (1980) and Hayes (1981). English word stress had extensively analyzed by Chomsy and Halle in their book *Sound Pattern of English* (SPE) which was published in 1968. In the metrical approach of phonology the SPE rules is not completely abandoned rather, the rules have been modified such as, the string of segments is now fed into an algorithm that parsed it into a constituent structure. This structure is called metrical structure since the central role of a units called foot, a term that is borrowed from poetic meter (Hulst, 1995). In metrical approach of describing sound system it is assumed that segments are organized into syllables whereas, SPE considered phonology without syllables. On the contrary, in metrical phonology hierarchical illustration of syllables are shown in order to understand phonological units. In metrical theory of stress pattern of a word is represented in terms of a binary branching constituent structure where sister nodes are labelled as ‘S’ means ‘stronger than’ or dominant and ‘W’ means ‘weaker than’ or dependent. The basic building block are look like,



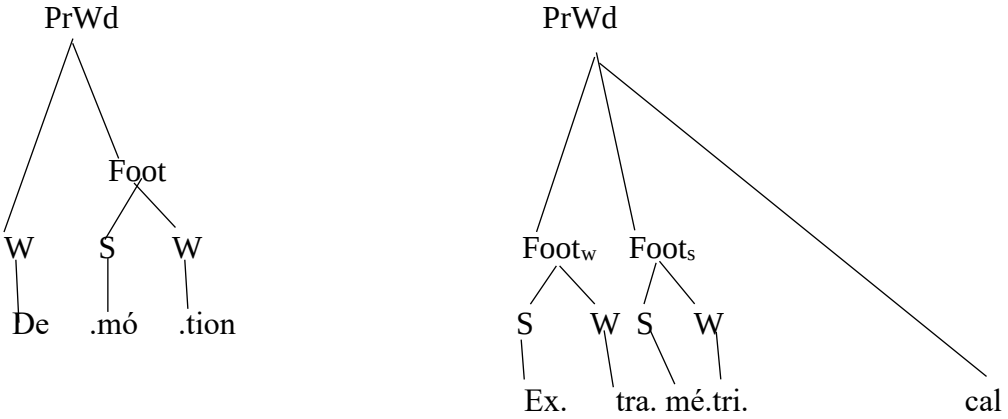
The metrical algorithm introduced by Liberman and Prince, added to the syllabified string which is a layer of bisyllabic constituent called feet. The labels ‘S’ and ‘W' do

not interpret as phonological features with a fixed phonetic interpretation. They indicate that the node labelled ‘S’ is in some way dominant with respect to the sister node labelled ‘W’. This stronger-weaker relationship is utterly binary and thus, asymmetrical and reflexive structures are not accepted like,

(a) Asymmetrical (b) irreflexive



Binary trees, labelled S and W, have one and only terminal element that is exclusively dominated by nodes labelled S. It is this property which makes them so suitable to express those characteristics of the sound flow that are traditionally called culminative. Stress is not only a culminative property but also a relative property. Stress patterns are rhythmically organized by feet (Prince 1976; Halle and Vergnaud, 1978; Selkirk, 1980). A foot is the metrical constituent that groups smaller units within a words such as, syllables or moras into bigger units. Each foot has exactly one head syllable marked with ‘S’ and ‘W’ and each prosodic word like, content word has exactly one head foot and it does not any matter that how many feet it contains such as,



(Apoussidou, 2007)

In this illustration the feet consist of maximally binary feet as in Hayes (1995). Feet with a strong-Weak pattern are called trochee and feet with Weak-Strong pattern are called iamb. Like, Feet inventory,

Trochee: (σ́ σ), (σ́) iamb: (σ σ́), (σ́) (Hayes, 1995, p. 438)

2.6.1. Types of stresses

2.6.1.1. Grammatical stress system

Grammatically assigned stress can serve as a word boundary marker by assigning stress on the first or last syllable of a word. Grammatically assigned stress can also serve as a marker of phonetically salient syllables like, in weight or quantity sensitive (Q-sensitive) language. Thus in this stage of our discussion it is essential to make distinction between quantity sensitive and quantity insensitive (Q-insensitive) features of language.

2.6.1.2. Q-sensitive Vs. Q-insensitive features

If stress is assigned depending on the structure of a syllable or depending on the weight of syllable in particular is called quantity sensitive language. The weight of syllables is determined by the number of moras it contains. Generally it is assumed that the rime of syllable can contain moraic elements. However to make it clear it is relevant to give a brief description on syllable structure. In the typical theory of syllable structure the general syllable consists of three segments and these segments are grouped into two components like, a) onset and b) Rhyme. The relationship

between this components are then shown either linearly or hierarchically. In this study we will put emphasis on the hierarchical organization of syllable like,

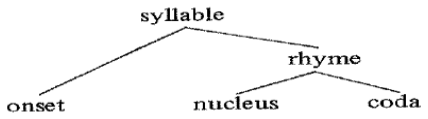
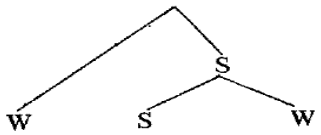


Figure 2. 18: Hierarchical representation of syllable

This structure has been hypothesized by some phonologists for a long time (e.g. Pike 1948, Fudge, 1969). The consequent structure can be given a metrical interpretation that each syllable has a peak like, that the segments that possess some phonetic features to the greatest degree. Metrical theory has brought modification of this structure as each word has one syllable bearing the main stress. Thus we got an extended structure of S/W relationship like,



Kiparsy (1979) proposed a metrical structure concerning syllables with a more complex structure like,

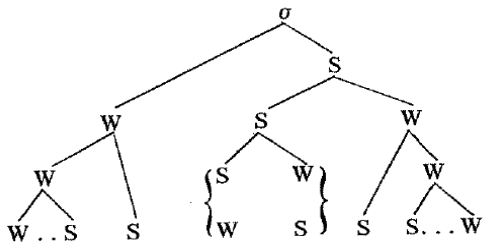
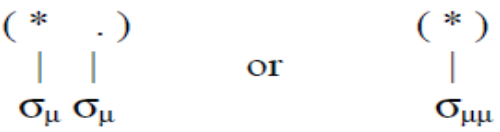


Figure 2. 19: Complex metrical representation of syllable

A syllable with a short vowel has one mora and that is light whereas, a syllable with a long vowel or diphthong has two moras and it is heavy. Coda consonant can count a mora like, in Piraha, an Amazonian language but it is not universal (Everett, 1988).

In some languages making the syllable heavy coda consonant are mora (Sapir & Swadesh, 1960), but in most of the cases the coda does not contribute to the weight of a syllable. In quantity sensitive languages with trochaic rhythm feet are ideally bimoraic. They should contain exactly two moras. Feet with Strong-Weak (S/W) pattern then called moraic trochee (Hayes, 1995). Moraic trochees can either consist of two light syllables (σ) containing one mora (μ) each or of one heavy syllable containing two moras like,



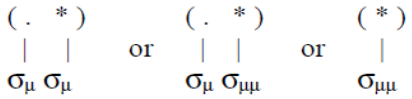
An example of this kind is Latin. Latin has phonemic vowel length and stresses the pre-final or penultimate syllable if heavy, otherwise the last third or antepenultimate syllable. For example, classical Latin has left prominent feet or trochee if it is weight sensitive and the last syllable in a word is extrametrical since it never receives stress if it is the only one syllable of a word (Allen, 1978). Syllables ending in a short vowel are light (L), while syllables ending with a long vowels or diphthongs as well as syllable that end in a consonant are heavy (H). In Latin word with three or more syllables the penultimate syllable is stressed if it is heavy. If the penultimate is light then the antepenultimate must be stressed and in the word with only one or two syllables, the left most is stressed like,

a.	Amice	‘friend’	[a.miːke]	[LH1L]
b.	Misericoida	‘pity’	[mi.se.ri.kói.di.a]	[LLLH1L]
c.	Homo	‘man’	[hó.moː]	[L1H]

(Apoussidou, 2007, p.51)

Here, the third column represents overt form including phonetic representations with stress (ˊ) and vowel length (ː) but without foot structure. From examples a, b and c it

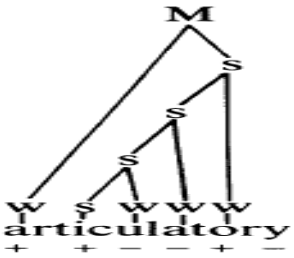
is clear that since Latin is a quantity sensitive language the stresses are put on penultimate, antepenultimate and left most syllables respectively. Whereas, iambs are weight sensitive if they consist either of a light syllable followed by a stressed light or heavy syllable of a heavy syllable (Hayes, 1995). Like,



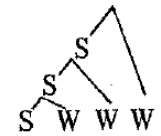
It is noteworthy that it has been mentioned in the previous studies of Bangla stress pattern in the literature review section of this chapter (see p. 59-61) that Bangla is an quantity sensitive language (Das, 2001; Khan,2008)

2.6.1.3. Bounded Vs. unbounded feet

Q-sensitive feet can be divided into two types: a) bounded feet and b) unbounded feet. A stress system makes use of bounded feet if there is an upper limit to the number of syllables that may be grouped into a foot. English feet are restricted to an upper limit of three syllables (Selkirk, 1995). Hayes claims that the bounded feet are universally limited to disyllabic feet, called binary feet and monosyllabic feet called degenerate feet (Hayes, 1995). He notes that ternary feet only occur at the edge of words, and he argues that in such cases we may assume that the marginal syllable (final of initial) are extrametrical. Like, an English word showing feet is given,



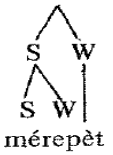
On the other hand, feet of unbounded Q-sensitive language may contain an indefinite number of syllables. For example, Hayes provided examples of unbounded Q-sensitive feet of eastern Cheremis (Hayes, 1981) where primary stress falls on the last full vowel of the word, and if there is no full vowel then first vowel. Examples of unbounded feet is shown,



kĭid əst əz ə 'in his hand'

(Hulst & Smith, 1982, p. 35)

In contrast, insensitive language feet are built ignoring the syllable structures, rather all kinds of syllable can occur in the head position of a foot. When a language has unbounded Q-insensitive feet all syllables of every word will always be grouped together in one foot, meaning that the word tree is always degenerated. Moreover it can be said that if a language has only one stressed syllable in a word, all other syllables being stressless and the language has unbounded Q-insensitive feet. Hayes provided examples of bounded Q-insensitive feet of *Maragungka* (Hulst & Smith, 1982, p. 35) and he adduced that the stress system of *Maragungka* where the primary stress falls on the initial syllable and a non-primary stress on every second syllable like,



mérepèt 'beard'

Hulst & Smith, 1982, p. 36)

In this study our prime concern is to understand Bangla stress system and since from the previous studies Bangla is a Q-sensitive language, Q-insensitive feature of feet will not be discussed here elaborately.

2.6.2. Parameters of metrical constituents of analyzing stress

According to Vergnaud and Halle (1978), the metrical algorithms introduced by Liberman and Prince (1975) is seen as just one member of a family of algorithms. Other members would involve the same type of foot, but assign from left to right or right to left and so on. Each step in the algorithm has been taken to be an "off/on", "left/right" or "yes/no" parameter. Hulst (1995) comments that "from Vergnaud & Halle's work on metrical phonology it is quite clear that the word stress rules of a great variety of languages could be unraveled and represents in terms of settings of metrical parameters (p. 3)". The basic metrical parameters that emerged from their studies have been given below,

a. Foot form: left- strong/ right-strong	left
b. Foot type: quantity-sensitive/ quantity-insensitive	QS
c. Foot size: bounded/ unbounded	bounded
d. Direction: Left-to-right/ right-to-left	R-to-L
e. Extrametricality: yes/no	yes
f. Edge: left/right	right
g. Word form: Left-strong/right strong	right strong

(Hulst, 1995, p.03)

The right hand column of this setting indicates the pattern of English word stress. Basically the parameters a. and g. are similar to the feet structure Trochaic vs. iambic feet structure. In this study we are not going to implement all these patterns listed above since the analysis has to be confined to feet structure only. Therefore we are going to discuss briefly on the foot form and direction and after that the metrical parameters for this study have been created.

2.6.2.1. Foot form and direction

Generally foot form allows the choice of "trochaic" and "iambic" structure. In accordance with the parameters foot type and foot size, there are four foot types. Hayes (1980) provides examples for all of them in both direction and footing by examining eight types of languages. Subsequent research has revealed that all types are widely attested even if it is considered the eight possibilities that has been just mentioned (Hulst, 1995, p. 04). Hayes (1985) reported that systems making use of the feet are suspiciously rare and unattested pattern under certain circumstances which are given below,

Rare feet (in either direction)

a. Q-insensitive iamb
b. Q-sensitive trochee

Hayes proposes to eliminate Q-insensitive iamb and to replace the Q-sensitive trochee by a so called moraic trochee. A moraic trochee is a left headed foot type that maximally contains two light (i.g. monomoraic) syllables or one heavy syllable which have already been discussed (see section 2.6.1.2.). Those rare feet structure has been reanalyzed alternatively by allowing certain manipulations at the edge of stress domain

like, excluding syllable from the parse by extrametricality or postulating empty syllable. The next step is taken by Kager (1989) who extends the bimoraic upper bound of moraic trochee in two ways. Firstly, he proposes that Q-sensitive iambic system do not require light-heavy (l h) feet. He suggests reanalysis for the few cases that were originally analyzed with such feet. Secondly he suggests that the bimoraic requirement is also the lower bound, which implies that the so called monomoraic feet are banned. Hayes accepts Kager's banned which has not been elaborated here. Both the ban on heavy-light (h l) and light-heavy (l h) are called unbalanced and degenerate feet results in leaving light syllables unparsed. Master (1994) refers to this as "trapped" syllables. These unparsed syllables raise a problem since it is unclear whether and how such syllables are incorporated in prosodic structure. If they get incorporated directly into the higher levels another problem arises because in all other respects it has been assumed that prosodic structure is strictly layered. That all units at each level get incorporated into units of the next higher level. Since this problem is unsolved to date (Hulst, 1995, p.5), we are not going to take this issue to build our metrical parameters.

In case of established direction of footing, it is necessary to assign stress in words with an odd number of syllables. In that case a two-by-two or binary branching has ignored one syllable which has to be located at the edge and that is opposite to where the parsing began. If we cross-classify direction with the word tree parameters, we arrives at four possible case,

Word	L-to-R	R-to-L
Left-headed		×
Right-headed	×	

Table 2. 1: Metrical foot direction

(Hulst, 1995, p.4)

The option not marked with the (×) are the most frequent. In those cases, the primary stress is located on the edge where parsing started. Thus except when a peripheral non-branching foot is ignored, primary stress falls on the first foot that is assigned. Hulst (1995) argues that in this type of case it is not necessary to exhaustively parse the

whole word into feet in order to find the location of primary stress. He proposes that those parts of the metrical structure that expresses secondary stress could just as well be done at a later stage of the derivation. This primary-stress-first approach has a number of advantages. The most interesting variety of this theory is one in which secondary stresses are assigned post-lexically. This "reverse order" of footing and primary stress assignment is impossible in the cases in table 2.1 that are marked with (×). In such system called count system, which indicates the location of primary stress is crucially dependent on a complete count of all syllable. For example, stress falls on the first syllable if the number of syllables in the word are even, and on the second syllable otherwise (Goldsmith, 1990, 173-177).

From the above discussion it is seemed that foot inventory requires a cross-linguistic analysis vastly. Since the linguistic metrical analysis of lyric is one part of our study, we need not only to sort out simplified foot inventory but also make metrical parameters economically. Here a set of parameters for analyzing metrical constituent has been given below,

(a) IAMBIC: The rightmost syllable in a foot is the head syllable
(b) TROCHAIC: The leftmost syllable in a foot is the head syllable
(c) R-to-L: Align the right edge of the foot
(d) L-to-R: Align the left edge of the foot

We have assumed here a simplified foot inventory, where feet are disyllabic and are either trochaic (σ́ σ) or iambic (σ σ́). Here we consider the first two parameters IAMBIC and TROCHAIC are responsible for the placement of the stressed syllable within a foot on the other hand, the rest of the two constraints R-to-L and L-to-R are responsible for the placement of the foot within the word. It has been seen in the previous studies that languages have tend to have either IAMBIC or TROCHAIC feet rather than a mix of them (McCarthy and Prince, 1986; Kager, 1996; Van and Vijer, 1998). From the previous observations it is also seen that R-to-L and L-to-R stems tend to have feet that are either close to the beginning or to the end of a word, or tend to assign feet relatively starting either near the beginning or near the end of the word.

We will now consider an underlying form of with three syllables represents as |ɓ ɓ ɓ|. If we assume that stress is assigned purely by the grammar, at least four different types of syllable arrangement can be found like,

Underlying: |ɓ ɓ ɓ|	IAMBIC	TROCHAIC	L-to-R	R-to-L
/(ɓ́ ɓ) ɓ/	×			×
➡ /(ɓ ɓ́) ɓ/		×		×
/ɓ (ɓ́ ɓ)/	×		×	
/ɓ (ɓ ɓ́)/		×	×	

Table 2. 2: Parameters of metrical constituents

Now suppose in a specific language the most frequent or important parameter is IAMBIC and the most infrequent parameter is L-to-R. In this case the 2nd column of the table is the assumed foot structure for this language. Here, The cross symbol (×) in the table depicts which arrangement violet which parameters. This table may look like the tableau of constraints in the experiment of optimality theory (OT). Even though our set and the table of parameters have been influenced a bit by OT, this theory is not our theoretical concern at all. For example, any OT type phonological constraints, ranking of constraints or winner of candidate have not been shown in this study. Rather, using these metrical parameters the data of this study have been analyzed in order to explore the feet structure.

We will not elaborate this issue any more here. In fact the solely linguistic metrical issues will not be emphasized here anymore. Moreover, other aspects of metrical phonology such as, string and grouping, metrical grid and linguistic prosodic segmentation have already been discussed with music simultaneously in the 2.5.1.2 section.

Moreover, in order to show the evidence of stress transformation the acoustic phonetic information of each syllable of our selected songs after putting melodies have been presented. In this case the two prime properties of acoustic phonetics have been shown, (a) pitch and (b) intensity. In addition the spectrograms of the most

prominent transformation of the phrase of the songs have also been provided in the index.

Finally, it is patently evident that direct analogy of language and music is not much convincible to do interdisciplinary study between those domains. Rather, it is more effective to develop domain impartial tools and methods to do the research and for this reason the theories of GTTM and metrical phonology as well have been taken.

The next chapter demonstrates the previous investigations which are more or less related to this study. Basically the chapter consist of two parts: the first one describes Lerdahl's experiment of Beatles' song and the second one is about the previous studies on Bangla stress pattern.

Chapter 3

Revisiting the previous studies

In this Chapter previous texts which have more or less relationship with our present study has been discussed. Though concerning stress pattern there is not found any single research on language music relationship regarding Bangla, vast amount of studies have been revealed Bangla stress pattern from the linguistic point of view. Since the prime aim of this research is to show how Bangla melody form by transforming the speech stress of language, it is significant to understand the speech stress of Bangla language solely. For this reason, we are going to present the previous studies of stress pattern of Bangla language merely. However, Lerdahl showed the transformation of stress pattern from language to music through analyzing Beatles's song 'yesterday' using GTTM's tools. This is the only one study which revealed this transformational phenomenon. Therefore prior to discuss previous studies of Bangla stress pattern Lerdahl's experiment has been given,

3.1. Previous experiment on stress relationship of language and music using GTTM tools

Using GTTM's analyzing tools discussed in the chapter 2, Lerdahl explored how linguistic stress pattern changed into musical stress (Lerdahl, 2013). By analyzing Beatles' song 'yesterday' to some extent, moving from lyrics to music and beginning with phonology he revealed how prominence and hierarchy of stress differ between language and music. First of all, prosodic information of each word of the first line of lyrics employing a tree notation with strong (S) and weak (W) node have been analyzed. Then same information using a combination of prosodic grouping and stress grid have been shown. Next, linguistic prosodic tree structures have been translated into musical time-span reduction tree notation in which domination is represented by branching length. The next level was a prosodic

analysis of the entire first line of the lyrics showing a stress grid, an inverted metrical grid and prosodic grouping. Finally, the prolongational structure translated from the prosodic analysis of first line was shown. Each stage of the experiment is given here,

(a)

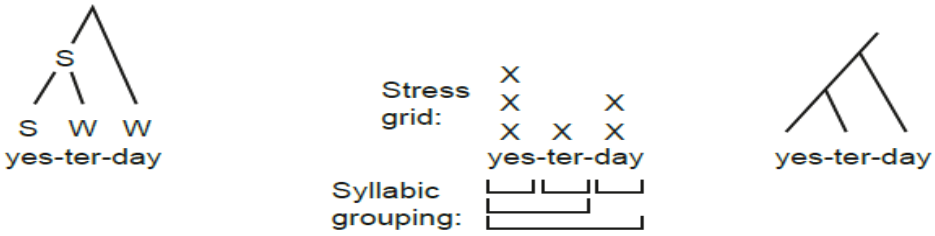


Figure 3. 1: prosodic analysis of the word ‘yesterday’ with mostly equivalent notation

(Lerdahl, 2013, p 263)

In figure 3.1 from the prosodic tree structure it is evident that ‘-yes’ is the most strong syllable in the word ‘yesterday’ and similar interpretation has been found in stress grid. It is clearly seen that ‘-yes’ is the only stressed syllable in this word. Thus the translated time-span tree notation of prosodic tree also indicates the elaboration of left node of the tree, thus the elaboration of ‘-yes’.

(b)

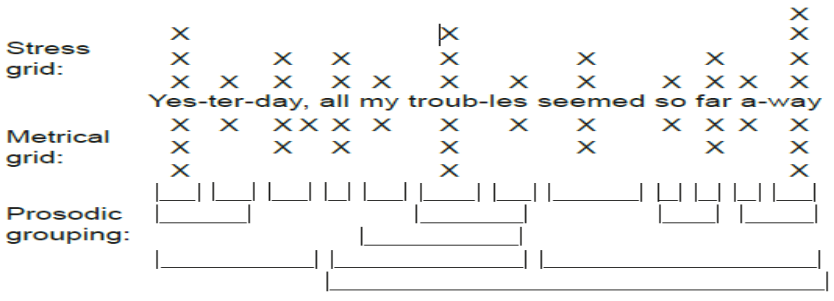


Figure 3. 2: Prosodic analysis of the first line of yesterday

(Lerdahl, 2013, p 264)

In figure 3.2 the complete information of stress, metrical grid and prosodic grouping of first line of the song ‘yesterday’ have been given. It is seen from the illustration that the most stressed syllables are ‘-yes’, ‘-troub’ and ‘-way’ whereas

rest of the syllables contain less stressed or without stress. Here, it is noteworthy that this stress assignment of the first line of lyrics follows the regular English speech stress.

(c)

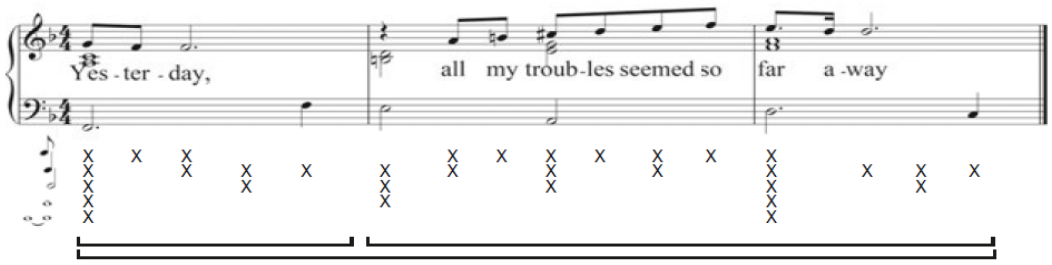


Figure 3. 3: First phrase of the yesterday with notation, metrical grid and grouping

Figure 3.3 shows the Beatles' musical settings, accompanied by a musical grouping analysis and metrical grid. To the left of the grid are the note durations of the metrical levels. In this case the setting differ in a few respect from the metrical analysis of previous figure 3.2. The first two syllables of the 'yesterday' are shortened because of syncopation (focusing stress on weak beats), and lengthening on '-day'. The stress metrical pattern of 'yesterday' essentially repeats in 'far way' in which 'far' receives the major metrical stress whereas, we have seen syllable '-way' receives the major metrical stress in regular speech in figure 3.2. This is the transformation of stress from speech to music. However in this experiment it is also mentioned that linguistic syntactic tree infer completely different hierarchical prominence. Jackendoff provided linguistic syntactic tree of the first line of the song yesterday,

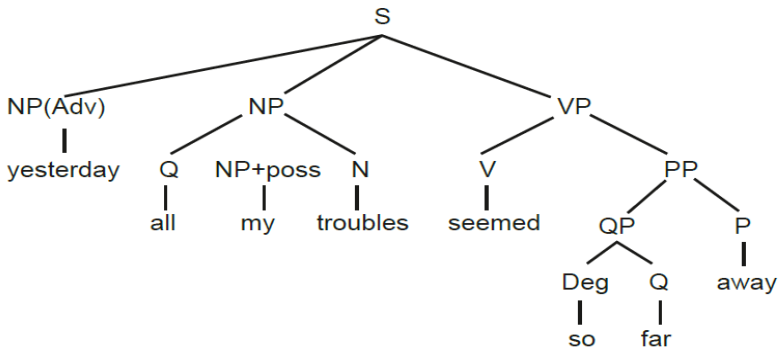


Figure 3. 4: Syntactic tree for the first line of yesterday

Here, S= sentence, NP (Adv)= Noun phrase with adverbial function, NP= Noun Phrase, VP= Verb Phrase, PP= Prepositional Phrase, Q= Quantifier, NP+Poss= Possessive pronoun, N=Noun, V= Verb, P= Preposition, QP= Quantifier Phrase and Deg= degree

In figure 3.4 ‘away’, ‘seemed’ and ‘troubles’ are the heads of the PP, VP and NP. Thus they are the most prominent elements in this structure. On the contrary prosodic structure shows completely different prominence like, ‘-yes’, ‘-troub’ and ‘-far’ are the most prominent elements.

Furthermore, a complete prolongational notation of the first line have been provided in this experiment like,

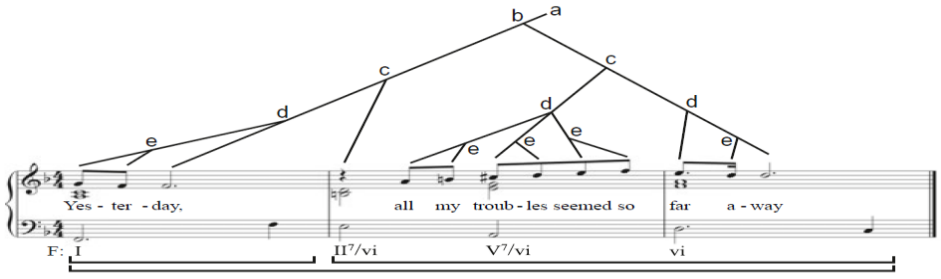


Figure 3. 5: Prolongational structure of the first phrase of ‘yesterday’

In this figure the complete elaboration of strong stress have been shown such as, in case of left node the node of ‘-yes’ has been elaborated as well the nodes of ‘-troub’ and ‘-far’ are also elaborated.

Therefore from this experiment of translation of prosodic tree into time-span reduction and prolongational tree reveals the truth that melody created different expression of sound by transforming the stress pattern of speech which is one of the significant assumption of this research. In fact, GTTM has proved this assumption. To conclude this section it is explicitly evident that GTTM contains effective analyzing methodologies by which the bridge between language and music can be constructed. Consequently, the above discussed analyzing tools of GTTM will be used to show how stress hierarchy and prominence transformed from speech or lyrics to melodies in Bangla songs in this study. Now the previous studies on Bangla stress pattern have been given below.

3.2. Previous studies on Bangla stress pattern

The overall linguistic discussion of Bangla can be divided into two parts: a) word stress and b) phrasal stress.

3.2.1. Word stress of Bangla

3.2.1.1. Stress-accent language

If the words of a language are assumed to bear stress through strong metrical prominence and in which pitch accents are attracted to these metrically prominent syllables, the language is defined as stress-accent language. Stress assignment or the patterns of assigning metrical prominence to the syllables of words varies considerably cross linguistically. In many stress-accent languages, the location of the stressed syllable is not entirely predictable, and can in fact be a contrastive feature between words. For example, in Spanish ́xuyo ‘juice’ vs. xúyo ‘played’ In other stress-accent languages, stress assignment is predictable from either syllable weight or the position of a syllable in the word. Almost all the studies of Bangla prosody has classified Bangla as a stress-accent language (Chatterji 1921; Goswami 1944; Ferguson & Chowdhury

1960; Anderson 1962; Ray, Hai, & Ray 1966; Bykova 1981; Shaw 1984; Kawasaki & Shattuck-Hufnagel 1988; Hayes & Lahiri 1991; Lahiri & Fitzpatrick-Cole 1999; Das 2001; Michaels & Nelson 2004; Selkirk 2006). They also add that the word stress is not a contrastive feature in the language and thus, two words cannot be differentiated solely on the basis of stress. For example,

(1) cʰéleti ékti kúkur ḏékʰecʰe
boy-DET one-DET dog see-PAST.1PER
"the boy saw a dog"

Check out the list of abbreviation which have been used in the interlinear glosses[14] of this study. The example (1) express the natural stress assignment of Bangla as the every primal stress have been fell on the initial syllables of the words. If the initial position of the stresses are transposed into medial or final positions, the meaning of the words and sentence would be unchanged. For example,

(2) cʰeléti ektí kukúr ḏekʰécʰe
boy-DET one-DET dog see-PAST.1PER
"the boy saw a dog"

Or,

(3) cʰeletí ektí kukúr ḏekʰecʰé
boy-DET one-DET dog see-PAST.1PER
"the boy saw a dog"

Here, the examples (2) and (3) show that those sentences containing different stress express as same meaning as example (1) does. Though they may have some extra pragmatic value other than example (1), but these three sentences convey identical meaning.

[14] In linguistics the interlinear gloss is the series of brief explanations such as, showing grammatical categories which placed between lines and its translation into another language. For example, grammatical categories like, DET=determiner, PAST= past tense etc.

3.2.1.2. Initial stress assignment

It is stated almost in all studies that words are consistently stressed on the initial syllable (Chatterji, 1921; Goswami, 1944; Ferguson & Chowdhury, 1960; Anderson, 1962; Bykova, 1981; Biswas, 1992 ;Kawasaki & Shattuck-Hufnagel, 1988; Hayes & Lahiri, 1991; Lahiri & Fitzpatrick-Cole, 1999; Michaels & Nelson 2004; Selkirk, 2006). For example, Bangla words containing from monosyllabic to hexasyllabic structures with stress assignment have been given below,

a.	cʰokʰ	“eye”	[cʰókʰ]	[H]
b.	jʰinuk	“oyster”	[jʰí.nuk]	[HL]
c.	kʰoabnama	“a type of book”	[kʰoáb.na.ma]	[HLL]
d.	pri ʈʰibi	“world”	[pri.ʈʰí.bi]	[LHL]
e.	gʰɔrʃɔnɟaʈo	“fricative”	[gʰɔr.ʃɔ́n.ɟa.ʈo]	[LHLL]
f.	obʰiɖʰanlobbʰo	“found in dictionary’	[o.bʰí.ɖʰan.lob.bʰo]	[LHLLL]
g.	ækaʈʈoʈaprapʈo	“get united”	[ǽk.aʈ.ʈo.ʈa.prap.ʈo]	[LHLLLL]

From the above examples it is seen that some of the words contain initial primal stresses and rest of the examples do not show this tendency like, the words [pri ʈʰibi], [gʰɔrʃɔnɟaʈo] and [o.bʰi.ɖʰan.lob.bʰo]. In case of monosyllabic word like, [cʰokʰ] the only vowel get the stress. Whereas, in disyllabic, trisyllabic and hexasyllabic structures: [jʰi.nuk], [kʰoab.na.ma] and [æk.aʈ.ʈo.ʈa.prap.ʈo], the initial syllables receive the primal stresses since these initial syllables are heavy to some extent than the penultimate, antepenultimate or final syllables. From these examples it is also assumed that Bangla is a Q-sensitive language which form trochaic feet structures frequently since stress are assigned depending on the weight of the syllable and mora. It is noteworthy that [jʰi.nuk] is the only native word among the examples. On the contrary, most of the words are derived from Sanskrit besides [kʰoab.na.ma] which is originated from Persian. In this regard it is seemed that the initial stress assignment rule is flexible for the words that are derived from Sanskrit or foreign languages. Nevertheless, in the word [kʰoab.na.ma] the primal stress is fell on the initial syllable as the initial syllable is heavy.

Biswas (1992) shows a comparative discussion among Bangla, Hindi and English stress pattern and reveals that how Bangla differ from the other two's stress assignment. For example, in Bangla

ʈáɟməhɔler	páʈʰor	ɖékʰecʰo	ɖékʰecʰo	ʈʰár	prán
tajmahal-POSS	stone	see-PAST	see-PAST	it-POSS	soul

'you have seen the stone of tajmahal, have not seen the soul?'

In Hindi, taɟmehelka	paʈʈár	ɖekʰa	kabʰi	ɖekʰa	usíka	ɟan
Tajmahal-POSS	stone	see-PAST	ever	see-PAST	it-POSS	soul

'you have seen the stone of tajmahal, have not seen the soul?'

(Biswas, 1992, p.156-157)

From this example it is evident that Hindi does not show the tendency of assigning the primal stress on every initial syllables in a sentence. Whereas, English shows completely different stress pattern than Bangla and Hindi like, in English,

The impréssion produced by moúntains, seás and stárs is nót so greát, so thrillíng as the músic of Wágner.

If we translate this sentence into in Bangla, we get,

ɸahar ʃómuɖro nɔkkʰóʈʈro ɖára úɖɖipiʈo bʰáb emón góbʰir o cʰómokproɖo hóʈe páre na ɟémon hóy wágner er ʃóngiʈ

From those two sentences it is clearly seen that most of the the stresses are contained in initial syllables in words.

On the contrary, only two studies (Khan, 2008) claim that stress can occur on non-initial syllables. Shaw (1984) claims that stress is assigned to the second syllable, unless the first syllable is heavy. For instance,

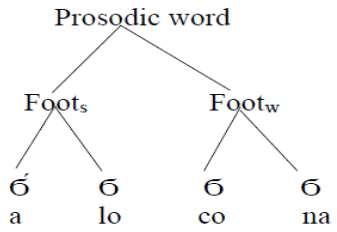
a.	kobiʈa	"poem"	[ko.bí.ta]	[LHL]	
b.	mali	"gardener"	[ma.lí]	[LH]	
c.	ʃɔŋʃar	"family"	[ʃɔ́ŋ.ʃar]	[HL]	
d.	ɔncʰɔl	"region"	[ɔn.cʰɔl]	[LH]	(khan, 2008, p.23)

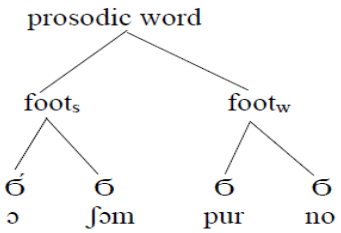
In case of examples (a) and (b), since the first syllables are not heavy, stresses are assigned to the penultimate and final syllables respectively such as on '-li' and '-bi'. Whereas, in the examples (c) and (d) as the initial syllables are heavy, they are stressed. Therefore, it is evident from the various examples that Bangla is a Q-sensitive language for having stress assignment depending on the weight of syllable.

Das (2001) focuses on the prosody of Tripuri Bengali in addition, claims that the stress pattern of both Tripuri Bengali and Standard Bengali is quantity-sensitive. Proposing detailed rules of metrical foot composition, Das claims that initial stress can only be found on a light syllable in words where the initial syllable is parsed into a binary foot such as, alochona "discussion" [á.lo.co.na]

ɔʃɔmpurno "incomplete [ɔ́.ʃɔm.pur.no]

In fact, the binary branching is one of the most significant reason behind the initial stress assignment of Bangla. Here, in order to make it clear prosodic tree diagram of those examples with showing feet structure have been given below,





In his detailed analysis of Tripuri Bengali and Tripuri English, Das also discusses the distribution of secondary stress. As neither of these two non-initial stress studies was focused on the phonetic correlates of stress, no acoustic measurements were made (Khan, 2008). It can be presumed from these previous studies that Bengali words bear stress, and that stress assignment is either consistently word-initial, as described in the majority of studies, or dependent on syllable weight, as described in Shaw (1984) and Das (2001).

3.2.2. Phrasal stress of Bangla

In case of phrasal stress of Bangla most studies also agreed that word stress is less significant than phrasal stress (Chatterji 1921, Goswami 1944, Ferguson & Chowdhury 1960, Ray et al. 1966, Bykova 1981, Shaw 1984, Hayes & Lahiri 1991, Lahiri & Fitzpatrick-Cole 1999). Moreover while one syllable such as the initial syllable of each word is considered stressed, one word of each phrase will be considered the most prominent. In a typical sentence the most prominent word can be either the leftmost (Chatterji 1921, Goswami 1944, Ray et al. 1966, Bykova 1981, Shaw 1984) or the rightmost (Hayes & Lahiri 1991, Lahiri & Fitzpatrick-Cole 1999, Selkirk 2006) in the phrase. Here some examples of rightmost and left most prominent phrases have been given below,

(1) t̪umi na ɟabe
you not go
"aren't you supposed to go?"

(2) ei kɔlomt̪a ɟar d̪am ækʃo t̪aka ami úpohar peecʰi
this pen-DET whose price one hundred taka I gift receive
"this pen, the price of which is 100 tk., I have received as a gift"

(3) kalt̪o skul ácʰe
tomorrow school exist
"there is school tomorrow"

(4) bǽbʃat̪a ʃiggir ɟómbe
business quickly flourish
"the business will flourish quickly"

(5) got̪akɔt̪ok t̪aka eno
some money bring
"you may bring some money"
(Ray *et al.* 1966, p.8-9; Chatterjee, 1963,p.21)

From the previous studies it is also seen that stress in Bangla appears to be phonetically weak, it is nevertheless phonologically salient (Khan, 2008, p.23).

However, word stresses can be changed by phrasal stresses and further changes can be occurred by some external influence in phrase structures such as melodic influence. Especially, this is the prime focus of our study thus, we are going to provide some sentences or lyrical phrases of two Bangla songs which were written as poems formally and after that melodies have been added. For example, “karar oi louho kopaʈ̪” and “rupoʃi banŋla” of Kazi Nazrul Islam and Jibananda Das respectively were basically poems and melodies were put later. The first two phrases with feet structures and stress assignment of those songs have been given below,

(1) kárar oí loúho kɔ́paʈ̪ bʰéŋe pʰél kórre lópaʈ̪
prison that iron gate destroy do exp
“these iron gates of prison” “destroy it and expunge”

(2) ábar áʃĩbo pʰíre ɖ̪ʰanʃiɾiʈ̪ír ʈ̪íre eí báŋlae
again come back dhanshiri bank this bangla
I will return to the banks of the Dhanshiri, to this Bangla

hóyʈ̪o mánuʃ nóy hóyʈ̪oba ʃɔ́nkʰocil ʃáliker béʃe
perhaps human not perhaps white hawk salik bird disguise
“not as a man, perhaps as a salik bird or white hawk”

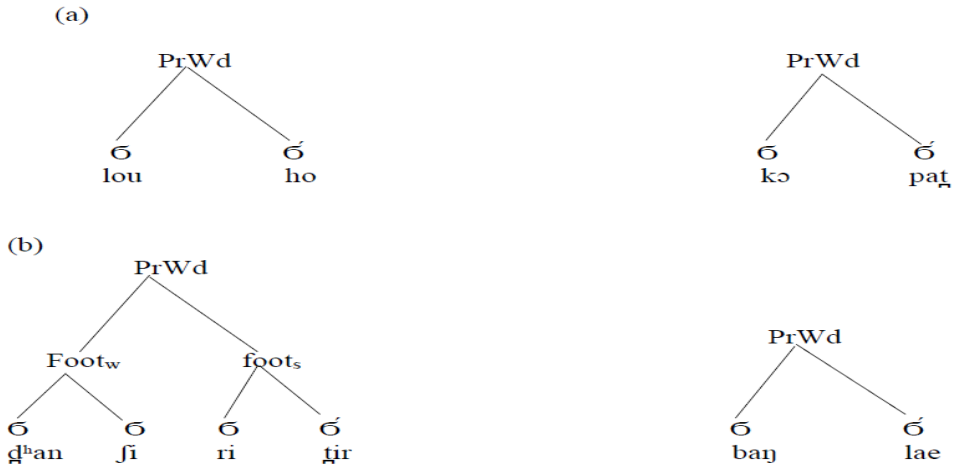
Examples (1) and (2) show that all the initial syllables of the words receive the primal stresses. To elaborate stresses are assigned on the heavy syllables and some light syllables also are stresses cause of binary feet branching. Such as, [loúho] [hóyʈ̪o] [mánuʃ] etc. Now we are going to show these phrases after adding melodies,

(3) kárar oí louhó kɔpáʈ̪ bʰeŋé pʰél korré lopáʈ̪

(4) ábar aʃĩbo pʰíre ɖ̪ʰanʃiɾiʈ̪ír ʈ̪iré eí baŋlaé

From the examples (3) and (4) it is assumed that significant stress transformation have been occurred after putting melodies, though experimental tools of exploring stress transformation have not been implemented here. Nevertheless, it is seemed that most of the stress transposition have been occurred from initial to final position like, [kɔpáʈ̪] [lopáʈ̪] [ʈ̪iré]. It is also seemed that some words of song-2 remain unchanged even after

inserting melody like, [ábar] [pʰíre]. This transformation generally happens by changing the metrical system as well as stress pattern of lyric. In fact, this transposition also brings changes in feet structures of words. From the above example, most of the feet structures of the words are changed from trochaic feet to iambic feet structure. Prosodic tree structures containing transformed stress pattern and feet structures are given,



From the above figure it is evident that almost all the words receive the prime stress through the right most syllables. Consequently, the right feet become strong and form iambic feet. Using the parameters of metrical constituent these the transformed feet structures can be clearer,

Words	Syllables	IAMBIC	TROCHAIC	L-to-R	R-to-L
Lou.hó	(σ σ́)		×	×	×
kɔ.páʈ	(σ σ́)		×	×	×
ɖʰan.ʃĩ.ɽi.ʈír	(σ σ) (σ σ́)		×	×	
baŋ.laé	(σ σ́)		×	×	×

Table 3. 1: Metrical parameters of the four words of abar aʃĩbo pʰire and karar oi louho kɔpat

The table 3.1 demonstrates how these words form feet structures. Here it is notable that most of the words get mono foot and iambic structures as each word has two syllables except the word [ɖʰan.ʃĩ.ɽi.ʈír]. The words which prevail single foot and iambic structure

naturally violet the other metrical parameters of the table. Whereas, [d̪ʰan.ʃi.ɽi.t̪ír] contains two feet and since the prime stress has been assigned on the right most syllable, the trochaic and L-to-R parameters have been violated automatically.

The subtle investigation of the feet structures of lyrics, stress transformation due to melodic transformation have been provided in the chapter 5. Therefore, we are not going to elaborate this issue any more. Rather, some other phenomenon such as, some observations of different linguists on Bangla phonological stress have summarized here,

1. Dasgupta showed that phonologically unstressed syllables rarely host lax vowels / æ ɔ/ (Dasgupta, 2003). For example, the monomorpheme [æk] 'one' is produced with a lax vowel in isolation, but is produced with a tense vowel when attached to the negative prefix /ɔn/-, giving [ɔnek] 'multiple'. This raising of the lax vowel / æ / to /e/ appears to be conditioned by the shift of stress from the root to the word-initial syllable (Khan, 2008, p.25)
2. Dasgupta also observed that phonologically unstressed syllables rarely host nasal vowels /ĩ ẽ ɛ̃ ã ɔ̃ õ ũ/ (Dasgupta, 2003). For example, words like [kãta] 'thorn' and [tẽtul] 'tamarind' are common, there are few monomorphemic words of the type *[katã] or *[tetũl]. Secondarily-stressed syllables can also be nasalized, as in the French borrowing [restorã] 'restaurant'. Rare exceptions to this rule include Sanskrit borrowings such as, [aṯ̪ːã] 'soul' and [aṯ̪ːĩo] 'relative', which Dasgupta (2003) describes as being actually pronounced [ãṯ̪ːa] and [ãṯ̪ːio] in all contexts other than stage performance (Khan, 2008, p.25-27).

3. Loanwords are often pronounced with the initial syllable phonologically stressed, regardless of the stress pattern of the donor language. This states that the stress pattern of original words are completely ignore in when borrowed into Bangla (Khan, 2008, p.27). Khan also mentions that in words that have primary stress on the second syllable in the donor language, the unstressed initial syllable is dropped completely in the

Bangla version to conform to the Bangla's stress pattern such as, [markin] 'American' presumably from American English [əˈmɛrəkən]. Moreover khan also describe the stress shift in words through syncopation, high vowel metathesis etc. process. For example, Many disyllabic roots lose their unstressed second syllable when suffixes are added such as,

[atok] 'obstruction'	/atok-ano/	[atkano] 'obstructing'
[pagol] 'crazy'	/pagol-ami/	[paglami] 'crazy behavior'

4. Along with Chatterji (1921), Hai and Ray (1966), Ferguson and Chowdhury (1960), Hayes and Lahiri (1991), khan (2008) et.al worked on various issues of Bangla intonational phonology like, pitch accent attraction, one-word and multiword utterances, phrasing and interphrasing disjuncture, pitch phonemes and so on which are more or less relevant to stress pattern of Bangla. In order to make our discussion precise we are not going to provide their arguments here.

Though a vast amount of works on various issues of Bangla phonology are available, studies on phonological changes due to external influence like, music has not been found. By this research taking metrical phonology as a common platform, investigation has to be proceeded though setting some tools and parameters by which both music and language ca be analyzed.

3.3. Tools and parameters for analysis

The logic behind considering metrical phonology as theoretical platform and GTTM as analyzing tools have already been discussed elaborately in chapter 2. Regarding this discussion our parameters of analysis can be divided into two aspects,

a) Linguistic aspect of parameters
b) Musical aspect of parameters

In case of those two aspects a complete parameter setting of this research has been given below,

a) Linguistic aspect of parameters

1. Prosodic hierarchical structure
2. Feet structure inventory
3. Testing parameters of metrical constituents of analyzing stress

   3.1. Trochaic
   3.2.Iambic
   3.3.R-to-L
   3.4.L-to-R

4. Acoustic phonetic evidence of stress transformation
   4.1. Pitch
   4.2.Intensity

b) Musical aspect of parameters

1. Analyzing songs through GTTM tools
   1.1. String and grouping structure
   1.2. Metrical structure
   1.3. Time span reduction or headed hierarchical structure
   1.4. Translation of hierarchical tree diagram from linguistic to musical structure
   1.5. Prolongational structure

The next chapter demonstrates the method(s) and procedure of this research. Moreover, it has also been described how our data have been analyzed in chapter 5 by using the provided parameters.

Chapter 4

Methodology

It is quite evident from the discussion of the previous chapters is that taking metrical phonology as core theoretical foundation, this study is an endeavor to explore the transformation of stress pattern through analyzing certain amount of Bangla songs. Since this study has not developed theory(s), our selected songs have been investigated by using tools and parameters of GTTM. It is noteworthy that this research has to be confined with analyzing small amount of data in order to do subtle investigation. For this reason, non-numeric data types have to be described to accomplish this experiment. Therefore, qualitative method has not only been used to conduct the research but the study has also been proceeded by finding answers of some questions.

4.1. Reason for choosing qualitative method

The basic and applied researches can be qualitative or quantitative or both. Quantitative research is based on measurements of quantity or amount. Basically this kind of study is numerical, non-descriptive and conclusive. On the other hand, qualitative research is non-numeric, descriptive and exploratory. It seeks answers to some specific question(s) and systematically uses a predefined set of procedures to answers the questions. Quantitative study seeks to confirm hypothesis about phenomenon whereas, qualitative study seek to explore phenomenon. Moreover, research instruments are used in more rigid style of eliciting and categorizing responses to questions in quantitative research, contrarily in qualitative research instruments are more flexible. In fact, qualitative approach refers to the meanings, concepts definitions, characteristics, metaphors, symbols, and description of things (Bruce &Lune, 2012). It sometimes starts as a grounded theory approach which appreciates no prior understanding of the phenomenon. Thus it is also assumed that qualitative approach encourage qausi-experimental study.

Since this research is a first attempt to understand the connection between language and music by taking prosodic structure as interface, ground approach of qualitative research is prevailed in this study. Consequently, this study has been conducted inductively in contrast to the hypothetical deductive approach. In addition, orthodox qualitative approaches and tools such as, ethnography, auto ethnography, phenomenology, interview, case study etc. have not been used in this research. Rather, a quasi-experimental method as well as model have been developed in this study.

4.2. Research question

It has been already stated that this study is a quasi-experimental qualitative study. Therefore, it is important to construct research questions and by solving these questions our entire research has been proceeded. The prime question of this research is given below,

What are the causes of transforming the stress pattern of Bangla songs through melodic insertion?

This question will be solved by finding answers of several questions and these questions can be categorized into two aspects such as, linguistic prosodic aspect and musical aspect. But here we are not going to divide these questions rather the questions have been provided together below,

1. Are the lyrics of the selected songs follow the stress-accent and Q-sensitive features of Bangla?
2. Does every initial syllable contain the primal stress of the lyrics?
3. What are the exceptions other than initial primal stress assignment rule?
4. What are the outputs after implementing parameters of metrical constituents?
5. Do grouping structures and grouping well formedness rules (GWFR) work on the melodies of the selected Bangla songs?

6. Are there any change occurred in the metrical grid system of the songs after inserting melodies?
7. Do the translated time span reduction tree diagrams show significant changes than prosodic tree diagrams?
8. Do the prolongational structures depict the complete transformation of stresses of phrases of the selected songs?

By solving the above questions the stress transformation tendencies from lyric to melody have been revealed and this is the ultimate goal of this study.

4.3. Data collection design

The data of this research may be classified into two types,

a) Lyrics of the selected songs

b) Melodies of the selected songs.

4.3.2. Lyrics of the selected songs

Lyrics have been considered as samples of Bangla language in this research. Here three songs have been selected from the most prominent three genres of Bangla songs. It is noteworthy and has already been mentioned in Chapter one is that the devotional aspect is considered as a common feature in order to select songs in this study. These selected songs for analysis of this study is given below,

a) Rabindra song: a song of *puja parva* which is called *anadaloke mongolaloke* is selected as data.

b) Nazrul song: one of the devotional songs of nazrul Islam is *amar apnar cheye apon je jon* is selected.

c) Lalon song: Lalon shai's *gosthe colo hori murari* is selected as one of the most significant song of *Baul-Fakir-shahajia* stream of Bangla song.

4.3.2.1. Reasons behind selecting these three songs

These three songs have been selected among millions of Bangla songs for some particular reasons. In fact, regarding some parameters these songs have been selected in this research such as,

a) Devotional aspect of Bangla song is one of the most important criteria of selection and these three songs are belong to this particular genre.

b) The musical features of this songs are apparently simpler than other devotional Bangla songs. Since this is an attempt to analyze Bangla songs through quasi-experimental approach, simple structures would be more convenient for our analysis.

c) These three songs are not only belong to the one of the most significant genre of Bangla songs but also they are very popular songs and, popularity is a selecting criteria of songs of this study. In this study the popularity of our selected songs have been determine by observing the number of views on the www.youtube.com. For example, the total views of the songs *anandoloke mongolaloke, amar aponar cheye* and *loe godhon gosther kanon* until access date are: 783067, 845696 and 4553 respectively. The screenshots of these youtube views have been given in the index. Here it is assumed that our selected Bangla song-3 is less popular than the two selected songs. Though the you tube view of this song is not as high as Tagore's or Nazrul's song, this song is a very significant in Baul-Fakir philosophy as well as it is an well practiced song.

4.3.3. Recorded form of the selected songs

Second type of data are the recorded songs. The selected songs have been sung and recorded by the researcher. In case of recording songs the sound recorder of Asus cell phone has been used.

Syllabic stress have been analyzed using metrical stress theories in this study. The prime inventory of this study is to show how the stress pattern of lyrics with tune differ

from the lyrics without melodies. Thus it is necessary to examine the physical representation like, acoustic phonetic representation of lyrics with and without melodies in this study. For this reason linguistic software praat have been used to investigate the acoustic presentations of stresses. In this research the version 6.0.43 of praat has been used. Using praat various types of spectrogram containing acoustic features of stress like, intensity and pitch in particular have been shown.

4.3.4. Staff notation of the songs

Graphical representation of melodies are the third types of data in this research. If analyzing tools of Generative Theory of Tonal Music (GTTM) are applied on selected data, staff notation of melodies are eventual. In particular, without staff notation of selected melodies investigation of language-music parallels as well as non-parallels using GTTM theories like, time-span reduction theory, and prolongational structure cannot be analyzed. Therefore the notations of the selected songs have been collected and written down. The notation of Tagore's song is available but the other two song's notations are not available in any source. In fact, the notation of Tagore's song is found in an authentic website www.geetabitan.con. The notations of the other two songs have been written by the researcher. In order to write the staff notations of these songs musescore 2 software have been used. However, since Bangla or Indian writing system of music do not contain lines which can show musical details like, strong/weak beats, interval or hierarchical relationship among notes, this writing system has not be taken.

4.4. Limitation of the study

1. In order to make this work precise only one genre of Bangla songs such as, devotional aspect has been focused in this research. For the same reason three songs among enormous amount of Bangla songs have been selected.

2. These three songs have been selected partially regarding to do subtle investigation such as, the first four phrases of each song have been selected for the analysis.

3. In case of writing the staff notations musical details as well as ornaments are omitted to make the melodic structures simpler.

4.5. Summary of the analyzing procedure

In chapter 5, the selected three Bangla songs have been analyzed through the tools and parameters of metrical phonology and GTTM which have already been sorted out at the end of the chapter 3. The complete analysis of the songs can be divided into two parts: a) linguistic analysis of the lyrics without melodies and b) musical analysis of both lyrics and melodies. In case of linguistic analysis metrical representation of lyrics have been shown such as, the feet structures, stress distribution etc.

First of all after providing the lyrical as well as musical descriptions, stress assignments of lyrics are shown solely. Then, the prosodic tree diagrams with syllabic feet structures are depicted following by a list of feet structures inventories. After that, the list of feet structures are reanalyzed by using the parameters of metrical constituents.

Secondly, after inserting the melodies the lyrics are investigated by using the analyzing tools of GTTM. In this case starting with grouping structures, complete prolongational structures are drawn. To elaborate, at the beginning of this experiment the grouping well formedness rules are implemented in order to show the structural prominence of the constituents. Next, the metrical representation of songs are shown. In addition, acoustic phonetic information (e.g. pitch, intensity) are presented as the evidence of metrical changes of stress patterns. Again, the metrical representation of transformed stress grid of lyrics with musical setting are provided. However, this types of representations do not show the hierarchical explanation of the stress transformation. The hierarchical relationship of the constituents have been revealed by drawing the time

span reduction tree diagram. In the next step, the prosodic structures of lyrics are translated into the time span reduction diagram in order to show hierarchical arrangement of the transformation. Finally, complete prolongational structures are constructed to show the ultimate transformation of stresses in the songs.

Chapter 5
Data analysis

5.1. Analysis of Bangla song-1

5.1.1. Reason for selecting the song

The song 'anandoloke mangalaloke' of Tagore belongs to the *puja parjaay* (worship episode) in *Gitabitan*[15] and it was composed for the *Magghotsava* (winter celebration) celebration in 1893. The song derived from a *bhajan*[16] music. Tagore's niece Sarala *devi* presented this song first time in public. Among his enormous amount of songs this song has been selected for our study for some particular reasons,

a) First of all the prime concern regarding to select songs in this study is to focus the feature of devotion other than rest of the features. Though Tagore composed vast amount of blissful songs that were created in his own way by which he conveyed his devotion to the absolute soul or a collective existence. This unseen abstract existence sometimes arrives as nature, god, country or mother. For this reason the division of the songs worship, love and nature are no doubt arbitrary as the themes are often intermixed. Nevertheless the selected song convey high devotion to someone or something else. The ultimate interpretation of the song entirely depended on the listeners though.

b) The musical features of this song is apparently simpler than his other devotional songs. This song was composed in C major scale without so much variation. The rising and falling notes, strong and weak beats are very explicit in this song. It is noteworthy that the musical data will be completely described and interpreted by western scale as well as notation system.

[15] *Gitabitan* is a book which contains Tagore's almost all composed songs and the total number of his songs is 2232. The book is divided into six major parts or episodes such as, *puja* (worship), *prem* (love), *prakriti* (seasons), *swadesh* (patriotism), *aanushthanik* (occasion specific), *bichitro* (miscellaneous), *nrityanatto* (dance drama and lyrical plays). http://geetabitan.com/.20.10.2018

[16] *Bhajan* means sharing and it refers to any song with religious theme or spiritual ideas

c) Since the melodic structure of this song does not contain much complexity, the staff notation is comprehensible to whom who has minimum knowledge of western notational system. The staff notation of this song has been taken from http://geetabitan.com/20.10.2018 website. As we need to analyze the hierarchical relationship of notes compared to the hierarchical organization of speech stress, simpler staff notation would be very convenient for the investigation.

d) The entire song has not been analyzed in order to make this study precise. Basically, the first line of the chorus[17] and the four lines of the verse[18] have been taken.

The selected songs have been analyzed through the tools and parameters which have been designed on the basis of the theoretical foundation of this research (see chapter 2) and these parameters have also been sorted out in chapter 3. Basically, starting with phonology in particular prosodic information of each linguistic elements of the song, it have been revealed how prominence and hierarchy of stress work between lyric and melody.

However, prior to show the transformation of lyrical or linguistic stress to melodic or musical stress metric phonological information of lyric have been represented solely. In this regard first of all the parameters 1, 2 and 3: prosodic hierarchical structure of linguistic elements, feet structure inventory and testing parameters of metrical constituents have been analyzed. After that applying the GTTM's parameters: grouping structure, metrical structure and time-span reduction, stress transformation have been revealed. Furthermore in order to show the headed or stress features of prosodic structure like, strong vs weak beats, supra-segmental features such as pitch, intensity of the prominent elements have been presented. In this case linguistic software Praat has been used.

[17] The chorus contains the main idea of what is being expressed lyrically and musically. It is repeated throughout the song.

[18] The verse contains the details of the song: the story, the events, images and emotions that the writer wishes to express.

5.1.2. Lyrical and musical description of the Bangla song-1

The interlinear glossing of the Bangla song-1 has been given below,

anonɖoloke moŋgolaloke biraɟo ʃoʈto ʃunɖɔro
joyful-LOC blissful halo-LOC present true beautiful
'You are honorably present with the halo at the blissful world'

mohima ʈɔbo uɖbʰaʃiʈo mɔha gɔgono maɟʰe
greatness you-POSS appearance infinite sky in
'your majestic appearance gorgeously fills the sky'

biʃʃo jɔgoʈo monibʰuʃono beʃtiʈo cɔrone
Universal world ornaments coiled feet
'The mortal world coiled around your adorned feet'

groho ʈaroko cɔnɖro ʈɔpono bækulo ɖruʈo bege
planets stars moon sun restless quick speed-LOC
'The sun, moon, the planets, stars are in restless incredible speed'

koricʰe pano koricʰe snano ɔkkʰɔyo kirone
do-CON drink do-CON bathe eternal light
'They are bathing and drinking in eternal light'
(http://geetabitan.com/.20.10.2018)

In the above glossing the basic linguistic information and English meaning of the song has been given. In this song Tagore searches the beauty of truth in the eternal and blissful light of the universe. In fact he is highly fascinated by the surroundings of his own which exists eternally. Moreover he praises the greatness of the absolute soul of the universe whose majesty appears in the infinite sky. Thus, Tagore expresses his gratitude to the unseen existence by dint of whom everything exist around him. In this study, the meaning and grammatical description of the song has not been described in detail as it is not our prime concern. Now the musical presentation of the song has been given below,

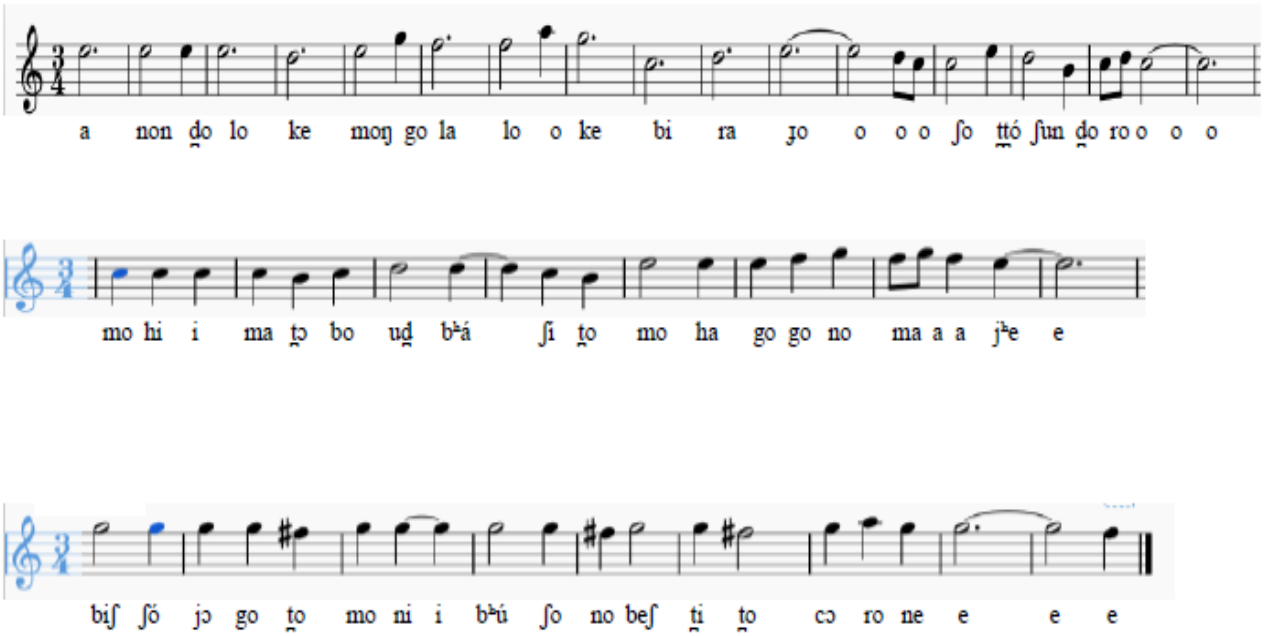


Figure 5. 1: Staff notation of the chorus and verses of the Bangla song-1

5.1.2.1. Musical notational description

This song was composed in C major scale and most of the Tagore artists usually sing this song in the same scale. The notes of C major scale are: C, D, E, F, G, A, B, C. The staff notation of C major scale has been given in the appendix. The significant aspects of the notes' arrangement by which each line of the song expresses unique melody as well as meaning have been provided below:

a) The figure 5.1 shows that the time signature[19] of the song is ¾ thus, each measure takes 3 beats maximally as well as each beat gets quarter or 4 beat. Here the first three phrases of the song have been given above as the melodic arrangement of the last two phrases are the repetition of the 2nd and the 3rd phrases. This three phrases take 33 musical measures.

[19] The time signature is a notational convention which specify how many beats are to be contained in each measure.

b) The first line takes 16 measures among the 36 measures of the first three line. In addition it is also comprehensible that each syllable or split of a syllable often takes an entire measure. The notes of the first 16 measures of first line is like, (E) (EE) (E) (D) (EG) (F) (FA) (G) (C) (D) (E) (DE) (CE) (D) (CDC) (C). From this syntagmatic arrangement it is seen that some syllables take one note and share one measure with another syllable and note whereas, some splits of syllables like 'a', 'o' occupy an entire measure and note. In this way the first line make unique melody from the rest of the line. In the groping analysis of GTTM this feature has been clearer.

c) In the 2nd and 3rd lines, the frequent use of quarter or 4th note is prominent. Almost all the syllables of those lines take one quarter note except some syllables like, '-uḏ', '-mo', '-bi', '-beʃ' which takes one half note. Thus from second line the song sounds faster than the first line. In fact implementing different notes and different syntagm those lines achieve unique rhythmic quality which makes it different from the other lines of the song. It has been more explicit by the GTTM and metrical analysis of the song.

In the section 5.1.3 the linguistic elements of the lyrics have been analyzed solely by linguistic prosodic metrical analyzing methods and in the section 5.1.4 the song has been described through GTTM theories.

5.1.3. Linguistic analysis of the lyrics

5.1.3.1 Prosodic hierarchical structure of the Bangla song-1

From the previous studies in chapter-2 it is quite accepted among the Bangla linguists that Bangla is a stress-accent language and there is not any contrastive features of stress assignment on words such as, two words cannot be differentiated solely on the basis of stress. Therefore it can be assumed that the word meaning would not be contrastive due to the stress assignment in Bangla. Furthermore, it is also stated in almost all studies

that stress is consistently assigned on the initial syllable of words. On the contrary, it is also found that stress is assigned to the second syllable unless the first one is heavy. Thus the first syllable has to be heavy if it is stressed. Concerning these above tendencies of stress of Bangla language the stress distribution of song-1 has been given below:

5.1.3.1.1. Syllables as well as stress distribution of Bangla song-1

Here the word stresses have been assigned on the basis of speech stress of Bangla without melody of the Bangla song-1.

á.non. d̪o.ló.ke móŋ.go.la.ló.ke bí.ra.ɟo ʃo.ʈʈó ʃun.d̪ó.ro

mó.hi.ma ʈ̪ɔ́.bo ud. bʰá.ʃi.ʈ̪o mó.ha go.gó.no má. jʰe

biʃ.ʃó jɔ.gó. ʈ̪o mó.ni.bʰú.ʃo.no béʃ.ʈ̪i.ʈ̪o cɔ́.ro.ne

gro.hó ʈ̪a.ró.ko cɔn.d̪ró tɔ.pó.no bǽ.ku.lo d̪rú.ʈ̪o bé.ge

kó.ri.cʰe pá.no kó.ri.cʰe sná.no ok. kʰɔ́.yo kí.ro.ne

It is evident from the lyric with stress notation provided above that stresses have been distributed in the most of the case according to the norm of Bangla phonology. In this lyrics most of the primary stresses have been fallen on the initial syllable thus, it can be stated that initial syllables act as heads in the most of the words of this lyric. Nevertheless, some word contains different word stress in which primal stresses are not assigned on the initial syllable like, [ʃo.ttó],[ud. bʰá.ʃi.ʈ̪o],[gro.hó],[ʈ̪a.ró.ko], [con.dró], [ʈ̪o.pó.no], [ok.kʰó.yo]. On the other hand, in case of compound word like, [á.non. d̪o.ló.ke], [móŋ.go.la.ló.ke] stresses have been fallen on the every initial syllable. Thus, we get two kinds of foot structures in a single word, though most of the word follow one foot type, either standard foot structure or deviated from standard foot structure of Bangla. In this regard it can be said that the trochaic formation of foot is very prominent in this lyric whereas, iambic formation as well as the manipulation of both formation are also found in this lyric.

Moreover, some words of this lyric show deviated form of syllabic structures from the standard structure of Bangla.

For example, the final coda consonants of these words have been omitted by adding vowels: /ɔ/ or /o/. Such as,

[ʃun.d̪ór] > [ʃun.d̪ɔ́.ro]

[go.gón] > [go.gó.no]

[jɔ.gó.t̪] > [jɔ.gó. t̪o]

[tɔ.pón] > [tɔ.pó.no]

In fact the deviated structures of these words are not used in both oral and written form of Bangla. Basically, Tagore constructed these types of word structures in case of composing songs. The reason behind deleting the final coda consonant is not clear. This syllabic change might be occurred in order to insert the melody in lyric since the melody line demands this type of syllabic structure. Such as, the transformed words contain three syllable thus, one foot and one syllable. The words would remain disyllabic without adding the final vowels and consequently, they do not get any feet structures. Therefore omitting the final coda consonant makes Tagore's song different from other devotional songs.

However, it should be mentioned here in advance that this stress assignment may be slightly or entirely changed by putting melody, thus the stresses of lyric have to be changed in order to become song. Our prime goal of analyzing the Bangla song-1 is to show how the stress of lyric transformed while melody is inserted and it would be revealed through theories of GTTM. Prior to start investigating this query the feet structures of lyric have to be understood in detail. Therefore we are going to analyze the syllable structures through prosodic tree diagram.

5.1.3.1.2. Explaining prosodic tree diagram and syllabic feet of the lyric

The prosodic tree diagram of the lyric of Bangla song-1 on the basis of the stress assignment of the section 5.1.3.1.1. have been given below,

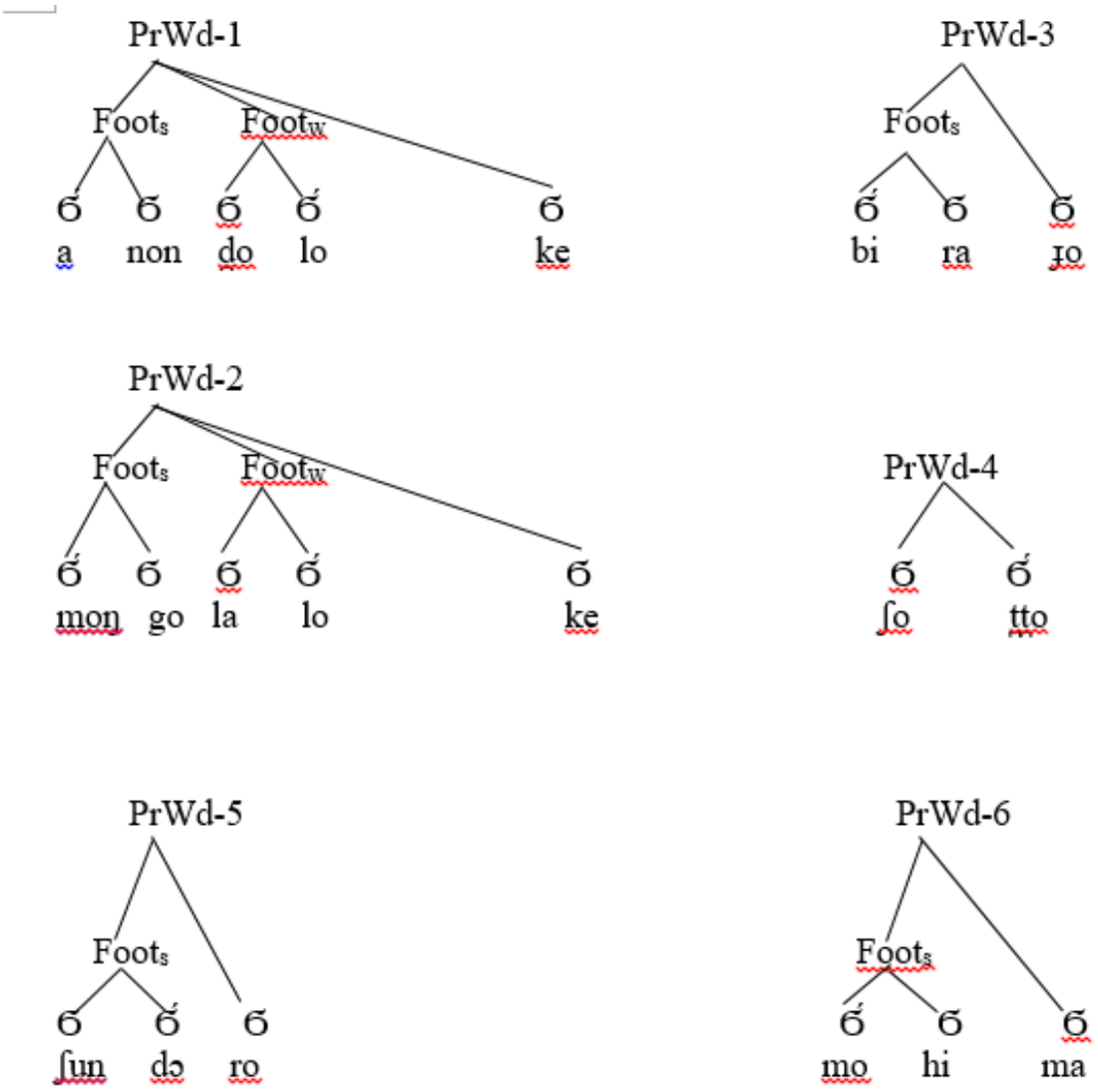


Figure 5. 2: Prosodic tree diagram of Bangla song-1

In this way we can show feet distribution, stress assignment or the strong and weak syllables of the each and every word of the lyric. Nevertheless it would be better to draw the most prominent tendencies of feet formation of the lyrics therefore, these 6 prosodic words' prosodic tree diagram have been given above. Now we are going to discuss about the feet features of the lyric of Bangla song-1 for example, whether the feet nature are trochaic or Iambic. Though we have elaborated briefly syllables and feet types of language in the chapter-2 and we also assumed from the previous studies that

the common tendency of Bangla syllable is to form trochaic feet, it is necessary to remind the syllable arrangement of both types such as,

Name of the foot	Syllable and stress assignment	Examples
Trochee	(ѻ́ ѻ) (ѻ)	bí.ra.ɟo
Iamb	(ѻ ѻ́) (ѻ)	ok. kʰɔ́.yo

Now the feet types of the selected five phrases of the Bangla song-1 have been given below,

Words	Feet structure	Feet inventory
á.non. ɖo.ló.ke	(ѻ́ ѻ) (ѻѻ́) (ѻ)	Trochaic+ Iambic
móŋ.go.la.ló.ke	(ѻ́ ѻ) (ѻѻ́) (ѻ)	Trochaic+ Iambic
bí.ra.ɟo	(ѻ́ ѻ) (ѻ)	Trochaic
sho.ʈʈó	(ѻ ѻ́)	Iambic
ʃun.ɖó.ro	(ѻ ѻ́) (ѻ)	Iambic
mó.hi.ma	(ѻ́ ѻ) (ѻ)	Trochaic
ʈɔ́.bo	(ѻ́ ѻ)	Trochaic
ud. bʰá.ʃì.ʈo	(ѻ ѻ́) (ѻ ѻ)	Iambic
mó.ha	(ѻ́ ѻ)	Trochaic
gɔ.gó.no	(ѻ ѻ́) (ѻ)	Iambic
má. jʰe	(ѻ́ ѻ)	Trochaic
biʃ.ʃó	(ѻ ѻ́)	Iambic
jɔ.gó. ʈo	(ѻ ѻ́) (ѻ)	Iambic
mó.ni.bʰu.ʃó.no	(ѻ́ ѻ) (ѻ ѻ́) (ѻ)	Trochaic+ Iambic
béʃ.ʈi.ʈo	(ѻ́ ѻ) (ѻ)	Trochaic
có.ro.ne	(ѻ́ ѻ) (ѻ)	Trochaic
gro.hó	(ѻ ѻ́)	Iambic
ʈa.ró.ko	(ѻ ѻ́) (ѻ)	Iambic
cɔn.ɖró	(ѻ ѻ́)	Iambic
ʈɔ.pó.no	(ѻ ѻ́) (ѻ)	Iambic
bǽ.ku.lo	(ѻ́ ѻ) (ѻ)	Trochaic
ɖrú.ʈo	(ѻ́ ѻ)	Iambic

bé.ge	(Ó Б)	Trochaic
kó.ri.c^{h}e	(Ó Б) (Б)	Trochaic
pá.no	(Ó Б)	Trochaic
kó.ri.c^{h}e	(Ó Б) (Б)	Trochaic
sná.no	(Ó Б)	Trochaic
ok. k^{h}ɔ́.yo	(Б Ó) (Б)	Iambic
kí.ro.ne	(Ó Б) (Б)	Trochaic

Table 5. 1: Formation of feet structure and feet inventory of Bangla song-1

From this table it is observed that most of the feet structure of the words of the lyric of Bangla song-1 strictly follow the general stress tendency of Bangla word as Bangla is a stress-accent quantity sensitive language. On the contrary, it have been also found some incongruity feature of stress assignment which do not obey the stress rules of Bangla at all. For example, the Iambic distribution of syllable. In fact we have found 12 Iambic syllabic structures among 29 words of the lyric of Bangla song-1. In a consequence a diverse use of both feet structure have been manipulated in the lyric of this song and this manipulation of feet make it unique from other poems or lyrics. For example, if the overall feet structure of the lyric is presented without word, we get,

First line: T+I T+I T I I

Second line: T T I T I T

Third line: I I T+I T T

Fourth line: I I I I T I T

Fifth line: T T T T I T

It is significant to remind from the previous studies of Bangla stress that initial word stress requires an initial heavy syllable in word otherwise, stress is generally assigned on penultimate or non-initial syllables. Moreover in case of the words derived from Sanskrit, Bangla stress rules might not be applicable sometimes. As a matter of fact, the Iambic structure of feet have been formed for this reason in the lyric such as, [ʃo.ttó]

or [gro.hó], [ʈa.ró.ko] do not have initial stress as they do not contain initial heavy syllable as well as they are derived from Sanskrit. Though initial stress has been assigned in some other Sanskrit originated words like, [bǽ.ku.lo] since it contains initial heavy syllable. However, the binary distribution of syllable such as trochaic and iambic is not sufficient in order to investigate the stress pattern of our selected data. Moreover, it has also been seen that single word contains both feet structures such as, [mó.ni.bʰu.ʃó.no]. In this regard we are now going to reanalyze the feet structures through the parameters of metrical constituents like, along with TROCHAIC, IAMBIC two constraints such as, Align the Right Edge of the Foot (R-to-L) and Align the Left Edge of the Foot (L-to-R). Using this four parameters of metrical constituents of the lyric has been provided here.

5.1.3.1.3. Testing the parameters of metrical constituents of the selected line of the lyric

Words	Feet structure	IAMBIC	TROCHAIC	L-to-R	R-to-L
á.non. ɖo.ló.ke	(σ́ σ) (σ σ́) (σ)				
móŋ.go.la.ló.ke	(σ́ σ) (σ σ́) (σ)				
bí.ra.ɟo	(σ́ σ) (σ)	×			×
sho.ʈʈó	(σ σ́)		×	×	×
ʃun.ɖó.ro	(σ σ́) σ)	×			×
mó.hi.ma	(σ́ σ) (σ)	×			×
ʈɔ́.bo	(σ́ σ)	×		×	×
ud. bʰá.ʃì.ʈo	(σ σ́) (σ σ)		×		×
ʈɔ́.bo	(σ́ σ)	×		×	×
gɔ.gó.no	(σ σ́) (σ)		×		×
má. jʰe	(σ́ σ)	×		×	×
biʃ.ʃó	(σ σ́)		×	×	×
jɔ.gó. ʈo	(σ́ σ) (σ)	×			×
mó.ni.bʰu.ʃó.no	(σ́ σ) (σ σ́) (σ)				
béʃ.ʈi.ʈo	(σ́ σ) (σ)	×			×
có.ro.ne	(σ́ σ) (σ)	×			×

gro.hó	(Ϭ Ϭ́)		×	×	×
ʈa.ró.ko	(Ϭ Ϭ́) (Ϭ)		×		×
cɔn.ɖró	(Ϭ Ϭ́)		×	×	×
ʈɔ.pó.no	(Ϭ Ϭ́) (Ϭ)		×		×
bǽ.ku.lo	(Ϭ́ Ϭ)	×		×	×
ɖru.ʈó	(Ϭ Ϭ́)		×	×	×
bé.ge	(Ϭ́ Ϭ)	×		×	×
kó.ri.cʰe	(Ϭ́ Ϭ) (Ϭ)	×			×
pá.no	(Ϭ́ Ϭ)	×		×	×
kó.ri.cʰe	(Ϭ́ Ϭ) (Ϭ)	×			×
sná.no	(Ϭ́ Ϭ)	×		×	×
ok. kʰɔ́.yo	(Ϭ Ϭ́) (Ϭ)		×		×
kí.ro.ne	(Ϭ́ Ϭ) (Ϭ)	×			×

Table 5. 2: Metrical constraints of the first three line of the lyric of Bangla song-1

From this test of table some facts have been revealed which were not seen in table 5.1. Here, the cross (×) sign expresses the violation of the parameters, thus if any parameter is not relevant to any particular syllabic structure, this sign has been used. First of all, generally one word contains maximum two metrical constrains except three words in the table 5.2 such as, [á.non.ɖo.ló.ke] [móŋ.go.la.ló.ke], and [mó.ni.bʰu.ʃó.no]. Since L-to-R and R-to-L parameters are function in these words, it is easily assumed that both IAMBIC and TROCHAIC features are active in their syllabic structures. Stressing on the left edge syllable is a primary requirement of trochaic constraints, thus it is beyond any doubt that L-to-R parameter helps to construct trochaic stress pattern of syllable. On the other hand R-to-L feature tries to build iambic stressed syllabic types as it concerns on the right edge stressed syllable. On the basis of this tendencies of the metrical constraints we could hypothesis:

a) If L-to-R parameter is presented in a word, trochaic stress pattern could be assigned.
b) If R-to-L parameter is presented in a word, iambic stress pattern could be assigned.

In this regard, if a word gets an L-to-R feature its syllabic structure has to be trochaic whereas, in case of iambic syllabic structure it must get an R-to-L parameter. On the contrary, in the lyric of selected Bangla song-1 all words do not follow those hypotheses, though most of the words follow. For example, in the words [ʃun.ɖó.ro], [ud. bʰá.ʃi.ʈo], [gɔ.gó.no], [ʈa.ró.ko] [tɔ.pó.no], [ok. kʰɔ́.yo] there is not any R-to-L feature, even though their syllabic structure is IAMBIC. Surprisingly, in case of Trochaic syllabic structure there is not any single word which violets the hypothesis (a). As a consequence all the words which get a trochaic stress pattern must get a L-to-R parameter. Observing data from the table 5.2 it could be said that the words structures of the lyric of Bangla song-1 do not follow the stress rules of Bangla as well as our constructed hypotheses for this study strictly in spite of having strong stress rules in Bangla language. However, those stress rules and hypothesis have been tested in our further experiment of Bangla song-2 and 3. To sum up the linguistic prosodic analysis of the lyric of Bangla song-1:

a) Most of the words of the lyric contains the initial stress which is the most prominent rules of Bangla.
b) All most all the words follow the rules of quantity sensitivity, thus the initial heavy syllables are stressed in this lyric.
c) The majority number of words contain trochaic syllabic structure or the stresses are assigned on the left most edge of the words.
d) Some explicit exceptional violation of metrical parameters have been shown by which our hypothesis of parameters have not been proved entirely. Furthermore some rear examples of word which contains all the constraints also found.

The discussion of the next sections have been proceeded to reveal whether the stress pattern of Bangla song-1 which have been found from the above discussion are transformed while melody is added. Since the previous study of Lerdhal proved that the stress pattern of lyric is changed dramatically by adding tune. In this regard, the lyric of Bangla song-1 has been analyzed through GTTM theories that have been mentioned in the second chapter. In particular, the theories of GTTM like, grouping structure, metrical structure and time-span reduction have been implemented in the next sections regarding the lyric of Bangla song-1. However in order to show the evidence of stress

transformation, acoustic phonetic information of the song with lyric and melody have also be provided.

5.1.4. Analyzing Bangla song-1 using GTTM theories

5.1.4.1. String and grouping structure of Bangla song-1

It has been already mentioned in the chapter-2 that both language and music are the hierarchal organization of strings of discrete objects or of features belonging to the objects. In GTTM assigning a set of well-formedness as well as prominence rules objects are constructed in a variety of groups. Some grouping rules which are relevant for analyzing the selected songs for this study have been given below,

GWFR1: Any contiguous sequence of pitch events can constitute a group and only contiguous sequences can constitute groups. To make this rule clear Lerdahl explained Mozart's G minor symphony by using this rule. Here we are going to implemented this rule on our selected Bangla song-1 such as,

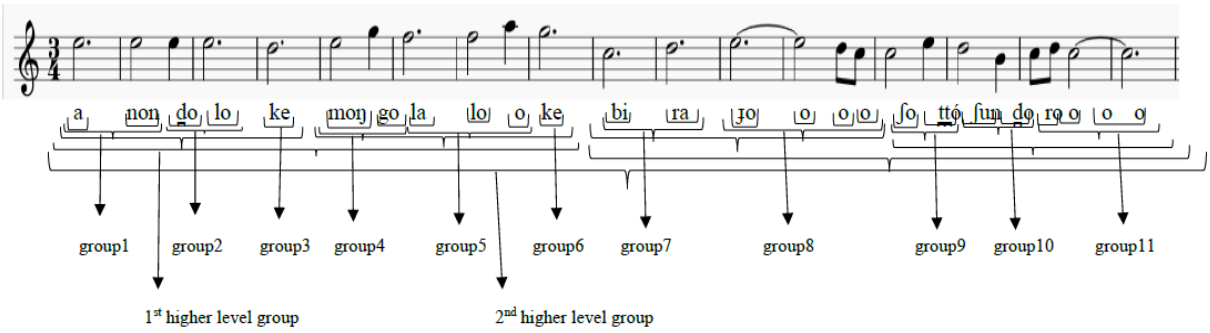


Figure 5. 3: Grouping of first line of Bangla song-1

First of all, it is seen from the figure 5.3 which shows the grouping construction of the first line is that same note as well as notes belongs to C major scale make a contiguous sequence such as, E E E E D G F F A G and along with linguistic syllables these notes create groups. For example, in case of first line '-a', '-non' and E, E construct

group1. Similarly, '-d̪o', '-lo' and E, E make group2, whereas '-ke' and D belong to one single group3. On the other hand, móŋ+go and E, G create group4; la+lo and F F A construct group5. Then group5 consists of one syllable '–ke' with single note G similar to group6. In the same way, rest of the words of this phrase construct groups and these groups can be marked as, G_1 G_2 G_3 G_4 G_5 G_6 G_7 G_8 G_9 G_{10} and G_{11}.

Secondly, there is an equal distribution of notes on each syallble approximately other than the syllables '-lo', '-jo', and '-ro' which cotain 2, 4 and 2 notes respectively. Each of these mentioned groups act as sub groups and step by step they build higher level group. The GWFR1 rule prevent from being group like, [E E E E D G F F A G]. Rather, it permits these sub groups to be incorporated in higher level groups G_1 ,G_2 and G_3 thus, [E E E] construct 1st higher level group within 5th bar. In this way the grouping of the first word of the song has been occurred as well as in the same process the group structure of the rest of the words have been accomplished but may be in defferent grouping style. Like group7 and group8 belong to the word [biraɟo] as well as G_7 G_8 G_9 G_{10} ,G_{11} make another 1st higher level group. Next, all the groups of 1st phrase create the the final higher level group.

Now the relevant grouping rules for this study given below,

GWFR3: A group may contains smaller group

GWFR4: If a group G_1 contains part of group G_2, it must contain all of the G_2.

GWFR5: If a group G_1 contains a smaller group G_2, then G_1 must be exhaustively partitioned into smaller group.

These grouping rules are explicitly appicable to the first line of the song in figure 5.1. For example the higher level group may consist of several sub groups like, 1st higher level group {(E E) (E E) (D)} contains sub group (E E), (E E), (D). These sub groups contain either one or two and several in some case notes as well as syllables. However, all the groups are not prominent in a given sequence rather some groups. In a consequence by implementing rules of prominence some groups act as heads. In

particular strong or stressed groups which are expressed by strong beats in music and stresses syllables in langauge as well are considered as headed prominent groups. In the next section by discussing metrical structure of Bangla song-1 this phenomenon will be focused.

5.1.4.2. Metrical structure of Bangla song-1

It has already been mentioned in chapter-2 that the fundamental component of metrical structure is grid in any system. Metrical grid or stress grid can be drawn on the basis of stress assignment. A stressed grid in linguistic phonology represents relative syllabic stress and on the other hand in music it depends on the strong beats. In this section firstly the stress grid of lyric of Bangla song-1 has been shown and after that the metrical grid of lyric with melody has been drawn in order to compare between the stress pattern of lyric with melody and without melody. Here our prime concern is to show how the stress grid transforme from speech to melody. In order to show scientific evidence of stress transformation acoustic phonological information has also been shown prior to draw the stress grid of lyric with melody.

5.1.4.2.1. Metrical structure of lyric

Here the metrical representation of first three lines on the basis of syllabic structure of section 5.1.3.1.1. have been given,

```
x                x                x          x         x
x        x       x        x       x          x         x
x  x  x  x  x    x    x  x  x     x  x  x  x  x    x    x  x  x
á.non.do.ló.ke   móŋ.go.la.ló.ke  bí.ra.jo  ʃo.ttó    ʃun.dó.ro
x  x     x  x  x  x    x  x  x  x  x  x  x  x  x    x    x  x  x
x        x       x        x       x          x         x
x                x                x          x         x
```

x x x x x x
x x x x x x
x x x x x x x x x x x x x x x x
mó.hi.ma ʈɔ́.bo ud.bʰá.ʃi.ʈo mó.ha gɔ.gó.no má.jhe
x x x x x x x x x x x x x x x x
x x x x x x
x x x x x x

x x x x x x
x x x x x x
x x x x x x x x x x x x x x x x x x x
bi.ʃ. ʃó jɔ́.go.ʈo mó.ni.bhu.ʃó.no béʃ.ʈi.ʈo cɔ́.ro.ne
x x x x x x x x x x x x x x x x x x x
x x x x x x
x x x x x x

In fact these diagrams are another kind of representation of syllabic stress of lyric which have been analyzed in previous section. Nevertheless, some subtle issues can be indicated here that was not possible to show in the previous section. By assigning metrical well formedness rules, actual stress distribution of any syntagmatic system can be analyzed by this metrical grid system and here we can describe this lyric through the rules,

MWFR3: At each metrical level strong beats are spaced either two or three beats apart
MWFR4: Each metrical level must consist of equally spaced beats.

It is clearly seen that those metrical well formedness rules are entirely applicable for the first three lines of the lyric as well as it is assumed that those rules have also been applicable for the rest of the lyric. At this stage of our discussion the acoustic phonological information of lyric with melody have been provided in order to show the stress transformation.

5.1.4.2.2. Acoustic phonetic evidence of stress transformation

By using linguistic software Praat the acoustic phonetic features like, pitch, intensity, spectrum of each note of syllable could be measured. In this study the higher degree of

pitch and intensity has been considered as higher intensity of stress as well as longer time duration also indicate the stress feature of syllable. In particular discussing Beatles song ‘yesterday’ Lerdhal shows that after putting melody the stress pattern of the word ‘away’ is changed. Thus, it is seemed that there is a shift of pitch and time duration from speech to melody. Due to melodic stress the stress assignment of each and every syllables are not changed. Now we are going to discuss about the acoustic properties of the Bangla song-1 briefly in order to show the stress shift. Here pitch and intensity of each syllable and note of first lines of chorus and verse of the song have been given. In this study the acoustic feature analyzing software praat (version 6.0.43) has been used.

Syllables	Notes	Time	Pitch (Hz)	Intensity (DB)
a	E	3.26	153.3	70
non	E	4.7	151.3	65.39
ɖo	E	4.92	151.6	65.2
lo	E	5.8	151.4	65.39
ke	D	6.9	75	63.16
moŋ	E	8.8	132.2	69.6
go	G	9.78	154.3	71.23
la	F	10.20	177.2	71.2
lo	FA	12.83	180.8	71.13
ke	G	13.4	183.5	70.98
bi	C	14.96	112.8	64.64
ra	D	16.48	131.6	63.63
ɟo	EEC	19.68	153.3	67.67
ʃo	C	21.5	118.7	64.39
ʈʈo	E	22.28	153.2	68.16
ʃun	D	22.89	133.7	65.38
ɖɔ	E	23.68	117.4	65.43
ro	DCC	24.49	121	75
mo	C	27.2	115.6	64.18
hi	C	28.09	118.7	64.4

ma	C	28.70	120.3	65.5
t̪ɔ	C	29.03	122	64.45
bo	B	29.50	119.1	61.17
ud	C	30.32	122.2	66.88
bʰa	D	30.72	139.6	66.07
ʃi	D	31.93	75	60.25
t̪o	DC	32.52	117.2	61.93
mɔ	E	33.56	112.3	64.11
ha	E	34.36	149.7	69.59
gɔ	E	35.01	151.9	70.25
go	F	35.36	160.8	70.56
no	G	35.90	181	70.3
ma	FGF	36.5	160	70.75
jʰe	EE	37.2	154.6	66.76

Table 5. 3: Acoustic phonetic information of the first three lines of Bangla Song-1

The above table illustrates the pitch and intensity of each syllable as well as notes of the chorus and verse of the Bangla song-1. The overall representation of the table shows a variety of data regarding different notes and syllables. Here, Hz and DB stand for measuring units of pitch and decibel respectively.

First of all, the table shows that the fluctuation rate of similar note is not so high. For example, same notes have different syntagmatic position such as, in the first word [á.non. d̪o.ló.ke], the first four syllables take E note and again E is seen in the first syllable '-moŋ' of second word. Moreover, E has been put on the other different syllables like, '-t̪o', '-d̪o', '-ha' '-go' and '-ɟʰe'. In the most of the case, the pitch frequencies of E fluctuate between 151Hz to 154Hz and intensities are 63Db to 65Db. Meanwhile, the pitch frequency of E slightly decreased on the second line of the first syllable '-moŋ'. However all the notes of C major scale have been used in these three lines of the song. Consequently, first three lines contain a variety of frequency and any 'out of key' or 'sharp note' has not been seen in the table.

Secondly, it is significant that in the first line the pitch frequency starts with 153.3 Hz following a dramatic fall of 75Hz on syllable '-ke' which contains D note and then the frequency rises at 183.5Hz surprisingly in G note of the same '-ke' syllable. Finally the first line ends up with three notes which belongs to one single syllable '-ro' that gets 121Hz of pitch. However, following the pitch frequency the degrees of intensity are also changed.

Thirdly, a gradual ascending nature from unison[20] to fifth of C major scale is seen in the third line such as, C D E F G. And this time the most frequent notes are C and E, though the melody touches almost all the notes of C major scale and the pitch frequencies starts from 115.5Hz and ends to 151.6Hz. In the meantime a sudden fall and rise are also noticed in the syllables '-ʃi' and '-no' which get 75Hz and 181Hz respectively.

However, from the above description of the table 5.3 it is clearly seen that due to the melodic insertion, the pitch frequency of speech has been changed which is a significant precursor of stress transformation. As a consequence, stress may assign on the unstressed syllables for instance '-la' '-jo' whereas, stressed syllables may get more intense stress like, '-bʰa', '-lo' etc. As a matter of fact the syllable '-lo' get the second highest frequency of pitch 180.8Hz and becomes the most stressed syllable or 'headed stress' of the first line. Even though, the highest pitch frequency belongs to syllable '-ke' which gets 183.5Hz but it is not the most stressed syllable of the first line. In the same way the pitch frequency variation and stress transformation of the rest of the two lines can be described.

5.1.4.2.3. Metrical representation of transformed stress grid of lyric

In the section 5.1.4.2.1. the metrical representation of stress grid of first two lines of the lyric has been shown and in this case the syllabic structures of speech have been followed. From the acoustic phonological analysis of the first three lines it is revealed that due to melodic insertion the pitch frequencies as well as intensities of some

[20] unison is two or more notes sounding the same pitch or at an octave interval, usually at the same time

syllables have been changed dramatically. Therefore it could be said that some sort of stress transformation have been occurred for adding musical notes with the syllables. Now the first line with musical setting, grouped strings and metrical stress grid has been given below,

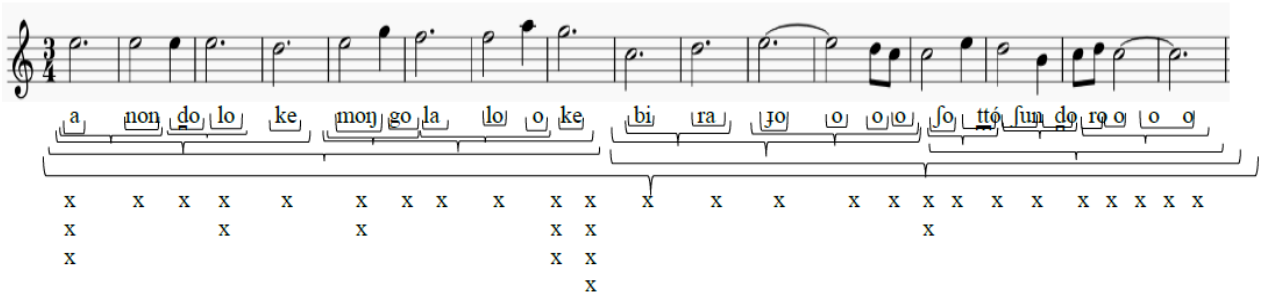


Figure 5. 4: First line of the Bangla song-1 with notation, grouping structure and metrical grid

Figure 5.4 shows completely different stress assignment from the previous figure 5.3 which demonstrate the stress pattern of actual speech of Bangla. Since the first four syllables not only contain the same note but also receive approximate pitch frequency, the initial stress of the word [á.non. d̪o.ló.ke] remains stressed. On the other hand, the rest of the syllables of the first word become unstressed. In case of the second word a sudden stress shift from the actual stress pattern of language is being noticed in particular, the initial word stress has been shifted to the final syllable. It is also noteworthy that stress is always assign on the initial or penultimate syllable regarding Bangla stress system nevertheless, the stress falls on final and half part of penultimate syllable. The stress metrical pattern of [á.non.d̪o.ló.ke] essentially repeats in [móŋ.go.la.ló.ke] and the syllable '-ke' and half of the penultimate syllable '-lo' receive the major stress on the contrary, as seen in figure 5.1 that the major stress receives the initial syllable '-moŋ'.

In this regard, this is an explicit transformation of stress from lyric to melody. In this way the melody of the first line of the song become music rather than language. In the same way the second line with musical setting, grouping strings and metrical stress grid can be shown,

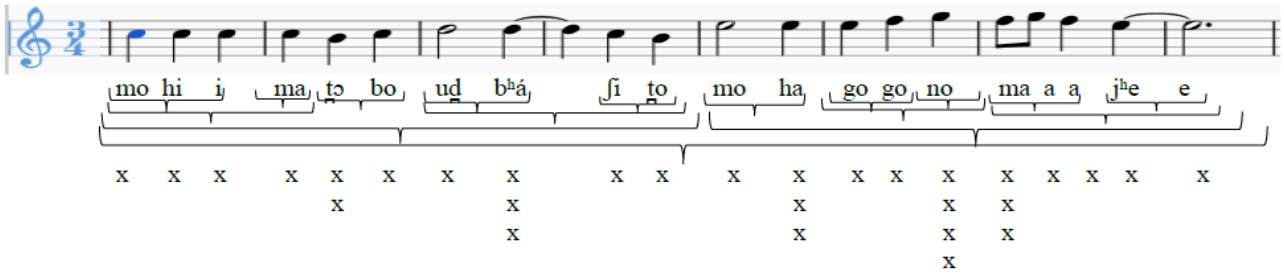


Figure 5. 5: Second line of the Bangla song-1 with notation, grouping structure and metrical grid

In this case significant stress transformation is not being noticed for instance, the first two words do not contain any major stress as well as their speech stress remain unchanged whereas the stress of the third word's pre penultimate syllable '-bʰa' receives extra intensity. As a matter of fact that the most stressed syllable of this line are '-bʰa' and '-ma' and figure 5.1 shows that those syllables are the major stressed syllables of those words. Therefore it is assumed that unlike the first line of the song the melody of the second line do not show dramatic stress deviation from the speech stress. In the same way the stress transformation of the rest of the two lines of the Bangla song-1 can be analyzed. Here the third line of the song has been given,

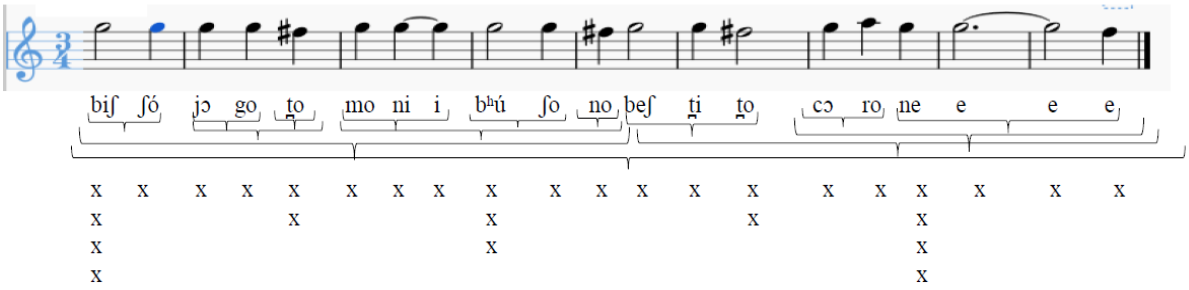


Figure 5. 6: Third line of the Bangla song-1 with notation, grouping structure and metrical grid

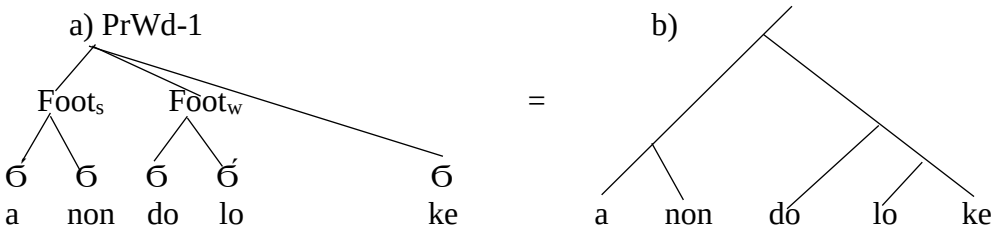
Now this stress transformation of speech to melody of Bangla song-1 will be presented through time-span reduction tree.

5.1.5. Time span reduction or headed hierarchical explanation of Bangla song-1

It is assumed from the above discussion is that grouping structure and metrical grids do not show the hierarchical relationship of musical and linguistic objects. In particular, the hierarchical relationship of stress assignment in lyric and the transformation of stress which occurred by the melody has not been explored yet. In the section 2.5.1.2.3. of chapter-2, it is explained that both language and music are strictly hierarchical system and the above analyzing techniques (e.g. grouping, grids) do not form dominating, sub dominating constituencies. In this regard time span reduction theory has been implemented in order to describe musical hierarchical objects. In this section lyric and melody will be explained through time span reduction simultaneously.

5.1.6. Translation of hierarchical tree diagram

The dominate, sub-dominate or headed strong feature of music is shown through drawing prolongational tree diagram which has been discussed in detail in chapter-2. In addition, it has been also mentioned that this tree structure is formed by the direct influence of linguistic prosodic tree diagram and syntactic tree diagram. Now firstly the prosodic tree structures of the words of Bangla song-1 have been translated into prolongational tree diagram and after that the phrasal prolongational structure with notation have been provided. Here the structural translation of the words of first line is given,

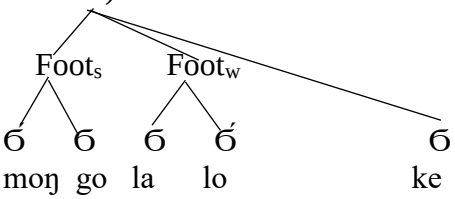


In tree diagrams of the prosodic structure of the word ‘anandoloke’ has been translated into prolongational tree structure. The prime stress has been assigned on the initial

syllable in this word. It is noteworthy that in the prosodic tree the opposition is strong versus weak node on the contrary, in time span reduction the opposition is head versus elaboration. In figure a) shows the prosodic structure of the word which is a representation of relationship of strong and weak nodes. In addition, the structure has been formed according to the syllabic structure of the word. On the other hand the prolongational structure b) does not show any binary relationship like strong vs weak as a) do rather it shows the elaboration of the head of the structure. For example the node of the initial syllable which contains the major stress of the word has been prolonged and this the only concern of this structure.

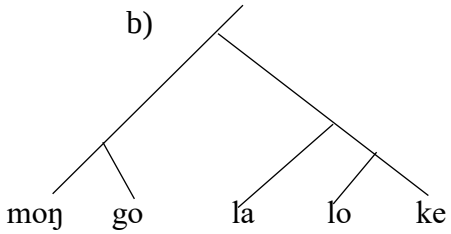
Moreover, it is also significant that this structure does not follow the linguistic syllabic structure such as, unlike prosodic structure the syllable '-do' does not merge with the syllable '-lo' rather it merge with the higher level node of the '-lo' and '-ke' jointly. Next, these three syllables form a single node and this node connect with the headed node and finally the headed node has been elaborated. In the same way we can translate other words of the first line of Bangla song-1 like,

1. a) PrWd-1

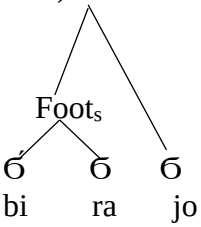


=

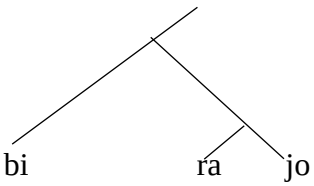
b)



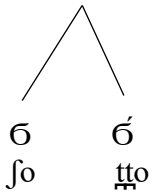
2. a) PrWd



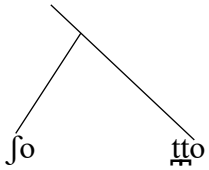
b)



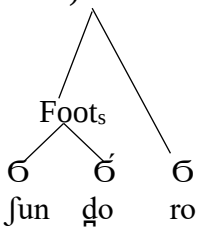
3. a) PrWd



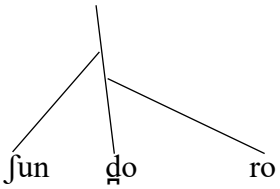
b)



4. a) PrWd-5



b)

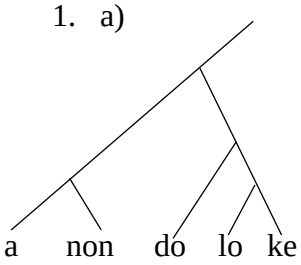


These figures demonstrate three types of stress elaborations such as, initial, penultimate and final. In 1 and 2 examples as the words contain initial stress syllables, the left nodes are elaborated. On the other hand since the final and penultimate syllables are stressed in case of 3 and 4 examples, the right nodes of the tree have been prolonged. In the same way the rest of the lines' words of the Bangla song-1 could be translated structurally into prolongational structure. Nevertheless we are not going to analyze the entire song rather the prolongational structure of first line of the song will be only shown later. Now prolongational representation of the transformed stress pattern of first line of the Bangla song-1 will be explored.

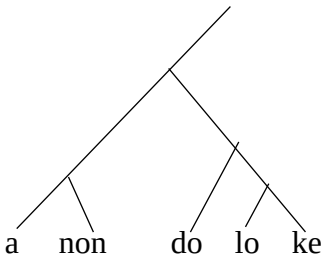
5.1.7. Prolongational trees with the transformed stress pattern of the first line of Bangla song-1

It is revealed in the previous section that after inserting melody the stress pattern of lyric is being changed significantly. In this section first of all the prologational tree diagrams of each words of the first line of the Bangla song-1 with transformed stress assignment will be drawn. After that the overall tree diagram will be illustrated. The prolongational tree structure of each words of the first line with transformed stress pattern have been given below,

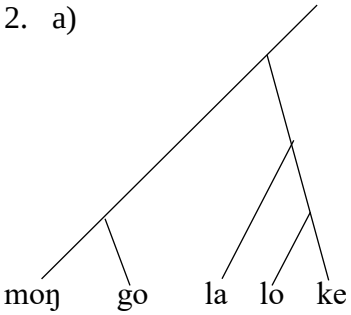
1. a)



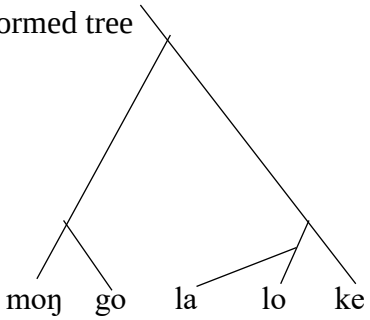
b)



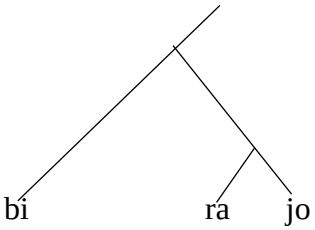
2. a)



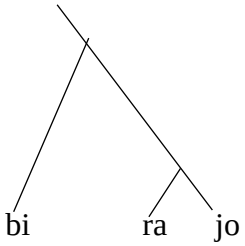
b) transformed tree



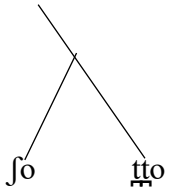
3. a)



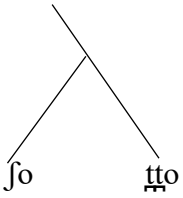
b) transformed tree



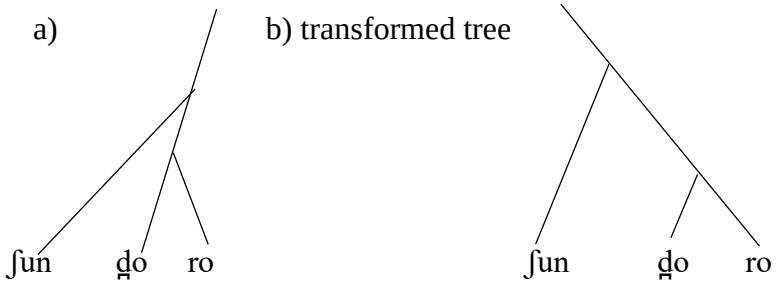
4. a)



b)



5. a) b) transformed tree



The above tree diagrams illustrate the transformed stress patterns of words due to the insertion of melody of first line. It is observed from the figure that stress pattern of all the words do not changed rather some words show stress transformation. For example, in case of the word [anond̪oloke] the initial syllable receives extra stress yet, the stress do not shift into other syllable. Similarly any stress shift or change do not occur in the word [ʃo.ttó]. On the other hand, the syllabic stress uttrely transposes from the initial to penultimate and final in the word [móŋ.go.la.ló.ke]. In this regard the final syllable '-ke' receives the major stress. In the same way stresses tranpose from intial to final in the words [bí.ra.ɟo] and [ʃun.d̪ó.ro]. Now a complete prolongational notation of the first line of Bangla song-1 has been given below,

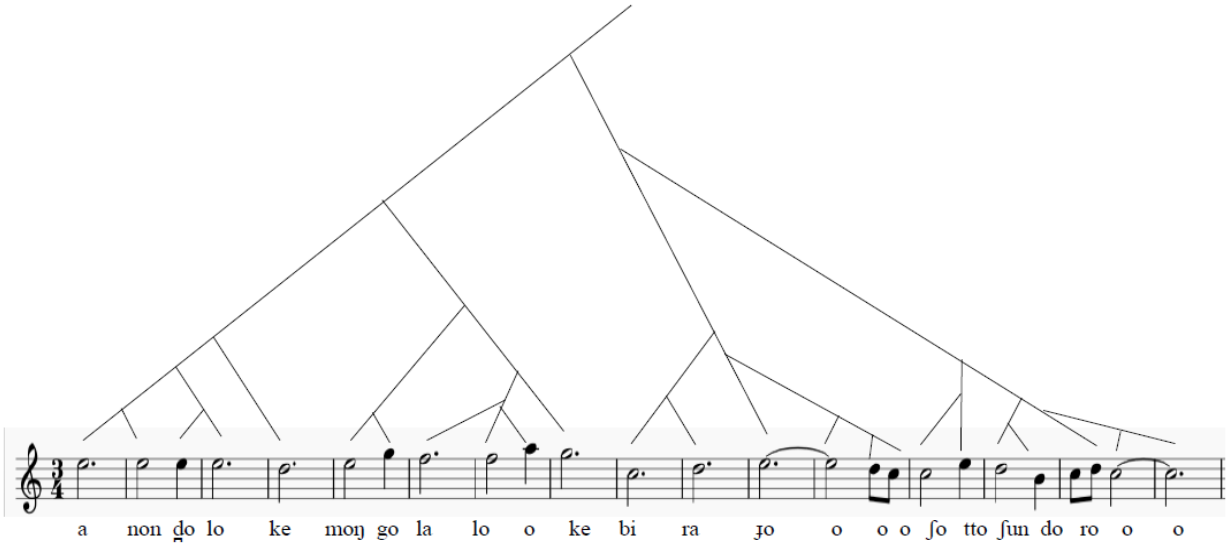


Figure 5. 7: prolongational tree diagram of the first line of Bangla song-1

In figure 5.7 the complete elaboration of the first line of Bangla song-1 has been given. It is observed from the figure that the left node of the tree has been prolonged thus, it is beyond doubt that after melodic insertion the most stressed syllable belongs to the left node of the diagram. To elaborate in case of the first word the initial syllable '-a' receives the major stress of the entire phrase and the syllable '-non' merge directly with the '-a' whereas, '-do', '-lo' joint together first and after that their elabotaed node links to the node of '-a'. Again simiar to '-non' the extrametrical '–ke' merge with the most prolonged node separately.

Secondly, the major stressed syllable of the [móŋ.go.la.ló.ke] is indicated as right node of the second sub tree diagram and it has been elaborated and merge to the left node as well. Consequently, the syllables '-moŋ', '-go' and '-la', '-lo' join as different group first and then finally they merge with the higher level node of '–ke'.

In case of the 2nd phrase of this line the syllable '-ɟo' receives the prime stress and thus it show the most prlonged node and other syllbales of this word merge with this syllable. Moreover, the syllables of the words [ʃo̪t̪to] and [ʃun̪doro] joint to the '-ɟo' since it bears the utmost stress of the phrase. Finally, by merging the node of '-ɟo' with the utmost prolonged node '-a' the prolongational structure of the first line has been constructed.

In the same way the entire song could be described. At the end of the analysis of the Bangla song-1 it can be utterly stated that the selected Tagore's song shows specific structural pattern regarding stress assignment. From the above analysis of this song it is quite evident that significant tranformation of stress has been occurred due to melodic insertion in lyric which makes the melody unique.

5.2. Analysing Bangla song-2

5.2.1. Reason behind selecting Bangla song-2

The second selected song for analysing in this study is Kazi Narul Islam's song *amar aponar cheye apon je jon*. This song was first published in the book titiled *Nazrul Geetika* in 1930 and this book consists of 127 songs. These songs were composed by using a variety of musical genre like, *thumri, tappa, gazal, dhrupada, kirtana, Baul, Bhatiali* and *Kheyal* (Karunamaya, 2007). As a consequence approximately all musical types by which nazrul was inspired in his intire musical life could be found in this volum of his songs. In fact Nazrul composed more or less 40000 songs despite severe drawbacks and obstacles in his life. These vast amount of songs can be divided into several parts as Tagore's songs such as, devotional songs, love songs, deviotion to nature, patriotic songs, war songs, parody etc. Although the boundaries of genre can not be strictly marked, musical variety is found in different genre. Among these enormous amount of songs, which have a great impact on developing the overall form of Bangla songs, a particular song has been selected as Bangla song-2 for our study for some specific reasons like,

a) It has been already mentioned in the section of analysing Bangla song-1 that devotional aspect is the primal concern of this study to select Bangla song. Though Bangla song-2 can not be traditionally marked as 'devotional nazrul geeti' like, Nazrul's '*Shyama sangeet'* or '*Ham nad'*, a high devotional feature is found in this song. Basically this study tends to show such feature which is found in almost all types of Bangla song. This 'unseen eternal entity' feature has already been discussed in Chapter-1. This feature is prominently seen in our Bangla song-1 and in the same way in case of selecting Bangla song-2 this feature has been considered as the most significant feature. Here Nazrul is telling about something which is closer than himself can be interpreted as god or eternal entity, yet he always finds it in his own. By this song he convey his deep devotion to this entity.

b) This song was composed in A major/ F# minor scale and using *Kawali* rhythm. Using this scale pattern the prominent arrengement of notes and musical tendencies have been written through staff notation by the researcher. Though subtle musical

ornaments of the song can not been shown due to diverse use of indian classical style, significant features of the melody have been written.

Similar analysis procedure of the previous song will be followed to analyze the Bangla song-2. Thus first of all the phonological in particular prosodic information of each linguistic elements of the song will be illustrated after that, the prominence and hierarchy of stress assignment as well as the difference between lyric and melody will also be revealed. Next, before showing the transposition of lyrical or linguistic stress to melodic or musical stress, metric phonological information of lyric will be showed. In this case similar to the analysis of Bangla song-1 GTTM and metric phonological parameters will be implemented. Similarly, using praat the suprasegmental features of the Bangla song-1 will also be revealed to show the prominent elements.

5.2.2. Lyrical and musical description of the Bangla song-2

The interlinear glossing of the Bangla song-2 has been given below,

amar aponar ceye apon ɟeɟon
my myself than beloved who
'the person who is more beloved than myself'

kʰuji ʈare ami aponay
Search-1st PER him/her I myself-LOC
'I am searching him or her in myself'

ami ʃuni ɟeno ʈar coroner ɖʰoni
I hear-1st PER as his/her feet-LOC sound
It seems to me that I hear the sound of his/her arrival'

amari piaʃi baʃonay
My-EMP thirsty desire-LOC
'In my thirsty desire'

Principal linguistic information and English meaning of the song have been given in the above glossing. Since the grammtical linguistic explanation is less important for this study, we are going to discuss the lyrical interpretation briefly here. Though both

Bangla song-1 and 2 express heartfelt affection toward something that is eternal and unseen, both are quite different regarding interpretation. For instance the subject or the person is considered as prime focus in this song who is getting experience of the eternal soul by his own. In this case this idea is pretty close to the Fakiri philosophy of Bangla song like, lalon shai. In this song Nazrul express his deep affection towards something which is not so blissful or devine like bangla song-1 rather, it is more close to actual human. For this reason he does not worship this existence or praise but tries to find it in himself. In fact it is Nazrul's endeavour to search the presence of god or eternal existence in human soul. To elaborate in third and forth lines Nazrul says that he hears the sound of the feet step of this existence in his thirsty desire. In fact through these above four lines Nazrul make it understand that this eternal exstence can easily be found in human being. Now the musical presentation of the first four lines of the Bangla song-2 has been given below,

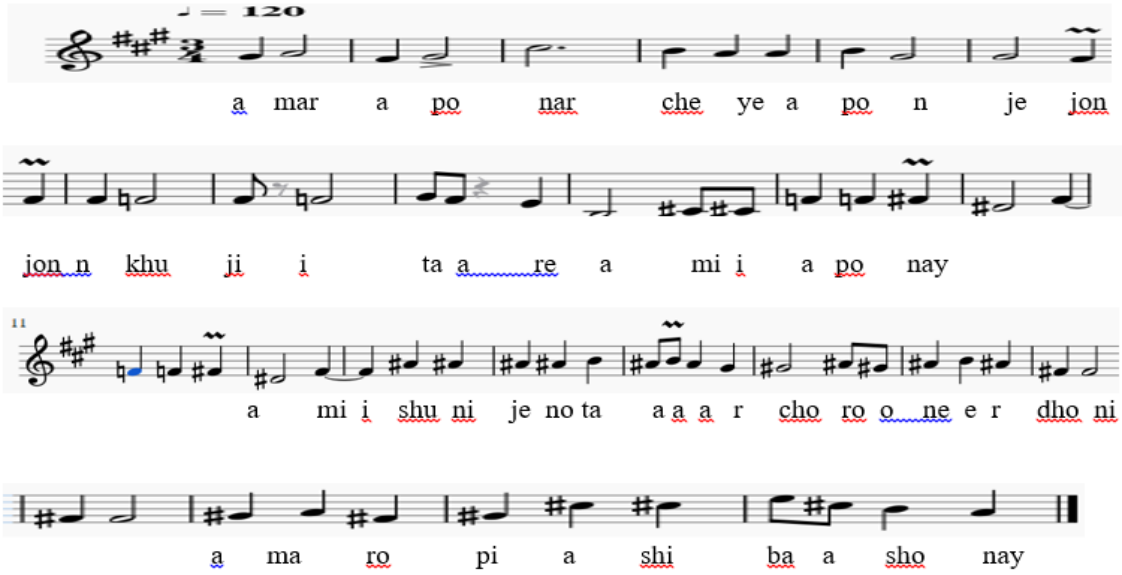


Figure 5. 8: Staff notation of Bangla song-2

5.2.2.1. Musical description of Bangla song-2

This song is composed in A major/ F# minor scale. The notes of A major scale are: A, B, C#, D, E, F#, G#, A. The staff notation of A major scale has been given in the index.

The most significant tendencies of the notes arrangement by which each line of the song express unique melody as well as meaning have been provided below,

a) It is seen from the notation is that the time signature of the song is ¾ thus, each measure takes 3 beats maximally as well as each beat gets quarter or 4 beat. The given four lines of the song consist 25 measures and the measures are well distributed among the four lines. Like, the first thee line get 6 measure in an average and the fourth line get 3 measures. It is significant from these four lines is that each line contains unique melody and no melody is repeated in these lines.

b) The notes of the 25 measures of the first four lines of the song are: (G#A) (F#G#A) (C#B) (AB) (G#F#) (FF#F) (G#F#E) (BC#) (FFF#) (D#F#) (A#A#) (A#A#) (BA#G#) (G#A#G#F#) (F#F) (G#GF#) (G#C#C#) (EC#BA). From this syntagmatic note arrangement it is evident that all notes of A major scale has been used in a diverse way in order to construct this unique melody of this song. It is noteworthy that each and every syllable of the song get minimum one note moreover, some syllable contains more than one note like, '-t̪a' and '-mi' of the second line get two notes, '-t̪a' of the third line contains three notes. In addition it is comprehensible that almost all the measure contains minimum one word except the third measure of the first line which contains only one syllable '-nar' and the 15th measure of the third line which contains a split of syllable '-ar'. In this way the melody structure of the first four lines of the song are arranged.

c) In this song the frequent use of the 4th note is very significant, half note is also seen in some syllables like, '-mar', '-po', '-je' in the first line. In case of rising and falling notes trill feature of note is used and this feature is showed by mordent sign. The most prominent measure of the first line is 4th measure which contains two syllables and three notes. The reason behind to get prominence to any particular measure will be discussed elaborately in the GTTM analyzing section. Similar to Bangla song-1 it could be say again that implementing different notes and different syntagm those line achieve unique rhythmic quality which make it different from the other lines of the song.

The next section will analyze the linguistic elements of the lyrics by solely linguistic prosodic metrical analyzing methods.

5.2.3. Linguistic analysis of the lyrics of Bangla song-2

5.2.3.1. Prosodic hierarchical structure of the song

From the analysis of Bangla song-1 it is evidently seen that the song follows the stress-accent feature of Bangla language moreover, any contrastive or semantic function of stress has not been found. Nevertheless some deviation from the norm of Bangla stress assignment has also been found like, stresses do not constantly assign on the initial syllable. Rather, it is observed that some time penultimate syllable receive the primal stress. In this regard the stress rule of Bangla 'stress is assigned to the second syllable if the first one is not heavy' is followed. Therefore observing the findings of the Bangla song-1 as well as concerning the general trend of stress assignment of Bangla the stress distribution of Bangla song-2 has been below,

5.2.3.1.1. Syllable as well as stress distribution of Bangla song-2

Here the word stresses have been assigned on the basis of speech stress of Bangla without melody of the Bangla song-2 has been given,

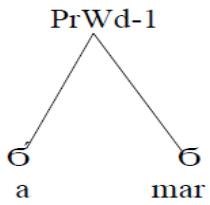
á.mar á.po.nar céye á.pon ɟé.ɟon
kʰú.ɟi ʈá.re á.mi á.po.nay
á.mi ʃú.ni ɟǽ.no ʈár có.ro.ner dʰó.ni
á.ma.ro piá.ʃi bá.ʃo.nay

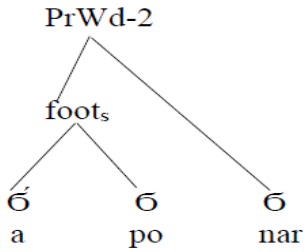
From the above distribution of syllables and stress of the song it is quite clear that most of the words of the given four lines are disyllabic, though some trisyllabic and monosyllabic words are also found. It is also patiently seen that the lyric entirely follow the phonological norm of Bangla stress system. In this lyric nearly all the primary stress have been felt on the initial stress syllable which is an essential condition of Bangla stress system. In this regard it can be said that initial syllables function as head of the

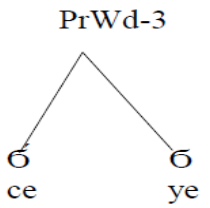
most of the words. It is noteworthy from the above distribution is that any compound or complex words are not present in the lyric and for this simple and most prominent stress assignment rule of Bangla is implemented unlike Bangla song-1. As a consequence the trochaic feet structure prevails in the majority number of words of the lyric, though a small amount of words also contain iambic structure. Unlike Bangla song-1 those two feet structure cannot find in a single word in this lyric. In addition it is relevant to mention it here in advance that this stress distribution may be slightly or completely changed through inserting melody. In fact the lyric will not become song unless having any transformation of the stress pattern. Here the ultimate goal of analyzing the Bangla song-2 is to reveal how the stress of lyric transpose while the melody is inserted and to do this test GTTM theories will be applied. Starting this investigation first of all we are going to analyze the feet structure of the lyric of Bangla song-2 by illustrating the prosodic tree diagram of the words.

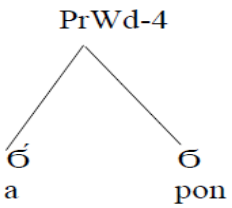
5.2.3.1.2. Illustrating the prosodic tree diagram of the lyric of Bangla song-2

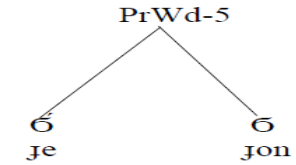
The prosodic tree diagram of the lyric of Bangla song-2 on the basis of the stress assignment of the previous section have been provided below,

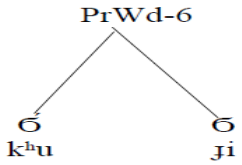


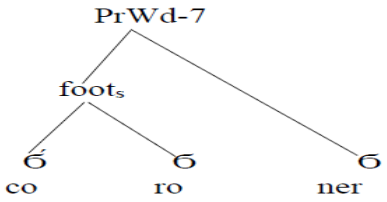


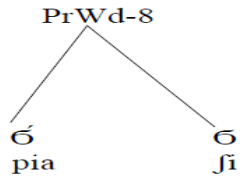












Here the most prominent tendencies of feet structures of the lyric have been provided and in the same way the feet structures, stress assignment or strong vs weak syllable of each word of the lyric can be shown. It is seen from the above illustration is that the initial syllables of the above prosodic words receive the major stresses. Therefore it is strongly stated that though most of the words of the lyric show trochaic feet structure. Now the feet types of the selected five lines of the Bangla song-1 have been given below,

Words	Feet structure	Feet inventory
á.mar	ɓ́ ɓ	Trochaic
á.po.nar	(ɓ́ ɓ) (ɓ)	Trochaic
cé.ye	ɓ́ ɓ	Trochaic
á.pon	ɓ́ ɓ	Trochaic
ɟé.ɟon	ɓ́ ɓ	Trochaic
kʰú.ɟi	ɓ́ ɓ	Trochaic
ʈ̪á.re	ɓ́ ɓ	Trochaic
á.mi	ɓ́ ɓ	Trochaic
á.po.nay	(ɓ́ ɓ) ɓ	Trochaic
á.mi	ɓ́ ɓ	Trochaic
ʃú.ni	ɓ́ ɓ	Trochaic
ɟǽ.no	ɓ́ ɓ	Trochaic
ʈ̪ár	ɓ́ ɓ	Trochaic
có.ro.ner	(ɓ ɓ́) ɓ	Trochaic
dʰó.ni	ɓ́ ɓ	Trochaic
á.ma.ro	(ɓ́ ɓ) ɓ	Trochaic
piá.ʃì	ɓ ɓ́	Trochaic
bá.ʃo.nay	ɓ́ ɓ	Trochaic

Table 5. 4: Formation of feet structure and feet inventory of Bangla song-2

It is seen from the above table is that all of the feet structure of the words of the lyric of Bangla song-2 undoubtedly follow the general stress norm of Bangla language since Bangla is a stress-accent quantity sensitive language. Any single contrastive structural deviation from the standard of Bangla stress system has not been found like, iambic feet structure. In this regard it is estimated from the table 5.4 that among 18 prosodic words single word does not contain iambic foot structure. Consequently, the manipulation of identical feet structures make this song unique from other lyrics. Here the overall feet structure of the lyric is presented without words like,

First line: T T T T T

Second line: T T T T

Third line: T T T T T

Fourth line: T T T

In this stage of our discussion it is important to mention from the previous studies of Bangla word stress and from the analysis of Bangla song-1 that initial word stress always requires an initial heavy syllable in word otherwise stress is generally assigned on penultimate or non-initial syllable. Similarly regarding borrowed words Bangla stress rules might not be applicable sometimes.

In the case of the words of Bangla song-2 which contain Trochaic feet structures follow the standard rules of stress of Bangla. For example, the penultimate or final syllables are as light as they cannot receive the prime stress rather, the initial syllables get the stress. For example, the words like, [á.mar], [ɲǽ.no] and also the rest of the words of the above lines that contain initial heavy syllables.

Moreover, any single Sanskrit rooted word does not violet the Bangla stress assignment rules in this lyric. Thus, it is assumed that these borrowed words adopt the stress rules of Bangla entirely. For example, the words [á.mi] [ʃú.ni], [Piá.ʃĩ], [bá.ʃo.nay] etc. are derived from Sanskrit, yet the prime stress do not fall on final or penultimate syllable. However, the native words (*khati Bangla shobdo)* of these lines such as, [á.mar], [cé.ye] [kʰú.ɲi], [ʈár] and [á.ma.ro] obviously follow the stress assignment rules of Bangla.

From the table 5.4 and above discussion it is clear that single feet structure prevail in the first four lines of this lyric. Now we are now going to reanalyze the feet structures through the parameters of metrical constituents like, along with TROCHAIC, IAMBIC two constraints such as, Align the Right Edge of the Foot (R-to-L) and Align the Left Edge of the foot (L-to-R). Using this four constrains test of the lyric has been given.

5.2.3.2. Testing the parameters of metrical constraints of the four lines of the Bangla song-2

Words	Feet structure	IAMBIC	TROCHAIC	L-to-R	R-to-L
á.mar	(σ́ σ)	×		×	×
á.po.nar	(σ́ σ) (σ)	×			×
cé.ye	(σ́ σ)	×		×	×
á.pon	(σ́ σ)	×		×	×
ɟé.ɟon	(σ́ σ)	×		×	×
kʰú.ɟi	(σ́ σ)	×		×	×
ʈá.re	(σ́ σ)	×		×	×
á.mi	(σ́ σ)	×		×	×
á.po.nay	(σ́ σ) σ	×			×
á.mi	(σ́ σ)	×		×	×
ʃú.ni	(σ́ σ)	×		×	×
ɟǽ.no	(σ́ σ)	×		×	×
ʈár	(σ́ σ)	×		×	×
có.ro.ner	(σ́ σ) σ	×			×
dʰó.ni	(σ́ σ)	×		×	×
á.ma.ro	(σ́ σ) σ	×			×
piá.ʃi	(σ́ σ)	×		×	×
bá.ʃo.nay	(σ́ σ)	×			×

Table 5. 5: Metrical constraints of the first four lines of Bangla song-2

This table reveals some subtle facts that have not been shown in the previous table of feet structure and the leaner presentation of these four lines of lyric. It has been already hypothesized in the analysis section of Bangla song-1 that a specific constraint require another constrain in order to construct feet structure and here it is essential to mention our constructed hypothesis again,

a) If L-to-R parameter presents in a word, trochaic stress pattern could be assigned.
b) If R-to-L parameter presents in a word, iambic stress pattern could be assigned.

Now we are going to observe the table on the basis of those hypothesis as well as figure it out whether the hypotheses are applicable for Bangla song-2.

First of all it is surprisingly seen in this table is that unlike Bangla song-1 most of the words of the given four lines strictly follow the constructed hypotheses. For example the words which contain a TROCHAIC feet structure eventually get an L-to-R parameter. It has already been seen in table 5.4 that no IAMBIC foot structure prevail in this lyric and as a consequence the IAMBIC parameter is also absent in the feet structures of the table 5.4.

In case of the disyllabic words like [á.mar], [Cé.ye], [á.pon], [ɟé.ɟon],[á.mi] etc. accept only one parameter. As a result, these types of words violet rest of the three parameters as well as those constructed hypothesis of metrical parameters of this study are not also applicable for these words.

However, unlike the feet structure of Bangla song-1 any single word among the four lines has been found which contains the mentioned four constraints simultaneously. Thus it is clearly seen from this table is that each word does not contain more than two constraints. Now the most core point of the prosodic observation of Bangla song-2 can be pointed out like,

a) All the words of the given four lines which get a TROCHAIC structure eventually follow the hypothesis (a)
b) Any single IAMBIC foot structure has not found in the lyric.
c) Most of the words follow the rules of quantity sensitivity, thus the initial heavy syllables are stresses in this lyric.

The next sections have provided the explanation of how Bangla song-2 achieve its unique melody and in order to do this the GTTM analyzing theories which have already been tested in case of Bangla song-1 have been implemented. Thus Bangla song-2 have been examined by using GTTM theories such as, grouping structure, metrical structure and time-span reduction. Basically the prime query of the next sections is how the stress pattern of Bangla song-2 change after inserting the melody in lyric. Moreover in order to show the evidence of stress transformation, acoustic phonological information of the song with lyric and melody have also been provided.

5.2.4. Analyzing Bangla song-2 using GTTM theories

5.2.4.1. String and grouping structure of Bangla song-2

In section 5.1.5 it has been well examined that there is a strong hierarchical relationship between the lyric and melody of Bangla song-1. Through well formedness rules and prominence rules of GTTM this connection of both domains has been constructed in case of Bangla song-1. In this section the association of discrete elements of lyric and melody will be revealed regarding Bangla song-2. First of all the grouping rules which have already implemented in section 5 have been given below,

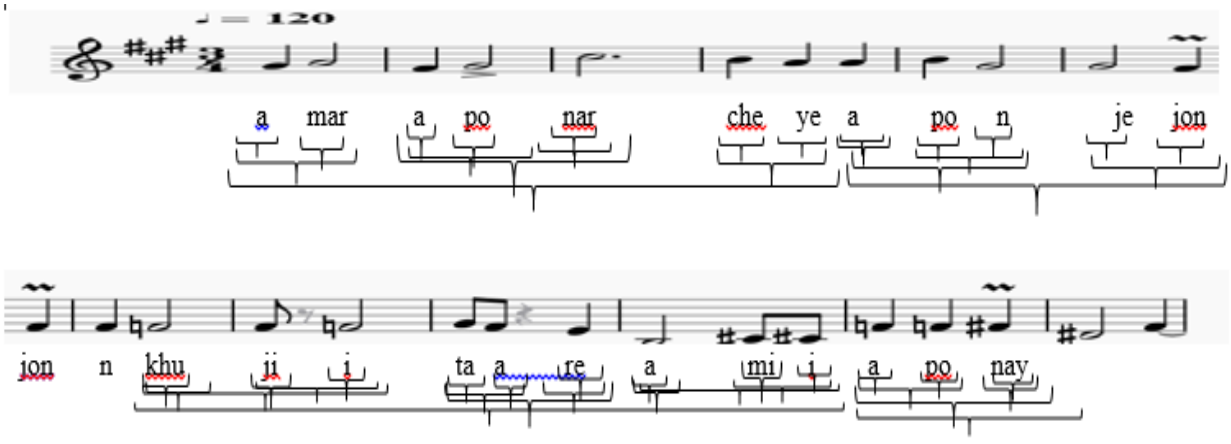
GWFR1: Any contiguous sequence of pitch events can constitute a group and only contiguous sequences can constitute groups.

GWFR3: A group may contains smaller group

GWFR4: If a group G_1 contains part of group G_2, it must contains all of the G_2.

GWFR5: If a group G_1 contains a smaller group G_2, then G_1 must be exhaustively partitioned into smaller group.

Lerdahl explained the sequences or syntagmatic structures of western classical music and English song such as, Mozart's G minor symphony and Beatles' song 'yesterday'. In the same way Bangla song-1 has also been described by using this grouping rules. Here the sequential sturcture of Bangla song-2 will be investigated through these rules. In this regard according to these mentioned rules our selected four lines of Bangla song-2 have illustrated,



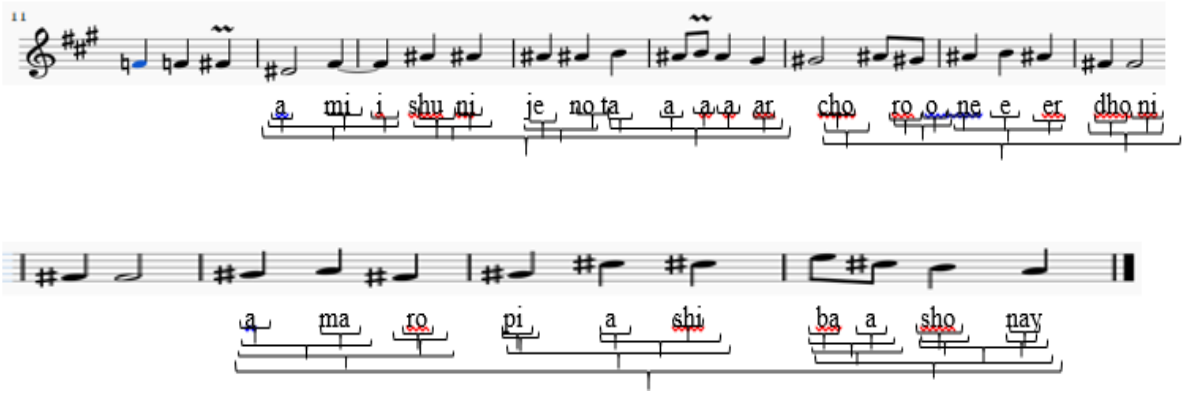


Figure 5. 9: Grouping illustration of the four lines of Bangla song-2

From the figure 5.9 which illustrates the grouping construction of these lines shows that the notes which belongs to A major scale make a contiguous sequence like, (G#) (A) (F#) (G#) (A) (C#) (B) (A) (B) (G#) (F#) (F) (F#) (G#) (E) (B) (C#) (F) (F) (F#) and so on as well as these groups could also be marked as G_1 G_2 G_3 G_4 G_5 and so on. Here it is noteworthy that the notes are equally distributed on each syllable except two syllbales like, '-ji' and '-ta' containing two notes (FF#) and (G#F#) respectively. In addition each group functions as sub group relatively and construct higher level group gradually. For instance, G_1, G_2 , G_3, G_4 and G_5 act as single group thus, (G# A) (F# G#) (A) function as single group individually.

Similar to Bangla song-1 these groups gradually build up higher level groups by merging with each other such as, G_1, G_2, and G_3 create 1st higher level group by merging syllables '-a', '-mar', '-a', '-po' ,'-nar' and musical notes (G# A) (F# G#) (A). Here it is seen that two or more than two single group can construct next greater group and in this case this higher level can be marked as sub group-2 if the single group is identified as sub group-1.

After building the sub group-2 notes are tended to accumulate in the next higher group like, [{(G#) (A)} {(F#) (G#) (A)} {(C#) (B)} {(A) (B) (G#)} {(F#) (F)}] which contain the syllables of the phrase [á.mar á.po.nar céye á.pon ɟé.ɟon] and in the same way the next higher level group can be constructed.

Therefore it is seen from this description is that GWFR1 rule is applicable to explain melody construction of this song. Similarly the rest of the line can also be explained through this rule.

On the other hand the grouping rules GWFR2, 3 and 4 are explicitly applicable to the first four lines of this song in figure 5.9. For example the highest level group contains several sub groups. If we take the example mentioned above then the group [{(G#) (A)} {(F#) (G#) (A)} {(C#) (B)} {(A) (B) (G#)} {(F#) (F)}] consists of 5 sub-groups as, {(G#) (A)}, {(F#) (G#) (A)}, {(C#) (B)}, {(A) (B) (G#)}, and {(F#) (F)} and further break down of the groups would provide the notational and syllabic information of the song.

Furthermore, all groups are not prominent in a given sequence rather some group work as significant group and in this way strong beat are formed. The next metrical section has discussed this prominence issue of Bangla song-2.

5.2.4.2. Metrical structure of Bangla song-2

In the section 5.1.4.2. of the metrical analysis of Bangla song-1 the fundamental component of metrical structure are grids have been observed moreover, it is also seen that stressed grids in lyric are represented by relative syllabic stresses whereas, in case of melody it depends on the distribution of strong beats. In this section similar to the analysis of Bangla song-1 the transformation of stress grid from speech to melody has been focused. To do this investigation prior to show the stress grid of lyric with melody the stress grids of lyric solely have been illustrated first.

5.2.4.2.1. Metrical structure of lyric

Here the metrical representation of the four lines on the basis of syllabic structure of the song has been given,

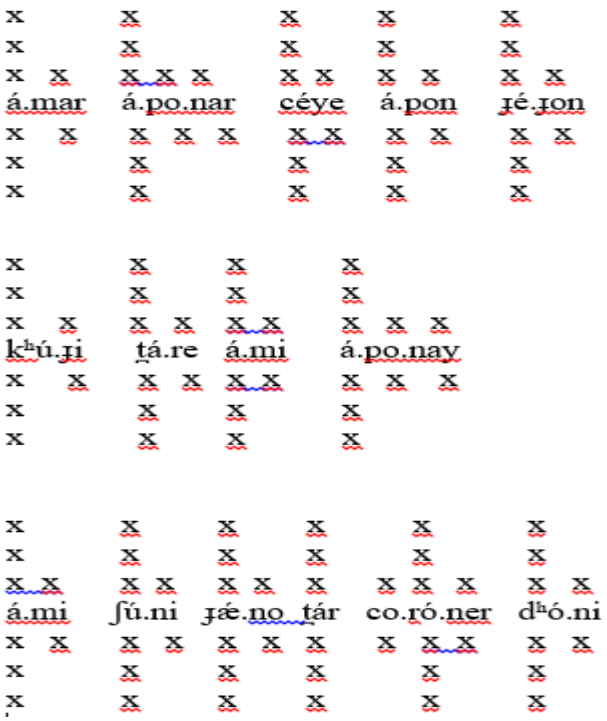


Figure 5. 10: Metrical representation of the first four lines of Bangla song-2

Basically the figure 5.10 is a representation of the table 5.5 and here these four lines have been tested through the relevant metrical preference rules as Bangla song-1 has been examined. The two metrical well formedness rules which are applicable for this study is given below,

MWFR3: At each metrical level strong beats are spaced either two or three beats apart
MWFR4: Each metrical level must consist of equally spaced beats.

In case of this lyric it is seen that stressed syllables are spaced one and two syllable apart but not three syllable. For example the first stressed or strong syllbale is '-a' of the word [amar] follows by a stressed syllable '-a' of the word 'aponar' and the syllabic gap between those syllbale is one. On the other hand the next stressed syllable is '-ce' and the distance between '-ce' and '-a' is two syllabic steps. In the same way lines 2,3 and 4 could also be explained through those well formedness rules. Now we are going to present the acoustic phonological information of the four lines of the Bangla song-2 in order to show the physical evidence of stress transformation.

5.2.4.3. Acoustic phonetic evidence of stress transformation

Now the acoustic phonetic features in particular, pitch and intensity of each note of syllable of Bangla song-2 have been measured similar to Bangla song-1. Similarly the higher degree of pitch and intensity has been considered as higher intensity of stress as well as longer time duration also indicate the stress feature of syllable. A list of pitch and intensity of the selected four lines using linguistic software praat is given below,

Syllables	Notes	Time	Pitch	Intensity
a	G#	2.1	154	71.13
mar	A	2.8	171.1	70.37
a	F#	3.35	162.3	70.73
po	G#	3.82	165.6	89.37
nar	A	4.32	200	71.09
ce	C#	4.87	223.4	69.35
ye	B	5.17	194.8	71.25
a	A	6.35	169.9	71.68
pon	B	6.67	179	70.96
ɟe	G#	7.73	165	70.33
ɟon	F#	8.14	165.9	69.42
kʰu	F	9.6	149.5	68.39
ɟi	F# F	9.9	144	70.59
ʈaa	G#F#	10.4	146.5	71.1
re	E	11.22	131.1	63.43
a	B	12.12	98.15	60.29
mi	C#	12.66	141	63.98
a	F	13.1	127.8	68.31
po	F	13.4	145.5	64.49
nay	F#	13.65	148.6	64.28
a	D#	27.4	117.9	65.8
mi	F#	27.8	150.3	65.98
ʃu	A#	28.7	194.5	71.1
ni	A#	29.02	189.5	71.21
Je	A#	29.3	185	71.31
no	A#	29.53	191.1	71.45
ʈar	BA#G#	30.04	201.7	71.53
co	G#	31.56	167.9	71.14
ro	A#G#	31.90	191.6	71.3
ner	F#F#	31.89	190.6	69.77
dʰo	F#	33.7	154	64.38
ni	F	34.08	146.8	61.33
A	G#	41.28	165.6	71.13

ma	G	41.58	166.3	71.28
ro	F#	41.99	166.6	70.36
pi	G#	42.92	178.7	70.15
aʃi	C#C#	43.80	198.2	71.17
ba	EC#	44.36	233.1	71.27
ʃo	B	45.06	248.5	71.37
nay	A	45.54	178.8	75.04

Table 5. 6: Acoustic phonetic information of Bangla song-2

The table 5.6 illustrates the pitch and intensity of each syllable as well as notes of the selected four lines of the Bangla song-2.

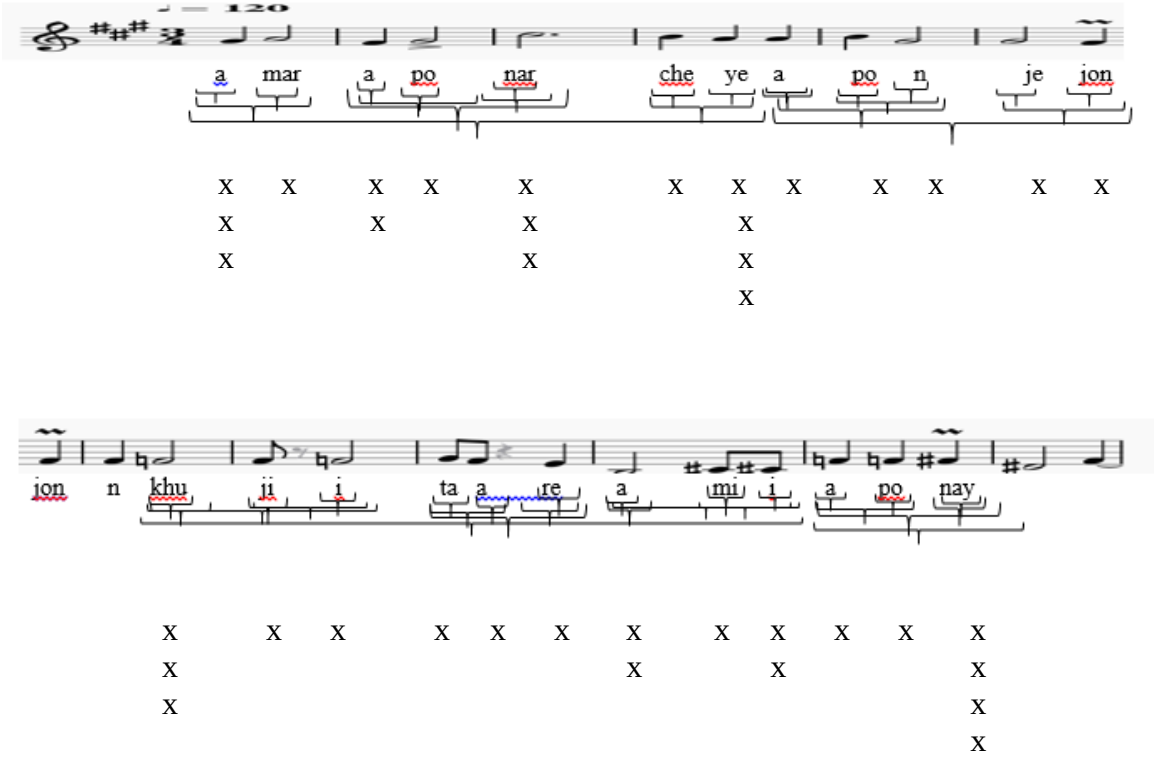
The overall representation of the table shows a variety of data regarding different notes and syllables. Here, Hz and DB stands as measure unit for pitch and decibel respectively. Firstly, this table shows that the fluctuation rate of pitch of similar note is not so high similarly Bangla song-1. Nevertheless the pitches of the same note does not stable in a certain number. For example the 6th or G# of the A major scale has been used in a diverse way in these first lines such as, the song starts with the 6th and it has been found 9 time within these four lines and each time it shows different pitch and intensity, though its rise and fall are not so tremendous. For instance, the pitches of G# ranges from 165Hz to 197Hz which are seen in '-a' syllable of the word [amar] of first line and '-ro' of the word [coroner] of the third line. Similarly A# has been used 4 times repeatedly in the third line of the phrase [ʃʊ́.ni ɟǽ.no ʈár] and its pitch limit is 185Hz to 194Hz.

Secondly, it is evident from the table is that the first line begins with 154Hz and the pitch frequencies regarding other notes rise gradually as well as all at once the pitch reach to the highest frequency at 223Hz in '-ce' syllable of the first line. On the basis of this increase it is decided that '-ce' is the most stressed syllable of the line after inserting the melody. On the other hand in case of the second line a gradual fall of pitch frequency is observed. For example the F note of '-k^{h}u' syllable starts with 149.5Hz and step by step the frequencies of the notes of the line have been decreased and surprisingly the frequency dips in B note of 'a' syllable at 98Hz and this is the lowest frequency of the line. In this way due to the ups and down of pitch frequencies the entire stress system of the lyric of the song transformed.

Furthermore unlike the Bangla song-1 eloquent use of out of key notes of A major scale is observed. For instance, A, D#, A# and F notes are not belong to this scale but they have been used in the '-k^{h}u', '-a', '-ʃu' and 'ni' syllables respectively. As a consequence this sudden use of out of keys make this tune more melodious. Basically Nazrul kept himself doing musical experiment with various Indian classical and foreign genre of music thus, this diverse use of out of keys is a consequence of his musical expedition. The next sections has illustrated the song with transformed version of the stress system.

5.2.4.4. Metrical representation of transformed stress grid of lyric

The metrical representation of the first four lines of the lyric following the speech syllabic structure have been given in the section 5.2.4.2 It is also been revealed in the previous section is that stress preference of the lyric of Bangla song-2 has been changed for transformed version of pitches and intensities of syllables. Therefore it is for sure that melodic insertion act as a precursor of changing the stress system of speech. Now the four lines with musical setting, grouping strings and metrical stress grid have been given below,



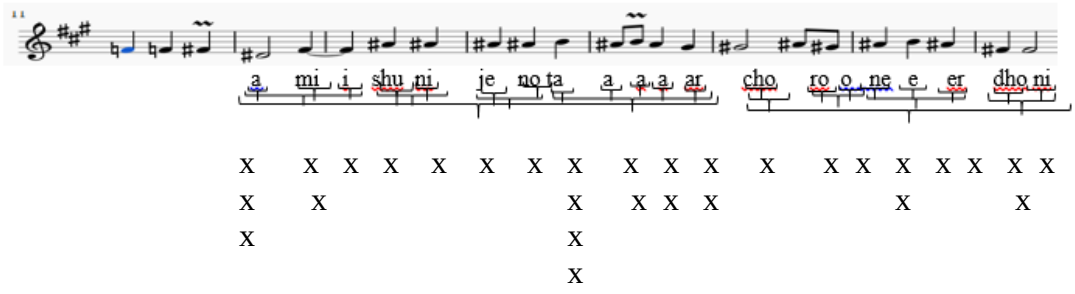


Figure 5. 11: First three lines of the Bangla song-2 with notation, grouping structure and transformed metrical grid

The figure 5.11 shows transformed metrical version of Bangla song-2 with musical notation and grouping structure. In comparison to the figure 5.8, which represents the grid based image of the lyric merely, this figure depict significant difference from the previuos one. In fact by putting melody on the lyric, the preference of stressed syllables or strong beats placement have been changed significatly. For example, unlike lyrical metrical depiction, every initial syllable of the lyric does not receive prime stress rather than, the primal stress assignment pretty much depend on the melodic structure. In paticular, according to strong beats of melody the major stresses of lyric have been determined in figuure 5.11. Like, in case of first line strong beats have been spaced regarding the MWFR1 as a result, the intial syllabic stress assignment rule of Bangla does not work. Rather, the lyric starts follow the metrical well formedness rules of GTTM. For instance we get the three stressed syllbales in the first line as, '-a', '-nar' and '-ye' which contain the musical notes G#, A and B respectively and the B note receives the most strong beat of the entire line. Consequently '-ye' becomes the most stressed syllable of the line after putting the melody.

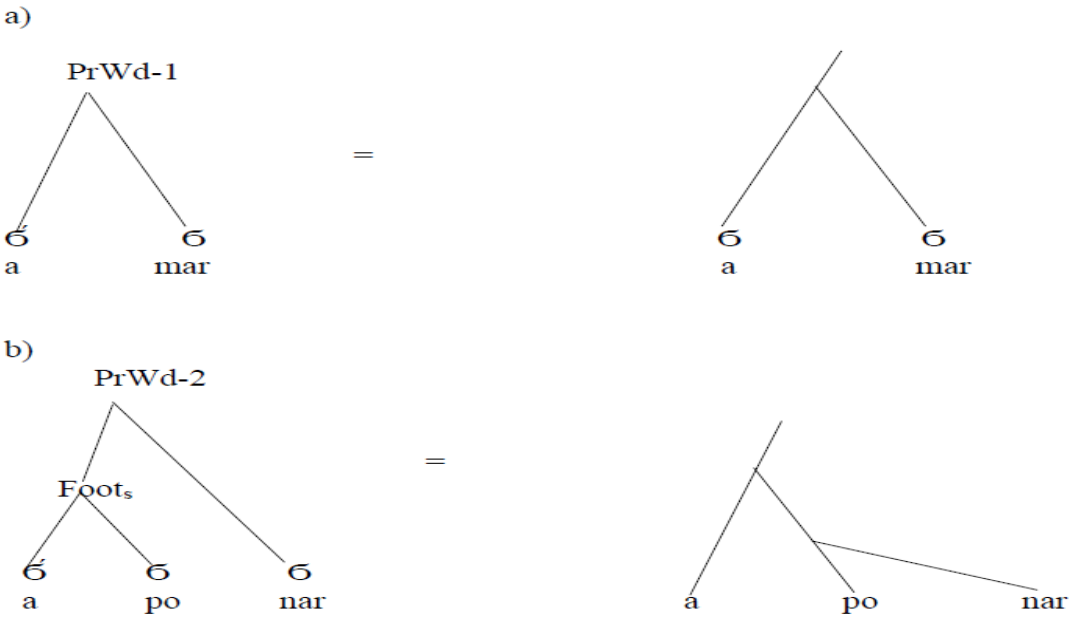
In the same way the transformation of the rest of the three lines could also be described. For example the first and last syllable like, '-k^{h}u' and '-nay' of the line two, which get the F and F# notes receive the major stress since those notes contain the utmost strong beats of the line. Similarly the stress shift of line 3 and 4 have been occurred according to the melodic structure. We will not provide this description in detail here rather, now we are going to give the explanation of stress transformation through time-span reduction tree.

5.2.4.5. Time span reduction or headed hierarchical explanation of Bangla song-2

Since metrical grids and grouping structure do not depict the hierarchical relationship of language and music, further analysis such as time span reduction is required in this regard. It is noteworthy that the hierarchical relationship of stress assignment in lyric and the transformation of stress which occurred by the melody has been explored in the section 5.1.4.5. in case of Bangla song-1. From this analysis it is assumed insofar that both domains are inherently hierarchical and the mentioned analyzing methods do not explain this association. Now, the lyric and melody of Bangla song-2 have been explained through using time span reduction tree. Prior to draw the complete structure of prolongational tree of the song, it is necessary to translate the prosodic tree structures of song into time span reduction tree.

5.2.4.5.1. Translation of hierarchical tree diagram

The translated structure of the time span reduction trees of the prosodic form of the words of lyric of Bangla song-2 have been provided below,



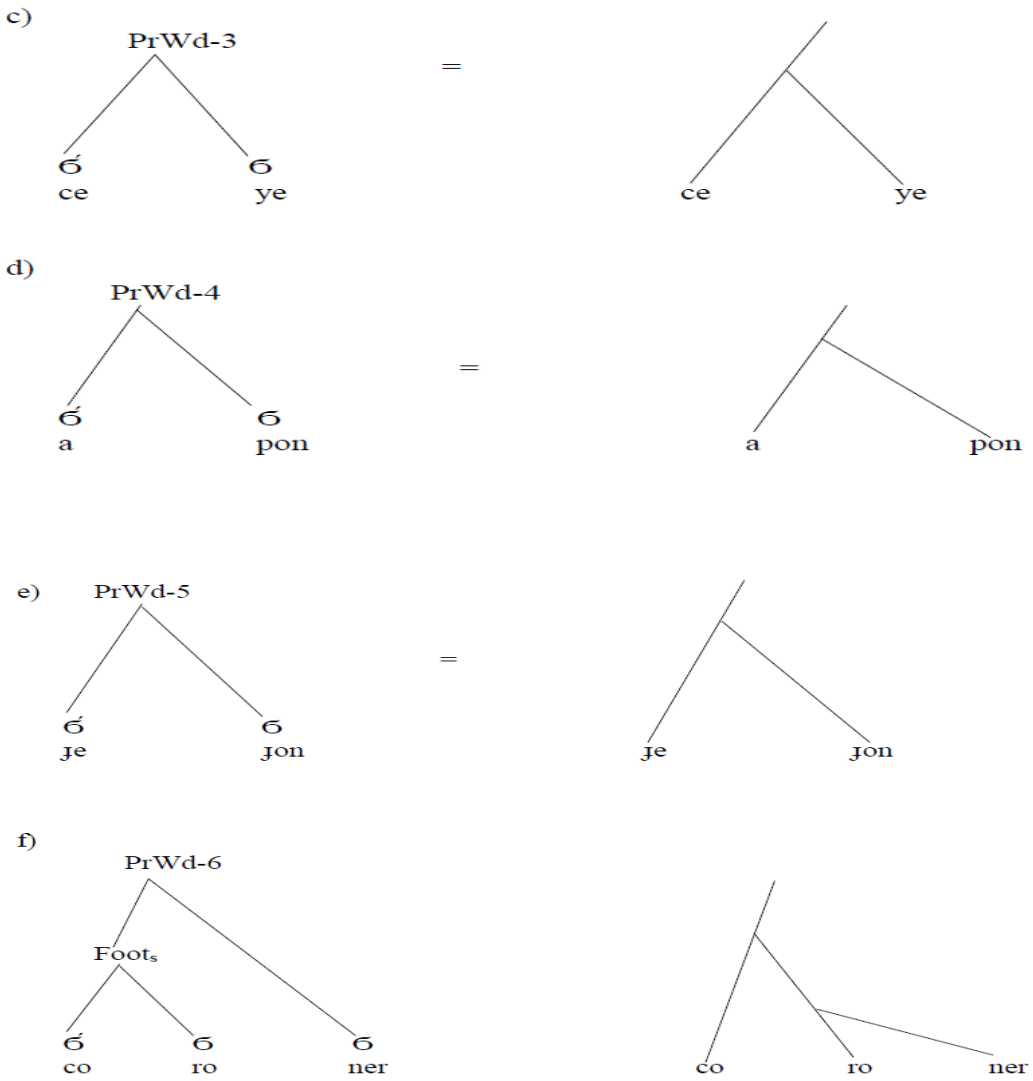


Figure 5. 12: Prolongational tree structural translation of the words of Bangla song-2

The figure 5.12 illustrates the prosodic tree diagram on the basis of table 5.5 which is a mere representation of syllabic stress assignment of lyric and the translated version of this structures into prlongational tress as well. However it is noteworthy that the melody has been omitted in these structures and for this reason transformation have been shown in the next section. Moreover the prolongational structures of the figure above depicts the elaboration of heads rather showing the mere binary relationship of strong and weak nodes. In this regard, the nodes of every stressed syllables of the words have been prolonged and this is the prime focus of this structure. For instance, the syllables which contain the major stress of the words like, '-a', '-a', '-ce' and '-je' of the words [amar], [apon], [ceye] and [ɟeɟon] respectively receive the prime stress and since they are initial syllables the left notes of the structures have been prolonged.

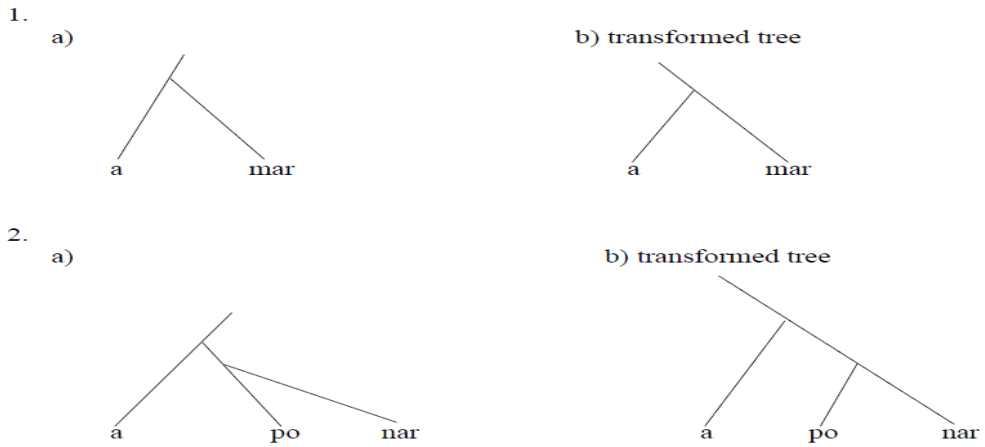
On the other hand in case of example (d) and (f) which contain initial stressed syllable do not show the left nodes elaboration as stresses do not fall on the initial syllables. Here in case of example (F) the medial node of the structure is elaborated according to the assigned stresses. Whereas, example (d) shows right node elaboration for the reason of final stress assignment.

Now some of these words have been reanalyzed after adding the melody of the song. Thus the prolongational structures of the words with transposed stress system has been shown in the next sections and after that the entire picture of the stress transformation of the first line has been revealed.

5.2.4.6. Prolongational trees with the transformed stress pattern of the first line of Bangla song-2

The sections of the metrical representation and acoustic analysis of the song explored significant change after adding melody in lyric. First of all the prolongational diagrams with transformed stress pattern of the words which have been drawn above will be provided in this section. After that the prolongational tree of the entire first line of the Bangla song-2 will be drawn.

The prolongational tree structures with transformed stress pattern of each words of the figure 5.12 have been given below,



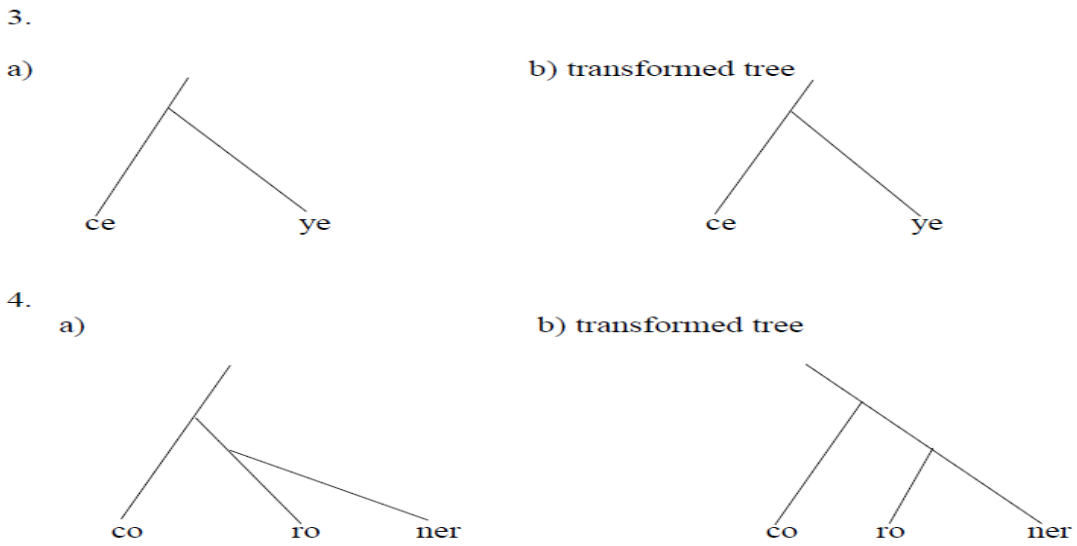


Figure 5. 13: Prolongational tree diagrams of the words with transformed stress pattern

The figure 5.13 depicts the transformed stress pattern of words of the previous figure. It is observed from the figure that stress pattern of the most of the words show transformation, though some words do not receive any transposition. For example, stress has been transposed from '-a' syllable to '-mar' in case of example (1) and consequently the right node has been elaborated. In the same way regarding example (2) stress transfer from initial syllable to final syllbale as the strong beat of melody put on this syllable and the right node has been elaborated. On the contrary, in the case of example (3) no transformation is observed and therefore, the elaboration of node remains the same.

Now a complete prolongational notation of the first line of Bangla song-1 has been given below,

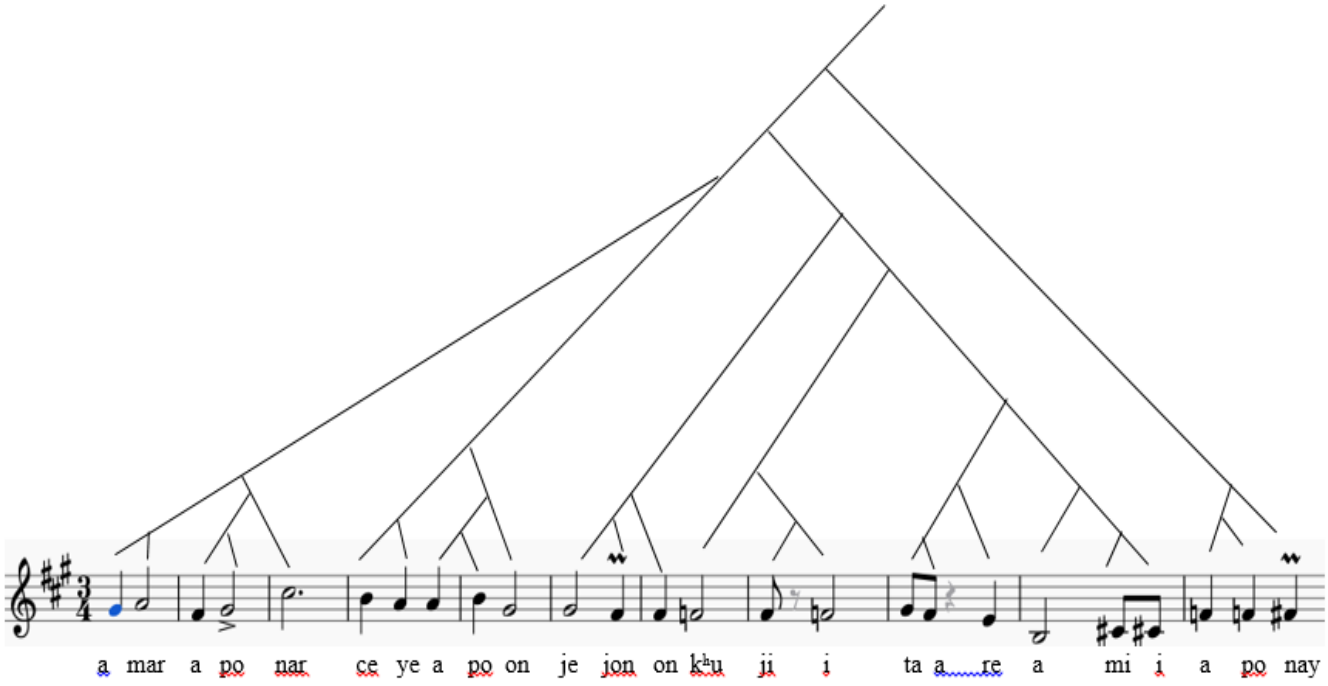


Figure 5. 14: Complete prolongational tree diagram of the first two lines of Bangla song-2

The figure 5.14 illustrates the complete elaboration of the first line of Bangla song-2. Basically this diagram has been constructed by accumulating the transformed tree structures of figure 5.13. It is sharply observed from the figure is that the left node of the tree is the utmost prolonged node. In this regard it can be undoubtedly said that melodic insertion makes this node the most strongest of the entire line. Specifically left node of the syllable '-ce' is the most elaborated node of this time spanned reducted structure. From this diagram two left nodes could be sharply marked and between those one is elaborated. For example notes and syllables of the phrase [á.mar á.po.nar céye á.pon] are constructed as the left branch nodes and since '-ce' get the strongest beat, and for this reason major stress receives this syllable as well, prolongs the most. Moreover, as a matter of fact this syllable is the strongest and the most stressed syllable of the entire line as there is no other syllable receiving the major stress. However, 5 syllables belong to the first left branch like, in case of this phrase '-a' merges with '-mar' as they construct a word [amar] and at the same time the node prolongs the most in order to join to the elaborated node of the phrase [ceye apon] in particular, it merges with the node of '-ce'. Meanwhile, '-a' merges with '-po' and next those merged syllables together incorporate to '-nar' which is the elaborated node of the word

[aponar]. In addition, finally it connects to the elaborated node of '-a' of the word [amar]. In the same way the second elaborated left node has been constructed. In this regard it is noticeable that disyllabic word [apon] looks like trisyllabic due to the melodic sequence such as, 'a.po.on' and here the connected form of '-a' and '-po' merge together with '-on' which is the elaborated node of the word and ultimately it is added to the prolonged node of '-ce'. Similarly the incorporation of different nodes and branches of right nodes could also be described.

To conclude the analysis of Bangla song-2 it is absolutely perceived that the selected Nazrul's song contains such structural pattern that makes it not only different from the other Bangla songs but also unique. Furthermore it is also comprehensible that transposition of stress pattern plays a vital role in order to create this song from a merely lyrical form.

5.3. Analyzing Bangla song-3

5.3.1. Reason behind selecting Bangla song-3

Lalon shai's gosthe colo hori murari has been selected as third song to analyze in this study. Unlike Tagore and Nazrul's songs, the songs of Lalon cannot be categorized strictly. As a matter of fact that Lalon composed a numerous amount of songs in order to solve different philosophical phenomenon. It is estimated that lalon composed about 2000-10000 songs of which only about 800 songs are generally considered authentic. This huge amount of songs can be classified into several aspects of Baul-Fakir's philosophical stances like, *dehotatto* (Body), *prematatto* (spiritual love), *gurutatto* (spiritual preceptor), *lilatatto* (dalliance of Radha and Krishan), *bhajantatto* (worship), *bhaktitatto* (devotion), *monosiksha* (self realization) (Sengupta). (http://en.banglapedia.org/index.php?title=Baul_Song.14.10.2018)

The reasons of selecting this single song as Bangla song-3 among these mentioned equally important streams have been given below,

a) Our selected song is included into the philosophical genre of *lilatatto* and this kinds of songs of Lalon are usually called *gostholeela* or *gostho sangeet*. This kinds of songs bring special pragmatic value in *baul-Fakir*'s daily life. Generally they sing these song in very early morning by which they embrace the beginning of the day. Moreover, the interpretation of *Srikrishna* is pretty much different from *Baishnava* stream. Such as, from Lalon's point of view Krishna represents the entity of '*purush*' or subjectivity on the other hand '*prakriti*' is the objectivity. Baul-Fakir, Lalon or human being tries to eliminate the distance between those entities through meditation. Here songs especially *gostho* songs are the tools of this meditation. Though this song is included into *lilatatto*, it contains high devotion and this is the fundamental reason of selecting this song.

b) The melody of this song is composed in D# major scale and the rhythm sounds like tri taal. The staff notation of Bangla song-3 have been written by the researcher considering prominent features of the melody.

Since Bangla song -3 has been analyzed just like the previous analysis of Bangla song-2 and 1. Illustrating the phonological or prosodic information of each linguistic elements, the prominence and hierarchy of stress assignment as well as difference between lyric and melody have also been shown. Next using the parameters of GTTM and metrical phonology, the transposition of lyrical or linguistic stress to melodic or musical stress have been revealed.

5.3.2. Lyrical and musical description of Bangla song-3

The interlinear glossing of the first four lines of Bangla song-3 has been given below,

loe godʰon goʃtʰer kanon cɔlo gokul bihari
to take cattle pasturage-POSS garden go-SUB cattle wanderer
'Taking the cattle hey cattle wanderer, let's go to the pasture garden'

goʃtʰe cɔlo hori murari
pasturage-LOC go lord Krisna flute
'hey hori, the flute holder let's go to the pasture'

ʈui amaɖer shoŋge ɟabi bɔnoful shɔb kʰeʈe pabi
you our along with go wild fruit all eat get
'If you go with us, you can get all the wild fruits'

amra morle ʈui bacabi ʈai ʈore shaŋgo kori
we die you save so you accompany do
'You will save us when we die that is why we accompany you'

From the above English literal translation of the Bangla song-3 the inner meaning of devotion is not comprehensible. The denotative meaning of the four lines of the lyric is that a cow boy is requested to go to the pastureland along with his cattle. Moreover it is make him understood that if he go with the community he will be entertained by all the fruits as well as if other companions fall in trouble, he will save them. However the song does not convey such simple meaning. Rather it coveys deep philosophical understanding of baul-Fakir. For example, Lalon begs the accompaniment of Sri Krishna in his life through this song. Basically, in this song Krishna does not refer to

any eternal soul or something else which is unseen as we observed in our previous two songs. According to Lalon the absolute soul or god lives in Human body and man can realize this power through meditation or practice. This song invites everybody to lead their practical life sincerely as well as to do their daily job properly. In order to live properly we need to achieve the mercy of absolute power and this mercy will not fall from the sky rather, it has to be achieved by one's own dedication of life. Now the musical description of first four lines of Bangla song-3 has been given below,

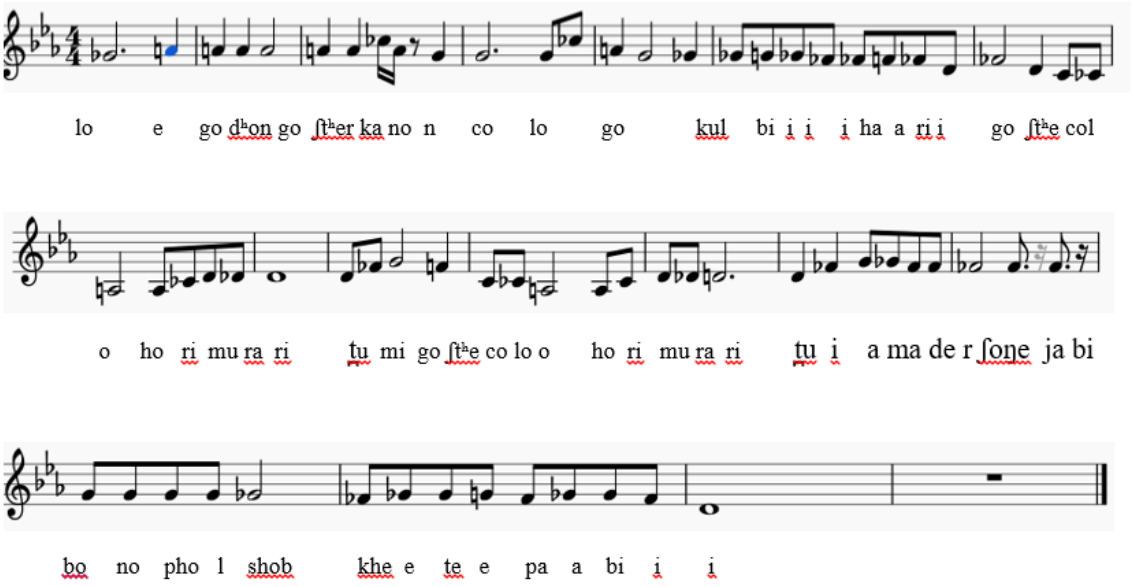


Figure 5. 15: Staff notation of the Bangla song-3

5.3.3. Musical description of Bangla song-3

The Bangla song-3 composed in D# major scale and the notes of D# major are: D#, F, G, G#, A#, C, D (The staff notation of this scale has been given in the index). The remarkable tendencies of the notes arrangement by which each line of the song express unique melody and meaning have been given below,

a) It is seen from the figure 5.15 that the time signature of the song is 4/4 whereas our previous two songs contains ¾ time signature. In this song each measure ae well as each beat takes 4 beats or quarter beat equally.

b) It is significant from the staff notation of Bangla song-3 that almost all the notes of the song are 4^{th} or quarter notes. However, half notes and full notes are seen in some syllables such as, '-lo', '-co', '-ri', '-ʃob' and '-ri', '-i' respectively. The frequent use of 4^{th} notes bring distinctive rhythmic quality which was not seen in previous songs. In addition the use of 8^{th} and 16^{th} beat is also seen in a very persuasive way. For example except measure 1, 2, and 17 almost all measures contain different syntagmatic arrangement of 8^{th} note. The eloquent use of 16^{th} beats are seen in measure 3 and 16. The highest number of notes are seen in measure 6 which contains 8 notes on the other hand some measures also contain only one note such as measure 9 and 17. As a consequence diverse use of various notes make this melody dynamic.

The linguistic elements of the lyrics through linguistic prosodic analyzing methods have been given in the next section.

5.3.4. Linguistic analysis of the lyrics

5.3.4.1. Prosodic hierarchical structure of Bangla song-3

It is seen from the lyrical description of Bangla song-3 is that the deviation from the norm of the stress-accent feature of Bangla language is not prominent. Though some violation of standard stress rules have also found, they can be understood by the rules of exceptions. For example, stress assignment on noninitial syllable. The stress and syllable distribution of Bangla song-3 has been given below,

5.3.4.1.1. Syllables and stress distribution of Bangla song-3

In this case the word stress of Bangla song-3 has been assigned on the basis of speech stress of Bangla without melody,

lóe gó.dʰon go.ʃtʰér ká.non cɔ́.lo gó.kul bi.há.ri

go.ʃtʰé cɔ́.lo hó.ri mu.rá.ri

ʈúi á.ma.ɖer shóŋge ɟá.bi bɔ.nó.fol shɔ́b kʰé.ʈe pá.bi

ámra mór.le ʈúi bá.ca.bi ʈái ʈó.re sháŋgo kó.ri

It is clearly evident from the above distribution is that most of the words of this lyric contain disyllabic structures moreover, frequent use of monosyllabic structures are also found among these four lines. However, three trisyllabic words are also seen such as, [bi.há.ri], [mu.rá.ri] and [bá.ca.bi]. As Bangla song-2 it is noteworthy that most of the words follow the stress norm of Bangla phonology. For instance, the prime stresses fall on the initial stress in case of most of the words, though some little exceptions are observed. Such as, [go.ʃtʰér], [bi.há.ri], [mu.rá.ri]. In this regard through the rule of exception of Bangla stress system the stress assignment of these words can be described like, since the initial syllable is not heavy, the stresses are put on the penultimate or final syllables. Next section has been discussed the hierarchical relationship of syllables of the lyrics of Bangla song-3.

5.3.4.1.2. Illustrating the prosodic tree diagram of the lyric of Bangla song-3

The prosodic tree diagram of the lyric of Bangla song-3 on the basis of the stress assignment of the section 10.1.1. have been given below,

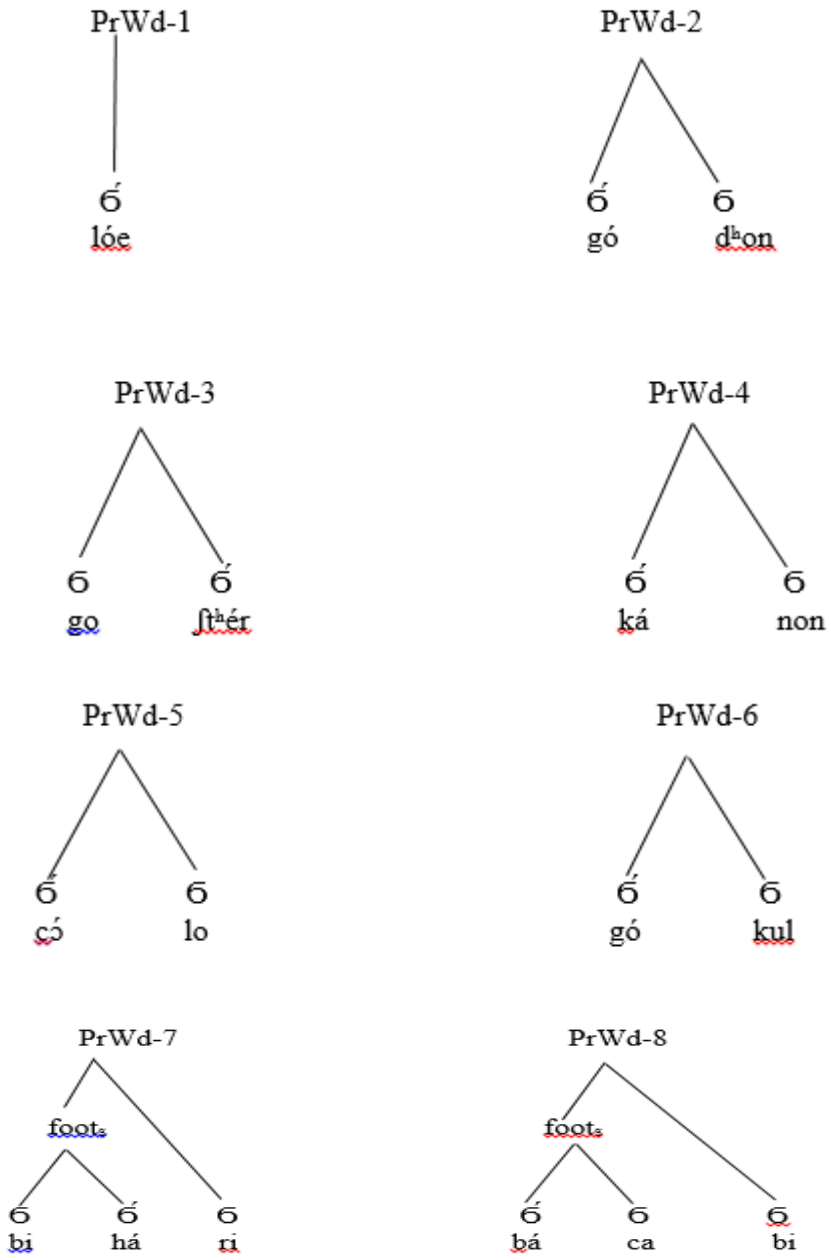


Figure 5. 16: Prosodic tree diagram of Bangla song-3

The figure 5.16 illustrates the prosodic tree diagram of the most prominent word structure of Bangla song-3. It is clearly seen from the figure is that the prosodic words 2, 4, 5, 6 and 8 thus most of the words of the lyric get an initial major stress. On the other hand, in case of prosodic words 3 and 7 the prominent stress felt on the final and penultimate syllables respectively. As a result trochaic foot structure prevails in the most of the words of this lyric. However iambic structure has also been found in some words. Here the feet types of the selected lines of the lyrics is given below,

Words	Feet structure	Feet inventory
lóe	́ ɓ	Trochaic
gó.dʰon	(́ɓ ɓ)	Trochaic
go.ʃtʰér	(ɓ ́ɓ)	Iambic
ká.non	(́ɓ ɓ)	Trochaic
cɔ́.lo	(́ɓ ɓ)	Trochaic
gó.kul	(́ɓ ɓ)	Trochaic
bi.há.ri	(ɓ ́ɓ) ɓ	Iambic
go.ʃtʰé	(ɓ ́ɓ)	Iambic
cɔ́.lo	(́ɓ ɓ)	Trochaic
hó.ri	(́ɓ ɓ)	Trochaic
mu.rá.ri	(ɓ ́ɓ) ɓ	Iambic
ʈúi	́ɓ	Trochaic
á.ma.ɖer	(́ɓ ɓ) ɓ	Trochaic
ʃóŋ.ge	(́ɓ ɓ)	Trochaic
ɟá.bi	(́ɓ ɓ)	Trochaic
bɔ.nó.fol	(ɓ ́ɓ) ɓ	Iambic
shɔ́b	́ɓ	Trochaic
kʰé.ʈe	(́ɓ ɓ)	Trochaic
pá.bi	(́ɓ ɓ)	Trochaic
ám.ra	(́ɓ ɓ)	Trochaic
mór.le	(́ɓ ɓ)	Trochaic
ʈúi	́ɓ	Trochaic
bá.ca.bi	(́ɓ ɓ) ɓ	Trochaic
ʈái	́ɓ	Trochaic
ʈó.re	(́ɓ ɓ)	Trochaic
ʃáŋgo	́ɓ	Trochaic
kó.ri	(́ɓ ɓ)	Trochaic

Table 5. 7: Formation of feet structure and feet inventory of Bangla song-3

The table 5.7 shows that most of the words of the selected lines of Bangla song-3 follow the standard norm of Bangla stress system, though some exceptions in particular 5 words are also observed. For example, this table contains 27 words of four lines and among them the syllable structure of 23 words are constructed by trochaic formation. Whereas a little amount of words such as, [go.ʃtʰér], [bi.há.ri], [go.ʃtʰé], [bɔ.nó.fol] do not follow common rule rather, they take the iambic rule as their structural form. However, it is observed that the majority amount of words basically follow the Bangla stress system. As a consequence a diversity of structural manipulation is not found in these selected lines. The overall feet structure of the lyric is presented without words below,

First line: T T I T T T I

Second line: I T T I

Third line: T T T T I T T T

Fourth line: T T T T T T T T

In comparison to our previous Bangla song-2 and 1 it is noteworthy that Bangla song-3 shows completely different syntagmatic arrangement regarding syllabic and stress distribution such as, the above feet distribution express the difference between the previous analyzed songs. In case of Bangla song-3 most of the initial vowels of the words are heavy enough in order to fall the primary stress. In addition use of borrowed words are not as frequent as the previous songs. To elaborate in case of the mentioned 5 words their first syllables are as light as they cannot receive the prime stress and consequently, the penultimate of final syllable get the major stress. Furthermore, in case of monosyllabic words containing diphthongs the first vowel receive the stress such as, [loe], [ʈui].

However, since the binary distribution of syllables are not sufficient to describe the overall stress pattern of the lyrics, the reanalysis of the feet structures through the parameters of metrical constituents is eventual. Therefore, as the reanalysis of the previous two songs using four parameters the selected lines of the lyrics have been tested. Before showing the table of this test it is important to remind our constructed hypothesis of this study,

a) If L-to-R parameter presents in a word, trochaic stress pattern could be assigned.
b) If R-to-L parameter presents in a word, iambic stress pattern could be assigned.

5.3.4.1.3. Testing the parameters of metrical constituents of the four lines of the Bangla song-3

Words	Feet structure	TROCHAIC	IAMBIC	L-to-R	R-to-L
lóe	Ѻ́		×	×	×
gó.dʰon	(Ѻ́ Ѻ)		×	×	×
go.ʃtʰér	(Ѻ Ѻ́)	×		×	×
ká.non	(Ѻ́ Ѻ)		×	×	×
cɔ́.lo	(Ѻ́ Ѻ)		×	×	×
gó.kul	(Ѻ́ Ѻ)		×	×	×
bi.há.ri	(Ѻ Ѻ́) Ѻ	×			×
go.ʃtʰé	(Ѻ Ѻ́)	×		×	×
cɔ́.lo	(Ѻ́ Ѻ)		×	×	×
hó.ri	(Ѻ́ Ѻ)		×	×	×
mu.rá.ri	(Ѻ Ѻ́) Ѻ	×			×
ʈúi	Ѻ́		×	×	×
á.ma.ɖer	(Ѻ́ Ѻ) Ѻ		×		×
ʃóŋ.ge	(Ѻ́ Ѻ)		×	×	×
ɻá.bi	(Ѻ́ Ѻ)		×	×	×
bɔ.nó.fol	(Ѻ Ѻ́) Ѻ	×			×
ʃɔ́b	Ѻ́		×	×	×
kʰé.ʈe	(Ѻ́ Ѻ)		×	×	×
pá.bi	(Ѻ́ Ѻ)		×	×	×
ám.ra	(Ѻ́ Ѻ)		×	×	×
mór.le	(Ѻ́ Ѻ)		×	×	×
ʈúi	Ѻ́		×	×	×
bá.ca.bi	(Ѻ́ Ѻ) Ѻ		×	×	×
ʈái	Ѻ́		×		×
ʈó.re	(Ѻ́ Ѻ)		×	×	×
ʃáŋ.go	Ѻ́		×	×	×
kó.ri	(Ѻ́ Ѻ)		×	×	×

Table 5. 8: Testing of Parameters of metrical constituents of Bangla song-3

In case of Bangla song-3 The table 5.8 reveal such information which were not comprehensible from the previous table of feet structure. As well as this parameter test show that most of the words follow our constructed hypothesis of parameters, though some words also show some derivation from the norm.

Firstly, it is seen from the table is that most of the words other than 3 words strictly follow our hypotheses. For example, a word which get a TROCHAIC feet structure must receives a L-to-R feature and on the other hand the words which contain IAMBIC features evenrually take an R-to-L feature.

On the contrary, in case of the words [bi.há.ri], [mu.rá.ri], [bɔ.nó.fol] the violation of the hypothesis (b) has been observed. Thus the IAMBIC feature does not take any R-to-L parameter rather, it takes an L-to-R parameter.

Furthermore, the monosyllabic words contain trochaic feet structure since left vowel of the dipthongs are generally stressed. For instance, [lóe] and [túi], in those words major stresses have been assigned on the first vowel of the dipthong. On the other hand regarding monosyllabic word which does not contain any dipthong, only one constraint can be applicable. For example, the monosyllabic [shɔ́b] shows only TROCHAIC feature since 'ɔ́' is the only syllable in this word and the position of this vowel is initial. Therefore rest of the constraints are not relevant for this word.

The next sections will be analyzed Bangla song-3 through the analysing tools of GTTM in order to show the stress transformation from lyric to melody.

5.3.5. Analysing Bangla song-3 by using GTTM tools

5.3.5.1. Strings and grouping structures of Bangla song-3

From the previous analysis of Bnagla song-1 and 2, it is well established that there is a systematic hierarchical relationship between lyrics and melodies. This relationship depicted through assigning well formedness rules and prominence rules of GTTM. Bangla song-3 has been analysed according to our previous analysis in this section. Here we are not going to provide the grouping rules of Lerdhal in order to aviod repetition since in our previous analysis those rules have been mentioned twice (see section 5.1.4.1 and 5.2.4.1). Rather first of all we are going to provide grouping structure of Bangla song-3 and then the structure have been discussed by the rules. In this section the first two lines of Bangla song-3 has been shown since the rest of two lines show similar grouping tendencies. After illustrating the grouping structure of those lines it has been investigated how GWFR1, GWFR3, GWFR4 and GEFR5 function in the structures. The grouping illustration of those lines have been given below,

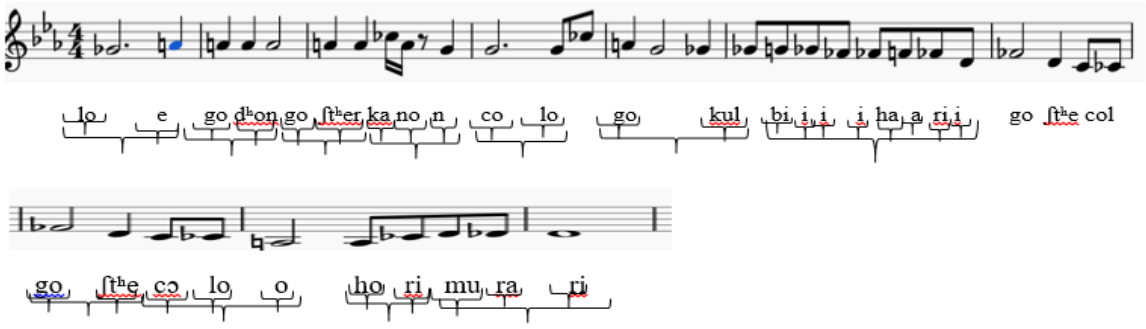


Figure 5. 17: Grouping illlustration of the first two lines of Bangla song-3

This figure depicts the syntagmatic arrengement and contiguous sequences of the melody of Bangla song in particular, this is a particular combination of D# major scale. Here, the notes are: (G♭) (A♮) (A♮) (A) (A) (A♮) (A♭) (C) (A) (G) (G) (C♭) (A♮) (G) (G♭) (G♭) (G) (G♭) (F) (F♮) (F♭) (F) (D) and so forth. Like our previous analysis these groups are also marked as G_1 G_2 G_3 G_4 G_5 G_6 G_7 G_8 G_9 and so on. According to GWFR1 any contiguous sequence of pitch event can constitute a group and only contiguous sequence can constitute group. Since these musical notes are contiguous sequence of D# major scale, they construct group.

It is important to mentioned it here that single syllable may or may not contain a single group. For example, the first word [loe] get one syllable with a dipthong in which each vowel receives a single note like, G♭, A♮. Whereas most of the single syllable contain atleast one note in this melody except '-bi' '–ri', '-no' and '-lo'. However, regarding GWFR2 a group may contains smaller group. According to this rule each group act as an individual group and by merging with each other they construct higher level group such as, in the first phrase of the first line the groups G_1 G_2 G_3 G_4 G_5 G_6 G_7 G_8 G_9 build higher level group like, {(G_1 G_2) (G_3 G_4) (G_5 G_6) (G_7 G_8 G_9)}. The second phrase of the first line can be explained through GWFR4 and 5. For instance the groups G_{10} G_{11} and G_{12} contain syllbales '-co' and '–lo' and it is mentionable that the last two groups share the syllable '–lo'. Basically since G_{12} is a part of G_{11}, this group contains all of the G_{12}. As according to GWFR4 if agroup contains part of another group, it must contains all of the containing group.

In this way the notes of D# major merge and construct melody through forming group.

5.3.5.2. Metrical structure of Bangla song-3

5.3.5.2.1. Metrical structure of lyric

From the previuos analysis of Bangla song-1 and 2 it is observed that the basic components of metrical sytructure are grids and stressed grids are represented by relative syllabic stresses in lyrics (see section 5 and 8). Similar to the previouos analysis the transformation of stress grids from lyric to melody have been focused. Firstly the metrical representation of the first three lines of Bangla song-3 has been given,

Figure 5. 18: Metrical representation of the first three lines of Bangla song-3

This figure is grid graphical representation of the table 5.18 of feet formation. It is observed from the above figure is that the lyric of Bangla song-3 does not follow the MWFR rules solely. According to MWFR3 and 4, at each metrical level strong beats are spaced either two or three beats apart and each metrical level must consist of equally spaced beats respectively. It is clearly seen from the above figure is that strong beats do not space three beats apart rather, they space zero, one and two beat apart. For example, there is not any gap between strong beat ‘loe’ and ‘go’ in the first line. Similar types of spaces have also been found between other strong beats. On the other, hand the distance between the strong beats ‘co’ ,‘go’ and ‘go’, ‘ha’ of the first line are one and two respectively. It is noteworthy that this spacing of strong beat have been changed

completely or partially after inserting melody. Now we are going to provide the acoustic phonetic information of the selected lines to understand the stress transformation.

5.3.5.3. Acoustic phonetic evidence of stress transformation

Using linguistic software praat a list of acoustic features in particular pitches and intensities of the selected lines of Bangla song-3 has been given below,

Syllables	Notes	Time	Pitch	Intensity
loe	G A♮	1.9	157.5	66.66
go	A♮	2.8	183.6	71.37
dʰon	A	3.2	184.2	70.97
go	A	3.75	178.5	70.6
ʃtʰer	A♮	4.34	190	71.4
ka	A	4.6	187.4	71.48
non	C♭ A G	5.2	189.6	71.1
cɔ	G	6.9	165.7	71.36
lo	G C♭	7.5	220.1	71.68
go	A♮	8.11	163.8	71.15
kul	G	8.51	167.2	71.62
bi	G♭ G♮	9.1	168.41	71.22
ha	G♭ F♭	9.5	139.5	68.31
ri	F♭ F♮ F♭ D	10.43	154.4	68.18
go	F♭	11.93	140.8	68.88
ʃtʰé	D	12.8	127.3	68.41
cɔ́	C C♭	13.2	113	66.33
lo	A♮	13.9	93.2	53.8
ho	A	14.9	102.1	60.78
ri	C♭	15.1	108.5	61.93
Mu	D	15.4	131.7	67.08
ra	D♭	15.65	114.8	60.36
ri	D	16.08	128.4	62.52

Table 5. 9: Acoustic phonetic information of Bangla song-3

The table 5.9 shows the pitches and intensities of each notes of the selected lines of the Bangla song-3. This table is quite different from our previous analyzed songs acoustic phonological tables. First of all, it is evident that the repetition of same note is significant in order to make this melody. This is a common tendency of *Baishnav shahajia* tune of Bangla song. For example the notes A, G, D have been used repeatedly.

In addition unlikely Bangla song-1 and 2 the fluctuation rate of pitches of similar notes are high as well as the pitches of the same notes do not stable in a certain number. For example, the song starts with the 5th note of the D# major scale and this note has been found ten times in the first three lines moreover, in the first phrase of the first line it is seen 7 time. It is important to mention that each time it shows different pitch and intensity as well as its rise and fall is significant. Such as, its pitch range from 157Hz to 190Hz in the first line.

However, it is noteworthy that most of the final syllable of each word of the first line receives the higher pitch frequency than the initial one. For example, the initial syllables like, '-go', '-go', '-ka', '-co', '-go' get 183.6 Hz, 178.5Hz, 187.4Hz, 165.7Hz, 163.8Hz pitch frequencies respectively. Whereas, the final syllables of these words get 184.2Hz, 190Hz, 189.6Hz220Hz and 167.2Hz. Therefore, from this data it is clearly evident that prominent stresses have been shifted from initial syllables to final syllables after putting the melody. Even in case of the monosyllabic [loe], second vowel 'e' get the higher pitch.

Furthermore, the syllable '-lo' of the word [colo] of the first line receive the highest frequency of the line as a consequence, it is seemed that '-lo' is the most stressed syllable of the line after adding the tune of this song. We are not going to proceed this discussion any more as the prolongational structure of first line has only been shown in the final section and necessary acoustic information of stress transposition have already been provided in the above description. This transformation has been represented metrically in the next section.

5.3.5.4. Metrical representation of transformed stress grid of lyric of Bangla song-3

Since the melodic insertion function as a precursor of the transformed stress prominence the metrical representation of the lines will also be different from the depiction of figure 10.5. Here the first two lines of Bangla song-3 with musical setting, grouping string and metrical stress grid have been given,

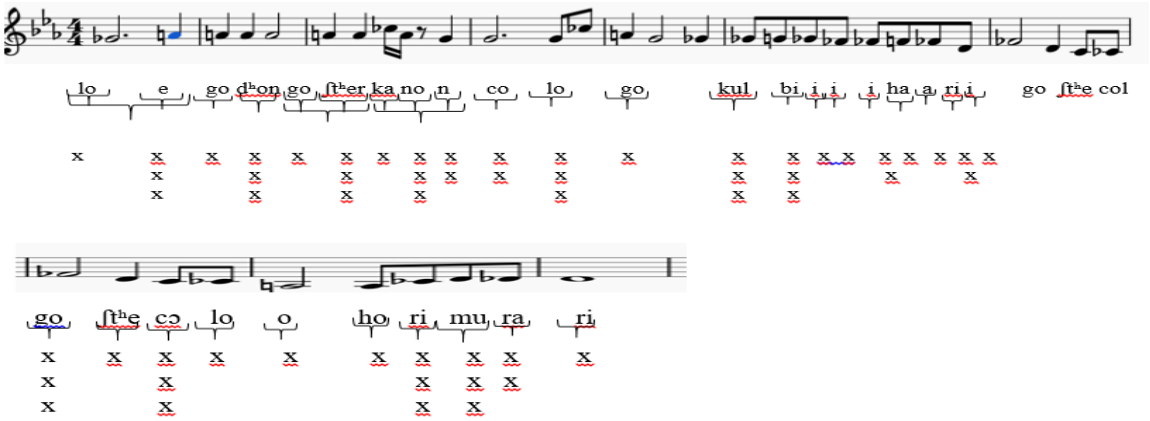


Figure 5. 19: First two lines of the Bangla song-3 with notation, grouping structure and transformed metrical grid

The strong beats distribution of this figure is completely different from the figure 5.18 which illustrates the metrical image of lyric only regarding speech stress. From figure 5.19 the significant transformation of the stress system of the lyric has been patently shown. For example, since each final syllable of the words of the first line contain the primary stress, the strong beats space one beats apart. On the other hand, in second line the prime stress fall on the initial syllable. For example, '-go' get the prime stress of the word [go.ʃtʰé], whereas the primary stress fall on the final syllable in figure 5.19. Here it is noteworthy that after inserting melody the song starts following the MWFR4 thus, each metrical level consist of equally spaced beats. Now this stress transformation has been explored through time-span reduction in the next section.

5.3.5.5. Time span reduction or headed hierarchical explanation of Bangla song-3

5.3.5.5.1. Translation of hierarchical tree diagram

The translated structures of the time span reduction trees of the prosodic form of the words which have been shown in the figure 5.16 have been given below,

a) PrWd-2

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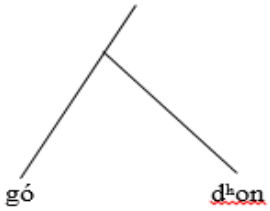
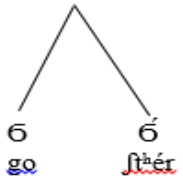
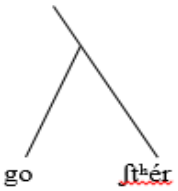


b)

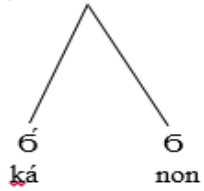
PrWd-3



=



c) PrWd-4



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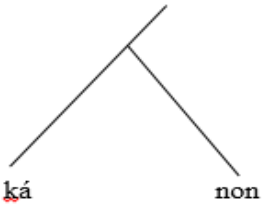
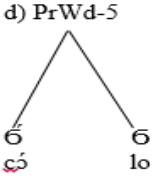


d) PrWd-5



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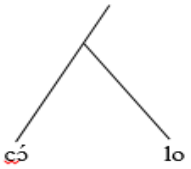


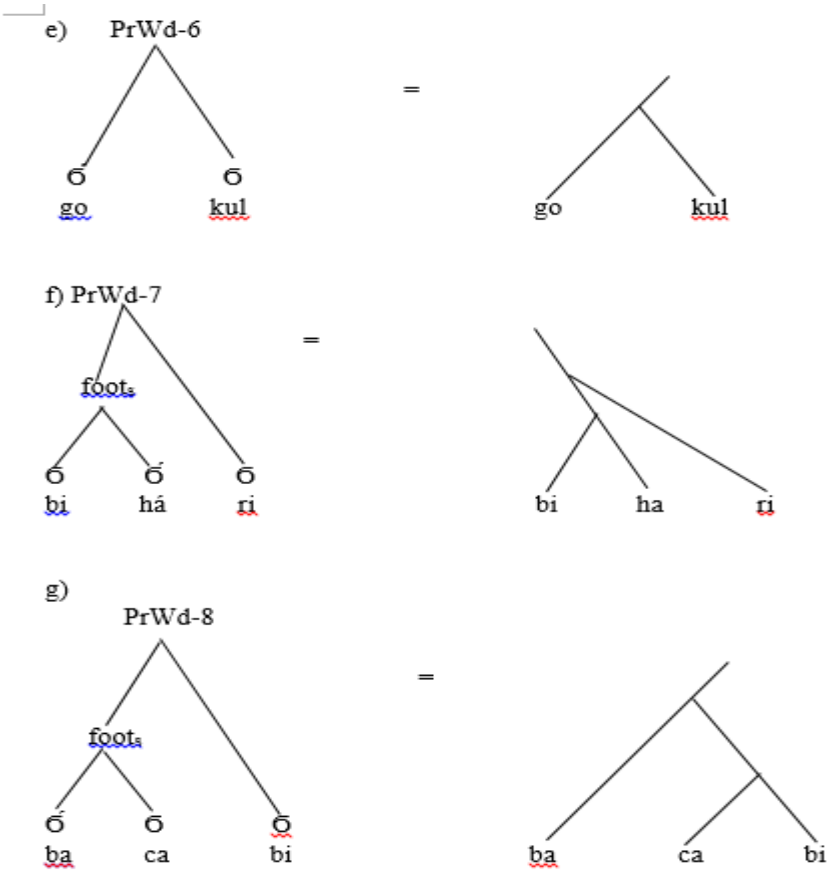


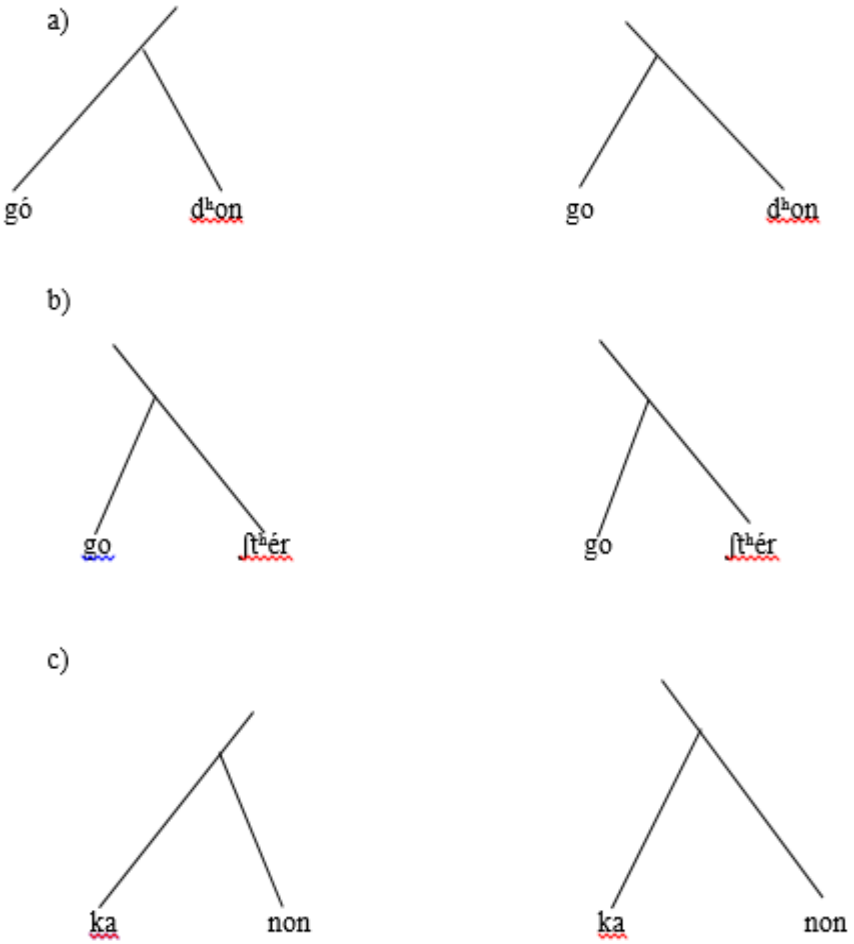
Figure 5. 20: Prolongational tree structural translation of the words of Bangla song-3

In this figure mere lyrical speech stress have only been illustrated since the next section will deal with the transformed structure. From the examples of (a), (c),(d) and (g) the left nodes of the prolongational tree have been elaborated since the initial syllables of these words like, '-go', '-ka','-co' and '-ba' respectively receive the prime stress. On the other hand, in case of example (b) and (f) the right and the medial nodes are elaborated as the stresses fall on the final and penultimate syllables in those words. Now this translated version of trees have been reanalyzed with melody in the next section.

5.3.5.5.2. Prolongational trees with the transformed stress pattern of the first line of Bangla song-3

In this section the transformed tree structures of the words of Bangla song-3 have been illustrated on the basis of acoustic phonetic information and transformed

metrical stress grids (see section 5.3.5.3 and 5.3.5.4). Here firstly the translated version of the tree structures of the previous section have been redrawn regarding the significant transformation of stress and after that the complete prolongational tree diagram of the first line have been drawn. The prolongational tree diagram with transformed stress pattern of each words of the figure 5.18 have been given below,



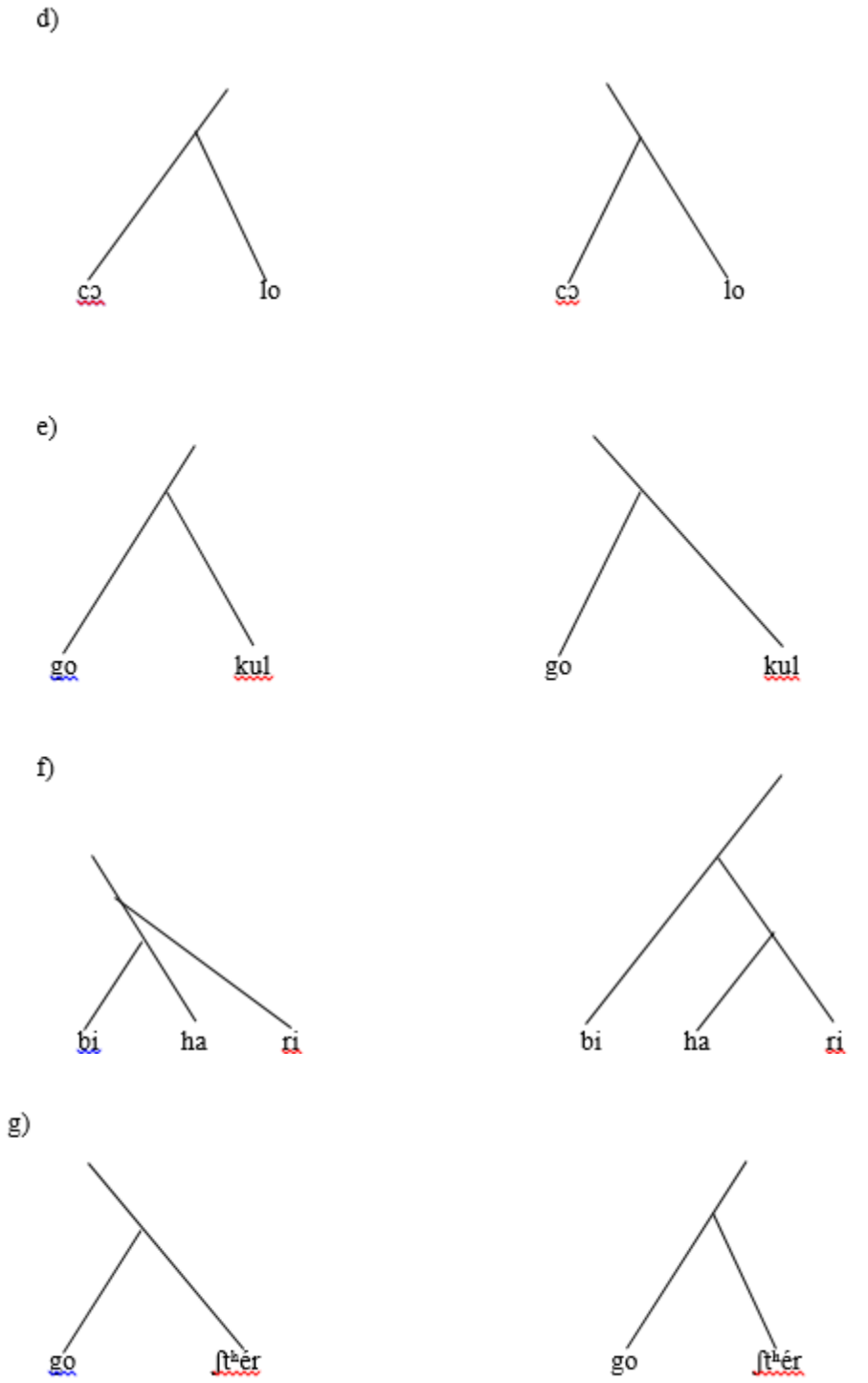


Figure 5. 21: Prolongational tree diagram of the words with transformed stress pattern

From this figure it is clearly evident that stress transformation process occur in almost all the words except example (b). For example stress have been transposed from '–go' to '-dʰon', '-ka' to '–non', '-co' to '-lo' and '-go' to '-kul' in case of the words [godʰon], [kanon], [colo] and [gokul] respectively. Therefore each of their right nodes have been

prolonged since the stress transformed from initial syllable to final syllable. On the other hand, in case of example (f) surprisingly primal stress shift from penultimate to initial syllable such as, syllable '-ha' to '-bi'. However, from the above figure no stress transformation is observed in case of only example (b).

Here, a complete prolongational tree diagram of the first line of Bangla song-3 has been given below,

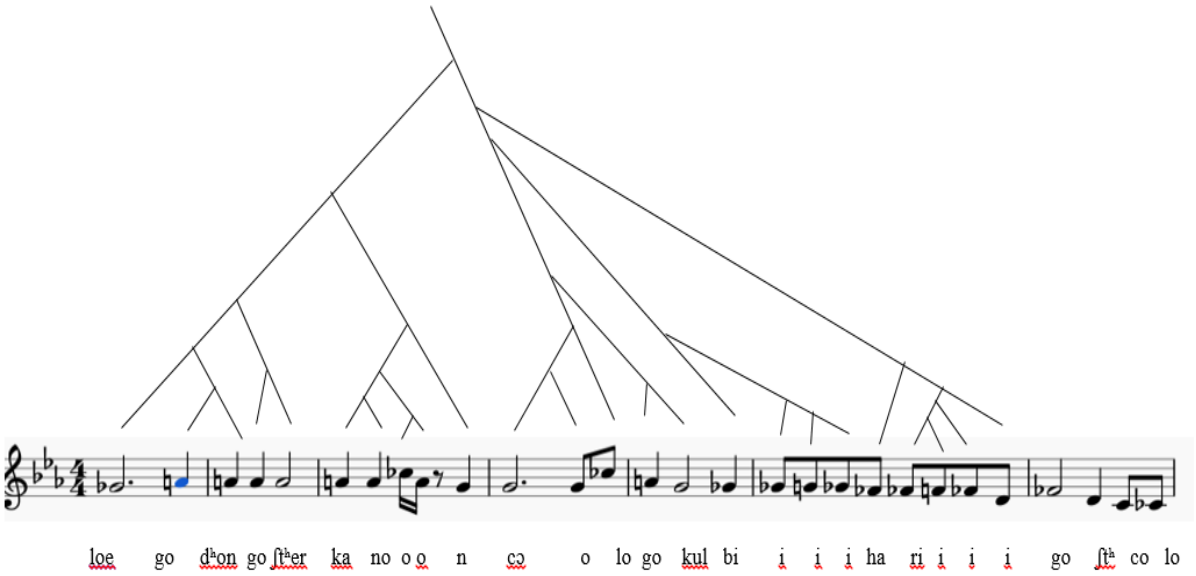


Figure 5. 22: Complete prolongational tree diagram of the first phrase of first line of Bangla song-3

The above figure is a depiction of the tree diagrams of figure 5.19 which have been assembled in a single structure. It is observed from the figure 5.22 is that the right node of the tree is the utmost elaborated node thus, it is beyond any confusion is that the syllable '–lo' of the word [colo] becomes the strongest syllable of the phrase after adding melody. In the same way the node of the syllable also become the most prolonged node. The prolongational diagram of figure 5.22 can be divided into two branches, left and right. Such as, the left branch consist of the syllables like, '-loe', '-go', '-dʰon', '-ʃtʰer', '-ka', '-non' as well as G A♮ A A A♮ A C G notes whereas, the right branch contains '-cɔ', '-lo', '-go', '-kul', '-bi', '-ha', '-ri' and G C♭ A G G G♭ F♭. However, each syllable merge with another syllable regarding a hierarchical

relationship and the syllable which receives the stronger stress get elaborated. For example, the node of [loe] and G♭ is the most prolonged node of the left branch it contains the most stress syllable or melody of the branch and rest of the notes or syllables merge to this node subordinately. On the other hand, the syllables of the right branch act as sub branches under the syllable '–lo' as well as note C♭ as the most beat fall on this syllable and note. However those are the strongest syllable and note of the entire phrase.

Finally at the end of our analysis of Bangla song-3 it can be utterly said that this *gostho* song of lalon shai contains such structural pattern which have not seen in our previous analyzed song. In fact this pattern and stress transformation process make it an autonomous genre in Bangla song.

Chapter 6

Comparative discussion

This chapter provides a brief but comprehensive summary of the most prominent similar as well as contrastive tendencies regarding stress assignment and transformation of the analyzed songs. We observe from the analysis chapter (chapter 5) that these three songs do not only follow the metrical phonological rules of Bangla strictly but the parameters of GTTM are not also implemented typically in some cases. In spite of having some exceptions, these selected songs have been analyzed through our sorted parameters. We are going to summarize the research findings by providing a comparative discussion among these three analyzed songs.

6.1. Summary of the findings

1. Analyzing the prosodic hierarchical structures of the songs it has been seen that most of the words of the lyrics without tunes follow the basic norm of Bangla stress system, though significant exceptions have also been noted. For example, in case of Bangla song-1 some words contain stress assignment different from the standard rules like, primal stresses are not felt on the initial syllables. Such as, the words [ʃo.ttó], [ud. bʰá.ʃi.t̪o],[gro.hó],[t̪a.ró.ko],[con.dró], [t̪o.pó.no], [dru.t̪ó], [ok.kʰó.yo] in Bangla song-1. Thus, a notable number of iambic foot structure have been seen in this song. Moreover, a combination of iambic and trochaic feet structures have been observed in this song like, [á.non. d̪o.ló.ke], and [móŋ.go.la.ló.ke]. As well as Bangla song-1 does not follow the hypotheses strictly which have been constructed concerning the parameters of metrical constituents. As a result L-to-R and R-to-L features do not take TROCHAIC and IAMBIC features respectively in all the cases.

   Whereas in case of Bangla songs 2 a single violation of hypothesis (a) has not been found. Thus, it is surprisingly observed that Bangla song-2 does not contain any single

IAMBIC foot structure consequently, the hypothesis (b) is not applicable at all in case of this song. On the other hand, for Bangla song-3 similar violation of parameters like Bangla song-1 have been seen such as, [bi.há.ri], [mu.rá.ri] and [bɔ.nó.fol]. Therefore, the testing parameters of metrical constituents tables of these three songs show that Bangla song-1 and 3 contain a variety of feet structures on the contrary, Bangla song-2 do not get any other stress assignment other than TROCHAIC parameter (see pages 96, 121 and 146).

However, it is also noteworthy that any mixed feet structures do not prevail in Bangla song-2 and 3. This type of structure only presents in Bangla song-1. For example, [á.non.d̪o.ló.ke], [móŋ.go.la.ló.ke] and [mó.ni.bʰú.ʃo.no]. In case of these three words any violation of the parameters of metrical constituents is not observed (see page 96).

Whereas, Bangla song-3 shows some monosyllabic foot structure which are not present in the rest of the songs. Such as, [lóe], [t̪úi], and [t̪ái]. Indicating the actual parameter(s) is difficult in case of these words. Since the stresses are fell on the first vowel of the diphthongs, the feet structures have been considered as TROCHAIC. In fact, monosyllabic and disyllabic feet structures show identical violation of parameters. In this study it is observed that if a word contain mono or disyllabic structure, then only one parameter can be prevailed as well as rest of the three parameters cannot be accepted. For instance, if the stress fall on the left most syllable in a word, the word must contain trochaic foot and the rest of the three parameters must be excluded. Similarly if the stress fall on the right most syllable in a word, the word must get the iambic foot as well as the rest of the parameters must be denied.

2. From the above discussion of the feet structure and the parameters of metrical constituents it is evident that our constructed hypothesis (b) (see page 96) is not acceptable at all. This hypothesis cannot be implemented among the words structures and stress assignment process of our selected songs. As a consequence all the iambic words necessarily take the L-to-R parameter on the contrary, any single iambic structure does not receive the R-to-L parameter. For example, [ʃun.d̪ó.ro], [jɔ.gó. t̪o] [bi.há.ri], [mu.rá.ri]. These types of structures do not accept R-to-L parameter.

3. Although the grouping rules: GWFR 1, 3, 4 and 5 have been followed by our selected songs, the grouping structures vary based on the feet structures as well as notational distribution. Therefore, some groups contain several linguistic and musical elements such as syllable and note respectively. In addition, some groups contain one or two element(s). For this reason, the 1st, 2nd or further higher level grouping projections are different among these songs (see page 98-99, 123-125 and 146-147).

4. The violation of Metrical Well Formedness Rules (MWFR) 3 and 4 have been observed significantly in case of all the selected songs of this research. For instance, strong beats are not spaced either two or three beats apart in all the cases. Basically this alternation happens due to melodic insertion. For Bangla song-1 strong beats have been distributed 3 or 4 beats apart (see page 100-101). For Bangla song-2 strong beats are distributed 1 and 2 beats apart (see page 126). In case Bangla song-3 strong beats are distributed 0, 2 and 3 beats apart. This violation is acceptable for this study as it is revealed from the previous studies that musical beat distribution might be influenced by speech stress

5. After inserting melody the stress pattern of the lyrics of the selected songs have been changed dramatically. Basically sketching out this transformation is the prime concern of this research. Among the analyzed songs the Bangla song-1 shows less transformation compare to the other songs. For example, in case of Bangla song-1 the major strong beats have been fallen on the iambic feet of the second word of the first line whereas, rest of the words of the first line do not show any significant transformation. Notable changes have been observed in case of Bangla song 2 and 3 like, the strong beats shift from trochaic to iambic feet very frequently, as a consequence the stress patterns of the lyrics of those songs are transformed tremendously.

6. In case of prolongational tree structure the left nodes of the Bangla song 1 and 2 are the highest elaborated notes of the trees (see pages 111 and 135) whereas for Bangla song-3 the right node is the most prolonged node (see page 156). From this structures it is assumed that the prime stress is assigned on the very beginning of the phrase

regarding the first two songs. Whereas in case of Bangla song-3 the major stress fall on the second phrase of the line. It is also evident from these GTTM's structure of Bangla song 1 and 2 that the assignment of prime stress do not violate the standard rule of Bangla Such as, in this case trochaic feet contains the prime stress. On the contrary, the prime stress falls on the iambic foot in case of Bangla song-3.

Chapter 7

7.1. Discussion and conclusion

At the end of this study it is strongly stated that the term musical linguistics do not infer the direct relationship between language and music. The viability of the analogical interface of those two mediums has been questioned critically while building the theoretical foundation of this study in chapter-2. By going through the similarities and dissimilarities of language and music, it is evident that the non-parallel features are prominent overtly. As well as it is also proposed that their relationship supposed to be investigated from the point of separation. Thus from this study it is stated that musical linguistics is a study of comparing the structural phenomenon of music and language and it explores how each structural element interacts with the other.

7.2. Recommendation and conclusion

Some particular problems have not only been dealt in this study, but some issues or questions have also been raised during establishing the theoretical framework as well as analyzing the songs.

By conducting further research those problems can be solved. The scope of further studies have been figured out,

1. In case of monosyllabic words the stress assignment has been considered as trochaic in this study since almost all the previous studies show that Bangla is not only a quantity-sensitive language but also the prime stress always falls on initial syllable. Further study might be proceeded to explore how the weight of syllables is defined in Bangla which is a precursor of syllabic sensitivity.

2. It is evidently seen in the chapter 5 is that none of the selected song follows our hypothesis (b) which is constructed from the parameters of the metrical constituents. Bangla songs might be investigated by taking more metrical constituents. In addition,

using the metrical constraints of Optimality Theory (OT) Bangla songs can be examined.

3. From generative point of view linguistic and musical transformation are quite different from one another. After reaching surface structure or prose level language has to pass through only one step to get to the super surface structure. On the contrary, music does not have any prose level representation rather it reaches to the super surface structure directly. This notion can be examined cross culturally.

4. In this research the analyzing framework has been formed by borrowing theories from linguistics like GTTM has been constructed following metrical phonology and generative linguistics. In the same way musical theories can also be taken in order to analyze combination of language and music. Thus, in further studies equal participation of both systems are supposed to be concerned regarding building the theoretical framework of musical linguistics. For example, musical theories like interval, consonance and dissonance can be implemented in language such as it may be tested cross linguistically whether there is any mathematical measurement in order to arrange the phonemes in language. Furthermore, it may also be examined whether phonemes or sounds of language correspond to consonance and dissonance psychologically.

   Since this study is an inception of musical linguistic analysis of Bangla song, all the problems could not be dealt. Nevertheless, the stress transformation is evident through our analyzing tools and parameters.

Appendix

1. List of musical symbols

1.1. Clef

A clef is a musical symbol used to indicate the pitch of written notes. Basically there are three types of musical clefs: G, F and C clef. In this study G and F clef have been used. Here those two clefs have been given,

G clef

G clef is also referred to as the treble clef. This clef indicates the higher notes of melody. The center of the spiral defines the line on which it rests as the pitch G above middle C.

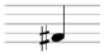
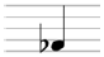
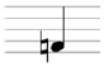
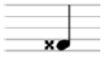
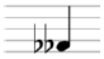
F clef

F clef is referred as to the base clef and this clef indicates the lower notes of melody. The line between the dots in this clef denotes F below middle C.

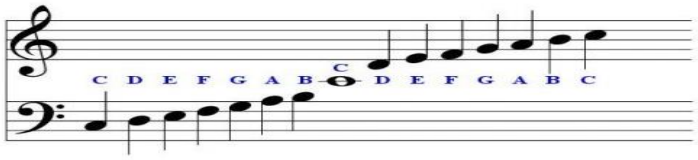
1.2. Different beats

Name	Note	Rest	Beats	1 4/4 measure
Whole	𝅝	𝄻	4	𝅝
Half	𝅗𝅥	𝄼	2	𝅗𝅥 𝅗𝅥
Quarter	♩	𝄽	1	♩ ♩ ♩ ♩
Eighth	♪	𝄾	½	♫ ♫ ♫ ♫
Sixteenth	𝅘𝅥𝅯	𝄿	¼	𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯

1.3. Accidentals

1.  **SHARP**: Raises the pitch of a note by one half step.
2.  **FLAT**: Lowers the pitch of a note by half step.
3.  **NATURAL**: Cancels a previous accidental, or modifies the pitch of a sharp or flat as defined by the prevailing key signature (such as F-sharp in the key of G major, for example).
4.  **DOUBLE SHARP**: Raises the pitch of a note by two chromatic semitones or whole step. Usually used when the note to be modified is already sharped by the key signature
5.  **DOUBLE FLAT**: Lowers the pitch of a note by two chromatic semitones or whole step. Usually used when the note to be modified is already flatted by the key signature.

1.4. Grand staff

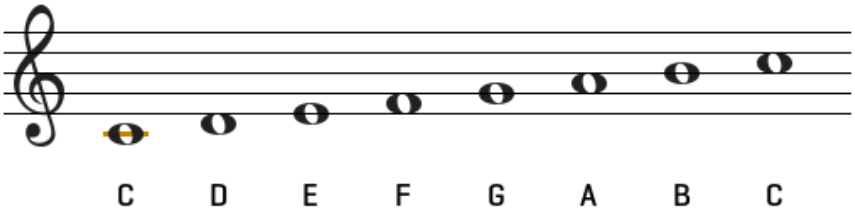


1.5. Articulations

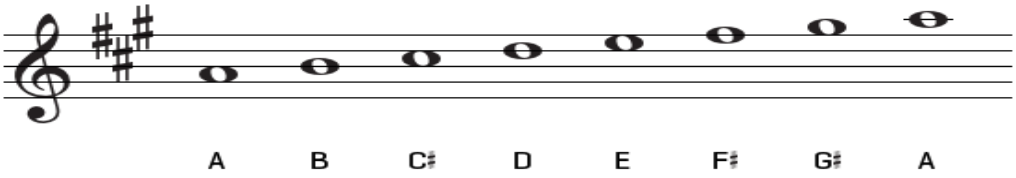
Symbol	*Name*	*How to Play the Note*
•	Staccato	Short
–	Tenuto	Long
>	Accent	Hard
Λ	Accent (Housetop)	Harder
>•	Accent with staccato	Hard and short
>–	Accent with tenuto	Hard and long

2. Musical scale

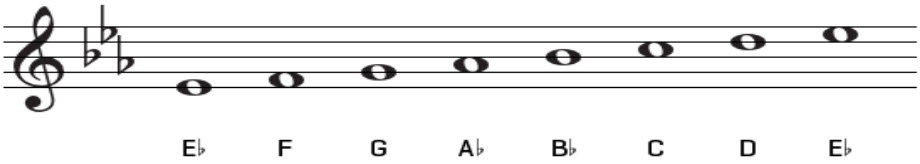
2.1. Scale of Bangla song-1: C major scale



2.2. Scale of Bangla song-2: A major scale

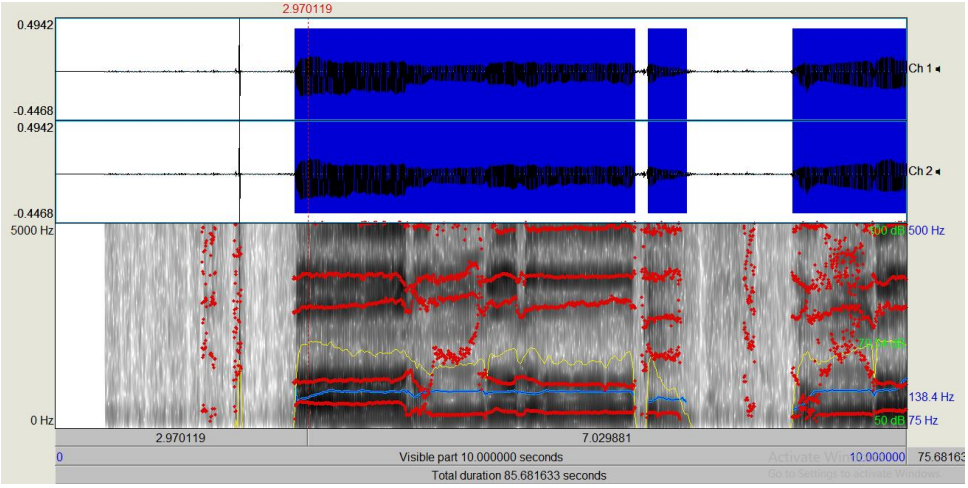


2.3. Scale of Bangla song-3: D# major/ E flat major scale

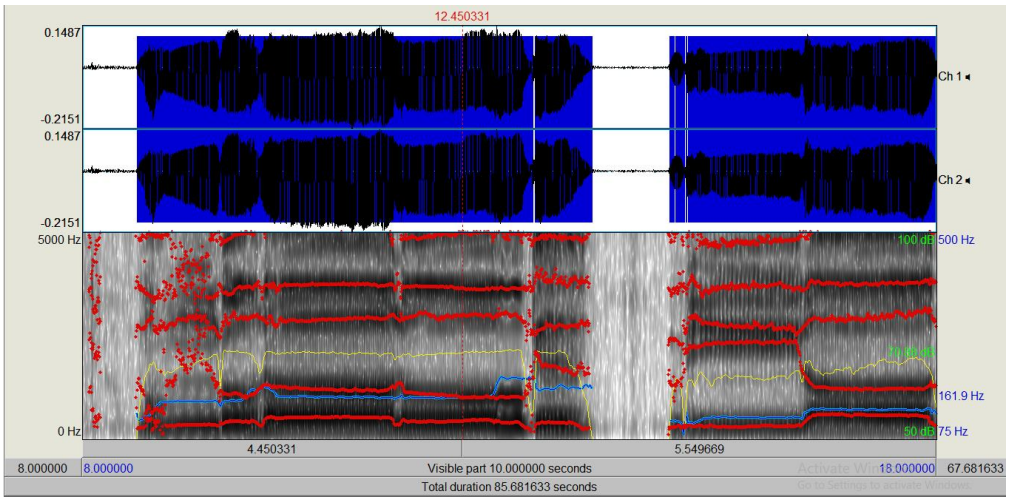


3. Graphical representation or spectrogram of the analyzed lines/phrase of the selected songs

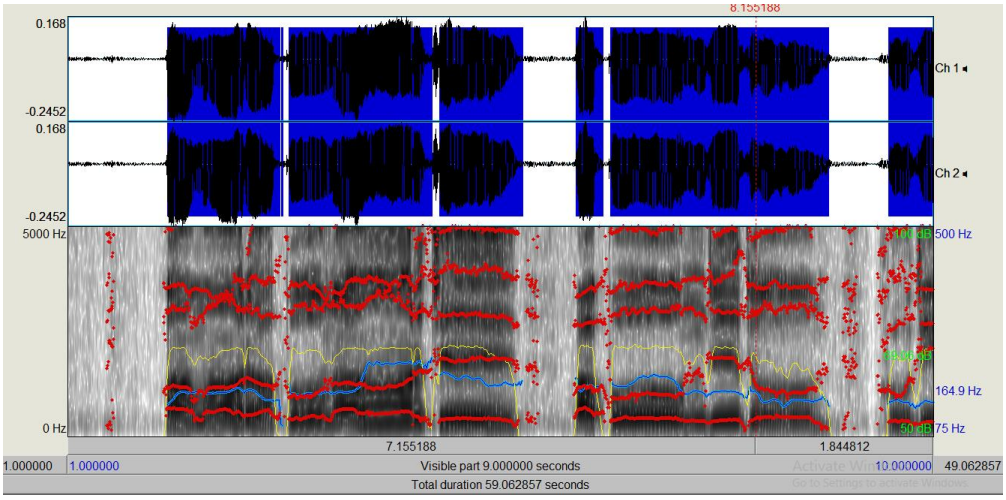
3.1. Spectrogram of anandoloke of Bangla song-1



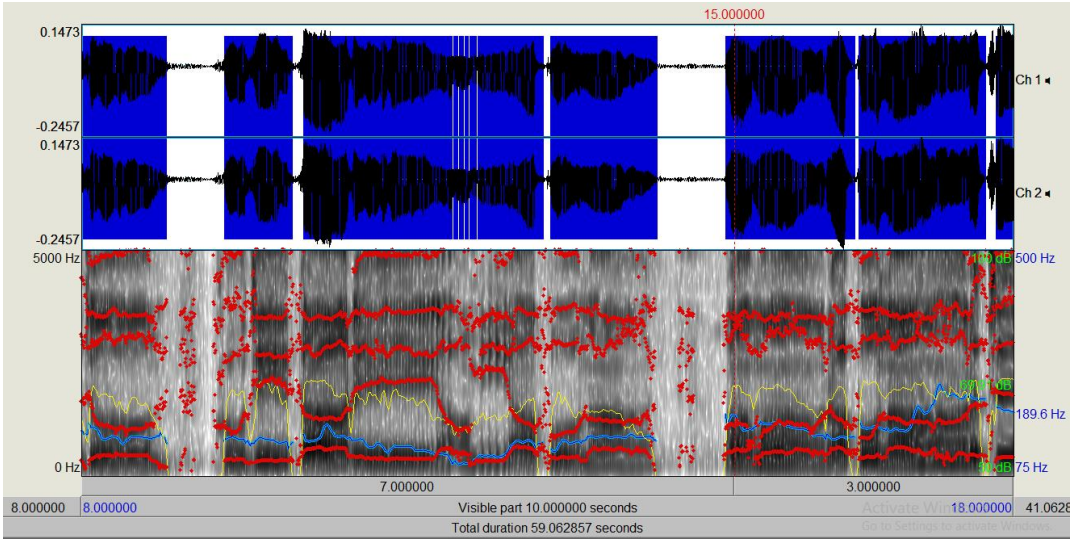
3.2. Spectrogram of mongololoke of Bangla song-1



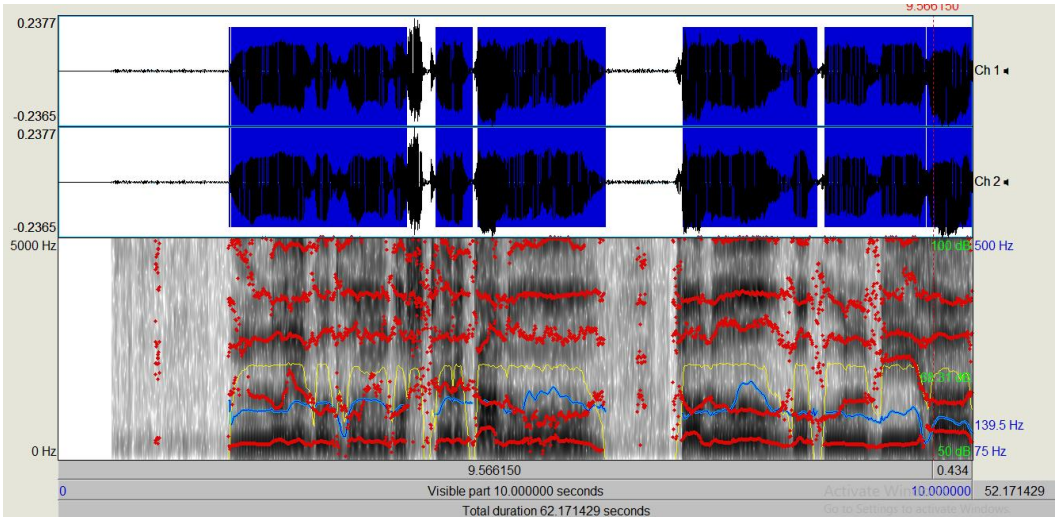
3.3. Spectrogram of *amar aponar ceye* of Bangla song-2



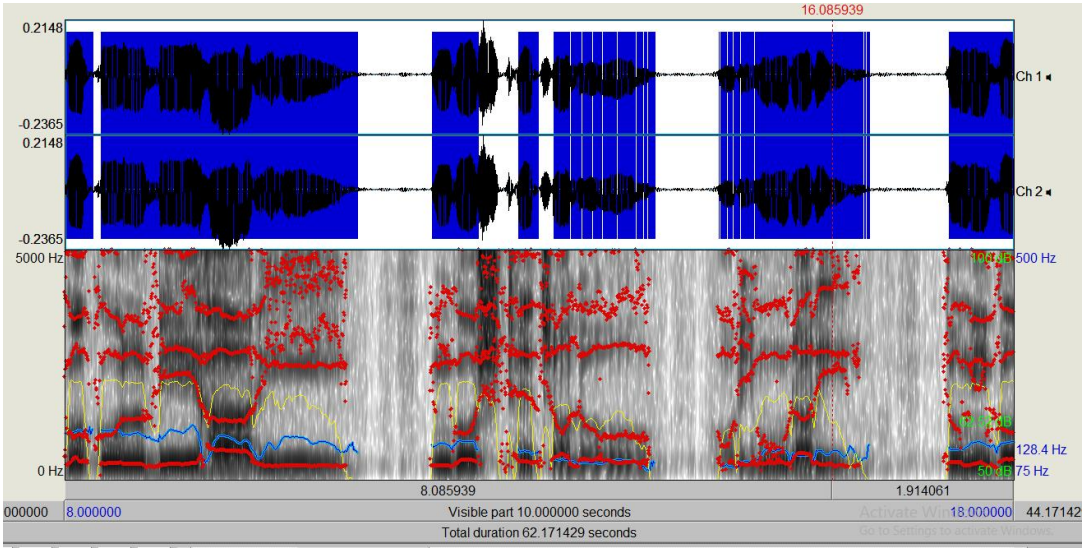
3.4. Spectrogram of *khuji tare ami aponay* of Bangla song-2



3.5. Spectrogram of *loe godhon gosther kanon* of Bangla song-3



3.6. Spectrogram of *gosthe colo hori murari* of Bangla song-3



4. International Phonetic Alphabet (IPA) chart of Bangla

	Bilabial	Labio-dental	Dental	Alveolar	Post-alveolar	Retro flex	Palatal-alveolar	Velar	Uvular	Pharyngeal	glottal
Plosive	p pʰ b bʰ		t̪ t̪ʰ d̪ d̪ʰ	t tʰ d dʰ			c cʰ ɟ ɟʰ	k kʰ g gʰ			
Nasal	m			n				ŋ			
Trill				r s							
Tap						ɽ ɽʰ					
Fricative							ʃ				h
Affricate											
Lateral fricative											
Approximant											
Lateral approximant				l							

IPA symbol for Bangla consonants

ক /k/	চ /c/	ঠ /ʈʰ/	থ /t̪ʰ/	ব /b/	ঢ় /ɽʰ/
খ / kʰ/	ছ /cʰ/	ড /ɖ/	দ /d̪/	ভ /bʰ/	ল /l/
গ /g/	জ /ɟ/	ঢ / ɖʰ/	ধ /d̪ʰ/	ম /m/	স /s/
ঘ / gʰ/	ঝ /ɟʰ/	ন /n/	প /p/	র /r/	শ /ʃ/
ঙ / ŋ/	ট /ʈ/	ত /t̪/	ফ / pʰ/	ড় / ɽ/	হ /h/

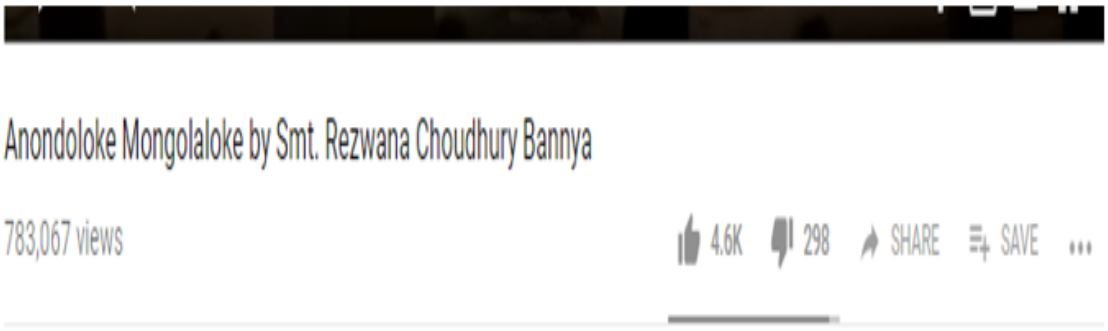
IPA symbol for Bangla cardinal vowel

ই /i/		উ /u/	
এ /e/		ও /o/	
এ্যা /æ/		অ / ɔ	
	আ /a/		

(Ali, 2006, p 49; Haque, 2011, p 179)

5. You tube views of the selected songs

You tube views of Bangla song-1



https://www.youtube.com/watch?v=i97xZxooTFc.27.10.2018

You tube views of Bangla song-2

https://www.youtube.com/watch?v=KUZn-WAw0Eo.27.10.2018

You tube views of Bangla song-3

https://www.youtube.com/watch?v=urlzd0NsBBI.2710.2018

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