A Linguistic Approach to Music

The Interpretation of Songs´ Transcriptions on the Saxophone

Tine Trijntje van den Geest

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Advisors: Doctor Daniela Coimbra & Professor Gilberto Bernardes

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Doctor Daniela Coimbra, advisor

Professor Gilberto Bernardes, co-advisor

Abstract

It is a common practice among saxophonists to transcribe songs. The lyrics, an essential element of a song, are not included in songs transcriptions for saxophone and consequently a substantial layer of the composition is lost.

This dissertation addresses the problem of song transcriptions by saxophonists and provides strategies for improving music performance through linguistics. In detail, the aim of this research is to study the three following topics: (i) the influence of vowels in shaping the saxophone timbre, (ii) the influence of consonants on the articulation and (iii) the impact of linguistic stress to agogic and musical phrasing.

I have developed an experiment, applying a convenience sample procedure to measure the relation and influence of linguistic to musical features. A group of highly trained saxophonists participated in the research experiment to evaluate how linguistics improves musical performance.

The results of the experiment demonstrate that vowels and consonants provide a deeper conscience and ability to apply a larger variety of timbre and articulation, in particular in the context of song transcriptions. Furthermore, the results show that the analysis of linguistic stress improves the quality of the musical phrasing of songs' transcriptions.

Keywords:

Saxophone, Song, Transcription, Musical Interpretation, Linguistics

Resumo

Saxofonistas habitualmente transcrevem repertório para voz. As letras, um elemento essencial de uma canção, não são incluído nas transcrições para saxofone e consequentemente uma parte substancial da composição perde-se.

Esta dissertação debruça-se sobre o problema da transcrição de canções por saxofonistas e providencia estratégias para aperfeiçoar a interpretação musical através da linguística. Em detalhe, o objectivo desta investigação é estudar os seguintes três tópicos: (i) a influência das vogais no timbre do saxofone, (ii) a influência das consoantes na articulação e (iii) o impacto dos acentos linguísticos na agógica e no fraseado musical.

Foi desenvolvida uma experiência, que aplica um estudo por amostragem para medir a relação e influência de elementos linguísticos em elementos musicais. Um grupo de saxofonistas profissionais avaliaram as implicações da aplicação dos elementos linguísticos na performance musical.

Os resultados da experiência demonstram que as vogais e consonantes oferecem uma maior consciência e palete de timbres e articulações, em particular na interpretação de transcrições de canções. Os resultados também revelam que a análise dos acentos linguísticos melhoram a qualidade do fraseado musical de transcrições de canções.

Palavras-chave:

Saxofone, Canção, Transcrição, Interpretação Musical, Linguística

I dedicate this work to my parents.

Thank you for your endless love and support, and for showing me God´s grace.

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Finally, words seem insufficient to express my gratitude to my wonderful parents Douwe & Weidy, and to my fiancé, Luís, for endless love and support.

Contudo, fazer a comparação destes dois sistemas, o falado e o musical, e as suas especificidades, é abrir novos caminhos e formular novas questões.

~

André Boucourechliev, ´A Linguagem Musical´, 1993

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Chapter 1 - Introduction

Chapter 1 presents the motivation behind this work, the hypothesis detailed in the middle section and the structure of the thesis.

1.1 Motivation

It is a common practice amongst saxophonists to play and transcribe repertoire for voice (Delangle, 1996; Marzi, 2010) and to play original chamber music together with singers (Delangle, 1996; Van Twillert, 2006). A saxophone transcription of a song excludes the lyrics and thus a substantial layer of the composition is lost, since the lyrics are an essential element of any song.

Lyrics and music melt together in a song. The order in the composition process is important: did the composition result from the poem or did the lyrics result from the music? Any musician who transcribes or plays transcribed songs should be fully aware of the importance of this melting process and include the lyrics in the interpretation and performance of a song.

While preparing my saxophone bachelor exam during the spring of 2010, I started rethinking the place of the transcription of songs in the saxophone repertoire, because part of the program featured Rachmaninoff's songs. My first concern focused on the song's lyrics. Even though the Rachmaninoff's melodies can stand by themselves as individual pieces, because of its musical value, I strongly felt the need to share the lyrics with the public on that particular performance. The main reason was the inspiration provided by the poems. My initial solution was to project the lyrics on a big screen, but even after my bachelor recital, I kept on thinking of how to include the lyrics directly in my saxophone interpretation.

Another major motivation behind the choice of this topic was a personal search for multiple "sounds" while playing (timbre), which was pointed by the jury of that same bachelor exam. After enrolling in a master program, one of the goals I set for myself was to develop a deeper flexibility in the sound quality (timbre). During the first year of my master program, I started to experiment with different tongue positions to improve the airflow, and develop a richer and more varied timbre on the saxophone **(**Liebman, 1994; Rascher, 1994**)**.

In parallel with the experiments I was pursuing in my saxophone studies, I also started researching about the relationship between language and music from diverse viewpoints. I figured out that through language I could explore music from a complete different perspective.

I imagined I could try to analyze the sounds of the words and the flow of the phrases of the songs of Rachmaninoff and use that in my interpretation of a song with my saxophone. This became the subject of my master thesis.

1.2 Approach

In this thesis, I claim the following hypothesis:

> *Linguistic analysis improves the development of musical interpretation and performance because it allows the development of a richer tone, greater variety of articulation and musical phrasing.*

Initially, it will be detailed and studied the influence of the following two primary linguistic features on the following musical elements:

1. The influence of phonetics on shaping timbre and articulation.
2. The impact of linguistic stress in musical phrasing.

The first point discusses the influence of phonetics in shaping timbre and articulation. The goal is to achieve a richer tone quality and a greater variety of articulation on the saxophone. Many classical saxophonist focus on a ‘perfect’ (French) embouchure and a clean sound but forget too look further and discover the rich amount of timbres and articulations that are available. We will investigate the existing models in and outside the saxophone literature that focus on the development of timbre and articulation. Afterwards we will present a series of exercises that we developed to improve the saxophone timbre and articulation to a group of saxophone students (graduate and post-graduate level).

The second point discusses the link between linguistic stress and musical phrasing. Phrasing is important for the musical interpretation and performance of any musical composition. The aim is to get a better understanding of musical phrasing by observing the linguistic stress of the song lyrics of Rachmaninoff’s songs. I expect that music students will get a better understanding of musical phrasing and be able to apply the new experiences with musical phrasing also in music without song lyrics. I will present a series of exercises to a group of saxophone students (graduate and post-graduate level) and ask them to connect the notes of the melody to the stressed syllables of the song lyrics and play these notes with more emphasis.

Finally, I will investigate if the exercises and new found information will help in the preparation of a saxophone recital. I expect the results to show an interesting correlation between the linguistic and musical aspects on corpus of Rachmaninoff songs revealing new insights for music analysis and performance.

In sum, the objective of this thesis is to explore the possible impact of the use of phonetics and stress, on the timbre, phrasing and articulation. I will annotate the phonetics (or 'speech sounds' divided in two major segments: consonants and vowels) and stress (a supra-segmental aspect of speech, see Figure 7) according to the *International Phonetics Alphabet* (The International Phonetic Association [IPA] 1999). Consequently, I will investigate (i) the influence of phonetics in shaping timbre and articulation and (ii) the impact of stress on musical phrasing. I will develop an experiment with exercises for saxophone students (graduate and post-graduate level) to develop and measure the influence of linguistic to musical features. Ultimately, I will try to apply the new techniques in a saxophone recital program.

1.3 Structure of the Thesis

Chapter 1 introduces the motivation behind this work that leads to a deeper study on the impact of phonetics in shaping timbre and articulation and the impact of linguistic stress in musical phrasing (§ 1.1). The study is approached as an experimental research with a hypothesis largely detailed in the in the middle section (§ 1.2), and finally the structure of the document is presented (§ 1.3).

Chapter 2 details theoretical background regarding the correlation between language and music which has the following two-fold organization: (§ 2.1) Approaches in Research relating Language and Music, and (§ 2.2) Shaping Timbre, Articulation and Musical Phrasing in Woodwind Instruments. Section 2.2 contains a division of four subsections: (§ 2.2.1) Singing as an Inspiration for Woodwind Players, (§ 2.2.2) The Impact of Vowels in Shaping Timbre, (§ 2.2.3) The Impact of Consonants in Shaping Articulation, and (§ 2.2.4) The Function of Tree Structures in the Analysis of Linguistic Stress and Musical Phrasing.

Chapter 3 points out the relation between linguistic and musical features in the study and interpretation of transcriptions of songs by saxophonists. Initially I will explain the meaning of the basic linguistic features (§ 3.1) and demonstrate the parallel with musical features (§ 3.2). The following sections, § 3.3, § 3.4 and § 3.5, focus on the strategy of using vowels, consonants and linguistic stress as a strategy to improve respectively the saxophone timbre, articulation and musical phrasing. Section 3.4 is divided in two subsections wherein the relationship between consonants and the possible results in the saxophone articulation (§ 3.4.1) and extended saxophone techniques (§ 3.4.2) will be exposed. Section 3.5 is divided in a fourfold organization in which I will establish the function of stress in language (§ 3.5.1), the function of agogic in music (§ 3.5.2), the differences and similarities of communication in music and language (§ 3.5.3), and the comparison of agogic with stress (§ 3.5.4).

In chapter 4 the empirical work will be presented (§ 4.1), the exercises (§ 4.2), the participants (§ 4.3), the recording material (§ 4.4), the experts (§ 4.5), the questionnaires (§ 4.6), the procedures (§ 4.7) and finally the results and discussion of the experiment (§ 4.8).

The conclusion presents the original contribution of this research along with its limitations and suggestions for future research.

Chapter 2 - Background

Chapter 2 presents research that relates language and music performance. Initially I address some general comments on both fields. Later, the influence of language in music interpretation and performance will be examined according to three different topics: (i) the impact of vowels on shaping timbre, (ii) the impact of consonants on articulation and (iii) the implication of linguistic stress to musical phrasing.

2.1 Approaches in Research relating Language and Music

Since the beginning of the 20th century, a large corpus of research has focused on the comparison between language and music (Boucourechliev, 1993). Different fields approach the comparison between language and music, such as musicology, ethnomusicology, music theory, linguistics, cognitive science, neuroscience, and evolutionary biology. There are two general methodological approaches in research, which relate music and language (Zhang 2010).

The first group of researchers studies the relationship between music and language with a unified method. In other words, they try to find a direct parallelism between linguistic and musical aspects (Bernstein, 1976) by applying the same analytical methods. The second group of researchers is considerably larger and states that music and linguistic theory are not similar, yet new insights may be revealed by comparing both fields (Lerdahl and Jackendoff, 1983; Boucourechliev, 1993). For instance, if we attempt to relate both fields according to the meaning that is produced, this group of researches argues that we cannot compare them with each other. As Bright states, "a musical performance does not necessarily have any reference to specific non-musical phenomena" (Bright, 1963). However, the meaning of the lyrics of a song is one of the most expressive elements to produce meaning or emotions.

On what concerns our topic of interest, the implication of language in an instrumental performance, very little research has been produced. However, song's transcriptions are a common practice among saxophonists (Delangle, 1996; Marzi, 2010). Research on the implications of language in music may improve performance.

A large body of research has been written about the importance of singing in the musical development of non-singer musicians. Singing is good for the development of the inner ear, tone quality, intonation, body position, air flow, and so on (Edlund, 1963; Liebman, 1994; Rascher, 1994; Ioan, 2007). Singing combines both language and music in a song, and that is exactly where this research starts. One can state that (non-singer) musicians should train their singing, to develop their musical abilities.

2.2 Shaping Timbre, Articulation and Musical Phrasing in Woodwind Instruments

According to an expert in the field of voice pedagogy, it is impossible to directly imitate vocal sounds on the saxophone because of its inner properties: vocal sounds are based on formants, while the sound of a saxophone has quite fixed series of overtones (Meyer, 2009; Phillips, 2004). Consequently, I concluded that it would not be possible to use phonetics for shaping the saxophone timbre and articulation. However, phonetics or speech sounds might help in the process of developing different timbres and articulations on the saxophone, as showed by Cristina Ioan (2007) in a similar approach to the flute.

This research is written from a saxophonist´s standpoint with the objective of improving a saxophonist's performance, and particularly the saxophone timbre, articulation and phrasing. Singers' techniques and sung or spoken language are the basis of this research. The objective is not to directly imitate singers or linguistic features, but to listen to their interpretation and to use their techniques to improve a musical interpretation.

In sum, the adopted approach states that saxophonists cannot directly imitate phonetics because of the difference nature of both instruments. The objective is not to imitate the process, but the results.

2.2.1 Singing as an Inspiration for Woodwind Players

Cristina Ioan (2007) proposes an alternative method to develop the flute tone through singing:

> *My idea was that if I will achieve a desired resonance when singing, I could then use the resonators in the same way when playing the flute, thereby modifying the colors of the flute tone* (Ioan, 2007).

Ioan states that every musician needs a clear image of sounds in order to produce them, in particular the intonation, consistence, dynamic and color. Without this clear image, the muscles will not drive the body towards what to do and there will be little or no coordination (Doscher, 1994; Ioan, 2007). Ioan further states that training the internal ear through singing will help flutists to train this sound image. The internal ear is necessary to sing and so by singing the flutist will train to first create a clear sound image and then sing or play the sound.

The renowned saxophonist Sigurd M. Rashèr states appoint very similar to Ioan, a music student should develop the inner ear as much as possible because without a clear

imagination of the music it will be harder to reproduce it (Rascher, 1994, p. 8). Rascher speaks about this process in his book *Top-Tones for the Saxophone* (Rascher, 1994). He draws a series of exercises in the book to train the inner ear through mental activity. The student has to play a tone and try to have an idea of an interval (e.g. playing a C and hearing in your head an F). When the student can clearly hear the second tone in his head, he can play the second tone and so on. The exercise practices both the inner listening and tone producing at the same time. In Rasher's approach, the imagination of a tone should be as concise as the imagination of an object such as a table, namely by comparing sound properties such to pitch, loudness, quality, timbre, stability, and duration to characteristics of objects such as size, shape, color and structure.

Singing adopts great techniques for training the internal ear and developing musical activity (Edlund, 1963). Singing not only combines concepts from both language and music, but also focuses on specific uses of linguistic features such as the vowels, consonants and linguistic stress (Liebman, 1994; Ioan, 2007).

2.2.2 The Impact of Vowels in Shaping Timbre

Ioan (2007) presents a series of exercises inspired on singing practices, in particular exercises for breathing and tone development. After exposing the exercises to a group of flute students, Ioan concludes that the exercises improve the tone quality, the internal ear and intonation, the coordination of the air column, projection and flexibility of the flute tone, and a more relaxed position of throat and larynx. The quality of the flute tone improved in general by applying singing techniques to flute playing.

Some of Ioan's exercises focus on the vocalization process. Ioan approaches the voice as a wind instrument, with the air from the lungs as the actuator of the vocal folds. The focal folds become the primary vibrator and produce the sound wave (Doscher, 1994; Ioan, 2007). Ioan describes that phonation takes place in the larynx and that from there the sound passes by two important resonance cavities: the throat and the mouth or oral cavity. Furthermore, these cavities can be tuned on the same frequency as the flute sounds by adjusting the tongue, lips, soft palate and jaw positions (Doscher, 1994; Ioan, 2007). As a result, the cavity will start resonating and this reinforces the voice or the flute tone. This process is called sympathetic resonance. Flutists can train the use of sympathetic resonances to improve their flute tone with Ioan´s exercises (see Figure 1). This whole process has its origin in the singing practice as described by Doscher, the author of the book *The Functional Unity of the Singing Voice* (Doscher, 1994).

The use of vowels is a ground principle for tone producing. Ioan (2007) states that each vowel gives a different timbre to the flute tone. A vowel consists of different formant frequencies or formants. These formants have an influence on the tone color of the flute. Ioan claims that when singing a vowel, one changes the resonance cavity. This changes the

formant frequencies and reinforces the partials of the flute tone (Ioan, 2007, p.64). Ioan demonstrates a series of spectrograms where she sings and plays the flute with the vowels a, e, i, o, and u. She shows that the spectrum of the flute sound changes by shaping the vocal tract as if for singing.

Ioan proved that adopting vowels while playing changes the resonance cavities, which influences the formant frequencies and reinforces the partials of the flute tone.

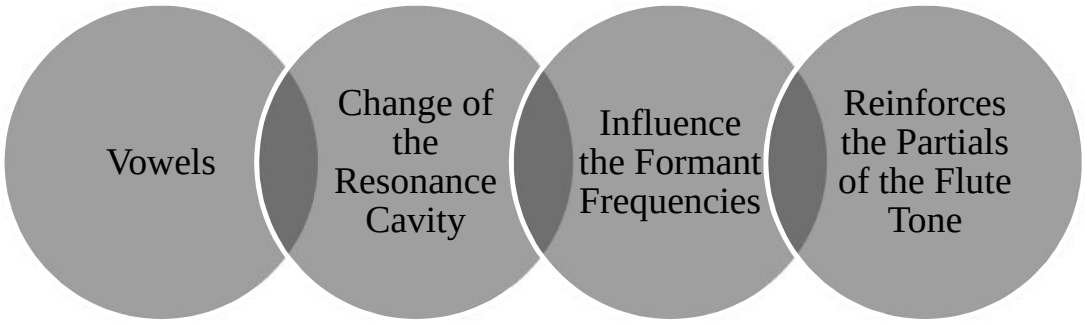

Figure 1. Chain of events in tone producing on the flute by tuning the resonances cavities (adepted from Ioan, 2007).

The saxophonist David Liebman uses a similar approach in his book *Developing a Personal Saxophone Sound* (Liebman, 1994). He points out that the tongue position has a huge influence on the direction and velocity of the airstream before it enters the saxophone mouthpiece. The airstream comes from the lungs, passes through the larynx and oral cavity and finally enters the saxophone mouthpiece. Liebman (1994) states that the goal is to create maximum velocity and minimum dispersion of the air flow to produce a well-balanced sound. Liebman writes that the use of syllables can be useful for demonstrating the various tongue positions while playing the saxophone. He distinguishes three tongue positions: (i) the middle position demonstrated with the vowel ´e´ as in ´eat´, (ii) the low position demonstrated with the syllable ´aw´ as in ´law´ and (iii) the high position demonstrated with the syllable ´ah´ as in ´father´. Liebman offer a clear strategy for the various tongue positions in order to discover different tonal shadings and maximum air velocity. Liebman states that the ´middle position´ of the tongue (as in ´e´) will result in maximum direction and velocity of air (Liebman, 1994).

It remains clear that vowels have a strong influence on tone producing and that using vowels helps developing a personal sound.

2.2.3 The Impact of Consonants in Shaping Articulation

Johann Joachim Quantz points that articulation is a crucial expressive element of music (Quantz, 2001, p. 71). Besides expressive nuance and phrasing, saxophonist Liebman underlines the importance of articulation in phrasing. The intensity and the type of tongue attack are important elements in determining the rhythmic flow of a phrase. Liebman states that a mature and artistic musician will vary these two factors in order to create many different types of articulation (Liebman, 1994).

In order to create articulation a saxophonist has to move the tip of the tongue upwards stroking the reed. The result is that the reed´s vibrations stop for a moment, which consequently stops the sound. After the tongue releases the reed, the sound of an articulation is hearable.

In Liebman´s opinion, many saxophonists accept whatever tongue position as good, ignoring the numerous possibilities of tongue positions in order to articulate. Liebman (1994) categorizes both tongue and reed areas in three classes. He states that combining different areas, saxophonists will discover maximum flexibility in articulation (see Figure 2).

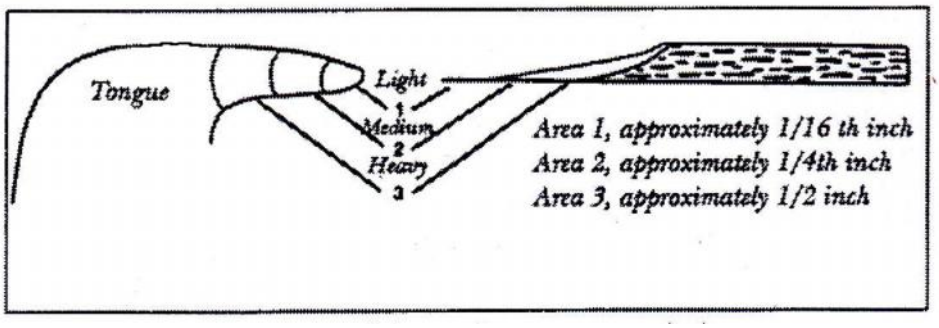

Figure 2. Tongue and reed areas according to Liebman (1994).

To visualize these tongue positions Liebman uses many syllable examples.

> *There are numerous syllables useful for hearing as well as conceptualizing various shadings of articulations. Some examples are t*ee, *tay, la, lou, dee, day, etc. They differ from each other in that voice activation and the vowel sounds after the initial bring about different results. (Liebman, 1994, p. 27)*

In order to train articulation Liebman proposes the ´e´-position of the tongue. According to Liebman, this tongue-position not only maximizes the direction and velocity of the airstream, but also places the tongue in a strategic position in relation to the edge of the

reed. The tongue naturally strokes the reed while using the least amount of motion (Liebman, 1994).

Liebman gives a series of further examples using consonants in order to train the articulation. He mentions the following examples: (i) ´tee´, (ii) ´dee´, (iii) ´ke-ge´ and (iv) ´n´). Every example relates to a specific reed area as demonstrated in Figure 3.

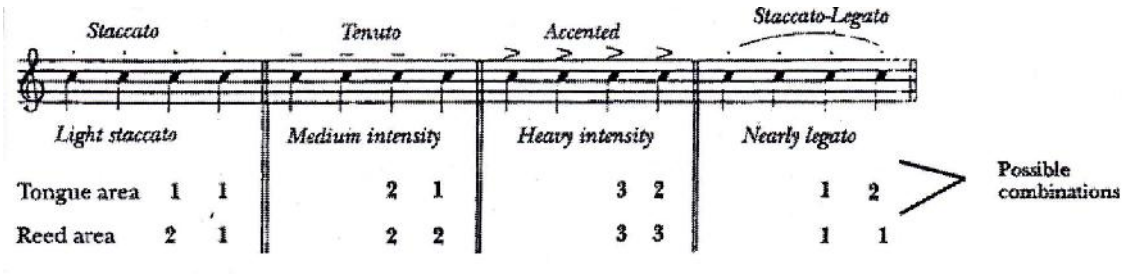

Figure 3. Overview of several types of articulation with corresponding tongue and reed areas according to Liebman (1994). The tongue and reed areas are defined in Figure 2.

Liebman proposes to use the consonant ´t´ in order to play a light staccato (area 1), the syllable ´the´ in order to play tenuto (area 2) and the consonant ´n´ in order to play an intense articulation (area 3). Quantz uses a similar approach with several syllable examples such as ´ti´ and ´di´. According to the author, the syllable ´ti´ should be used for short, equal, lively and quick notes, while the contrasting syllable ´di´ "must be used in slow melodies (Quantz, 2001, p. 71 – 72).

Another musician who uses syllables as a strategy to improve a musical interpretation, namely the timbre and the articulation, is the saxophonist Fernando Ramos, one of the most prolific Portuguese saxophonists. In his approach, the first step to improve timbre and articulation is a stable sound with maximum air velocity and minimum waste. Ramos proposes a relaxed body position, a stable breathing and a not too open position of the tongue as in the syllable ´she´. This is very comparable with Liebman´s ´middle-position´ with the vowel ´e´ as in ´eat´ (Liebman, 1994).

When a student is able to produce a stable sound, he/she can focus on the use of syllables to alter timbre and articulation. Ramos proposes that a student instinctively vocalizes music by imagining and singing the vocal sounds that could fit into the style of the piece. If necessary, a student can write these syllables in the musical score. Afterwards the student can try to imitate these vocal sounds. Automatically, the student will improve timbre and articulation due to the change of vowels and consonants.

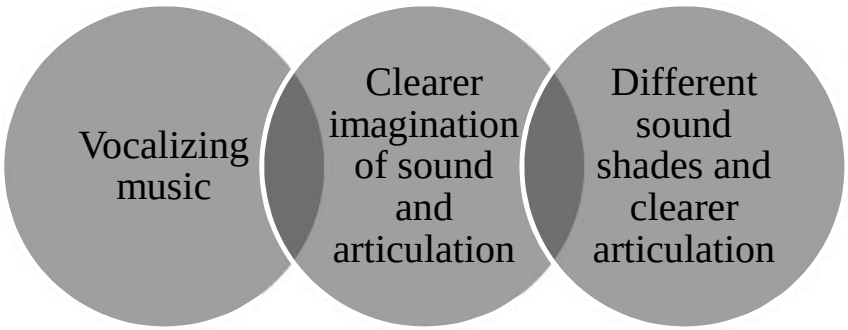

Figure 4. Vocalization approach of saxophonist Fernando Ramos.

Ramos states that the right choice of syllable will contribute to a more interesting musical interpretation, in particular to a better control of the airstream in general and in different dynamical ranges, a controlled change between registers and a bigger variety of timbre and articulation.

Ramos' vocalization approach as demonstrated in Figure 4, results in a clear imagination of sound and subsequent articulation possibilities. This consequently augments the color palette available to the performer and allows a vaster array of articulation options that can be used within the various musical contexts needed while playing.

The use of linguistic elements assists the saxophonist to experiment with different timbre and articulation variations. Besides this, the syllables help a saxophonist to feel the tongue positions directly in the mouth cavity, which help to produce a more clear articulation base as a whole.

2.2.4 The Function of Tree Structures in the Analysis of Linguistic Stress and Musical Phrasing

Research relating language, or ‘speech’, and music interpretation is sparse. One of the possible explanations is the difficulty to master both areas, because a deep understanding of linguistic and musical knowledge is required. Fred Lerdahl and Ray Jackendoff’s *A Generative Theory of Tonal Music* is a rare exception. It formulates a theory of musical grammar by relating concepts from music and linguistics. The formulated theory intends to express generalizations about the perceptual process that is undertaken in the listener’s mind. The rules enlighten and explain patterns that frequently occur in musical pieces (Lerdahl and Jackendoff, 1983).

Chapter 12.3 of *A Generative Theory of Tonal Music* by Lerdal and Jackendoff compares the musical theory of time-span reduction with the linguistic theory of prosodic structure. Time-span reduction creates representations of the various hierarchical layers of the music structure, in particular the importance of the low-level elements of the music (e.g. notes) with respect to their function and position within the metrical structure. Prosodic structure can be described as the organization of linguistic stress applied to syllabic structures. The Oxford Dictionary Online [ODO] (2013) defines linguistic stress as an *emphasis given to a particular syllable or word in speech, typically through a combination of relatively greater loudness, higher pitch, and longer duration.*

Liberman and Prince (1977) developed a system of rules, in order to predict stress in English words quite accurately. The prosodic tree structures depict the relation of the various combinations of syllables as shown in Figure 5. Syllables combine to feet and feet to words; feet are combinations of several syllables (Lerdahl and Jackendoff, 1983, p. 315).

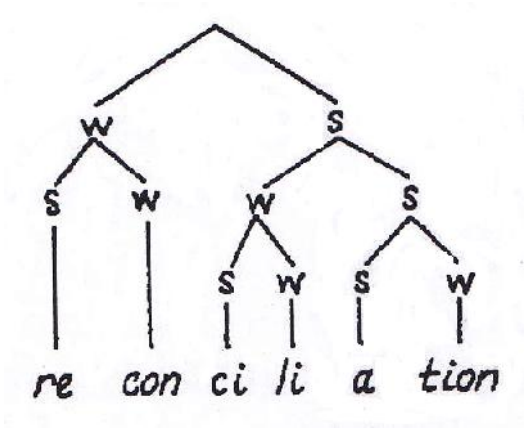

Figure 5. Prosodic tree structure of the word ´reconciliation´ according to Liberman and Prince (1977). W and S stand for weak and strong stress.

Figure 5 depicts the hierarchy of weaker and stronger stress. The tree distinguishes two types of stress: main stress and subsidiary or secondary stress. Main stress falls on the syllable immediately dominated by two times ‘S’ while subsidiary stress falls on the syllable immediately dominated by one ‘S’. Unstressed syllables are immediately dominated by ‘W’. S and W stand for weak and strong stress.

Lerdahl and Jackendoff have developed similar tree representations to describe the musical time-span. For every musical pattern, one can pinpoint the most important events or ´head´, which are selected from the notes. The remaining notes are inferior to the head (Lerdahl and Jackendoff, 1983, p. 152). The tree divides a musical piece into “domains of elaboration at every level which results in a hierarchy of time-spans” (Lerdhal and Jackendoff, 1983, p. 119).

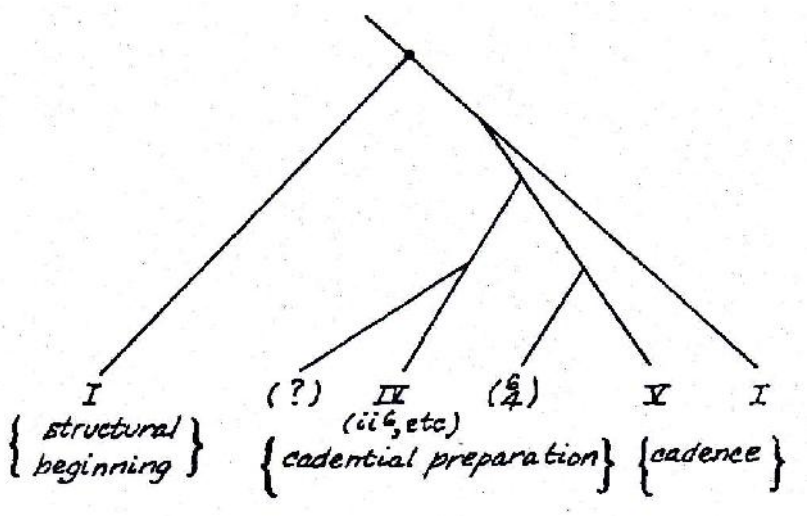

Figure 6. Time-span reduction tree of a harmonic progression according to Lerdahl and Jackendoff (1983).

The time-span reduction tree in Figure 6, distinguishes the ´head´ or most important event, from the subordinate or secondary elements. The head falls on the tonic and is demonstrated in the tree with the largest branch pointing left. The tonic is divided into smaller elements organized in stronger and weaker branches depending of their importance.

According to Lerdahl and Jackendoff (1983), the trees that encode the time-span reduction of musical sequences and prosodic structures are in essence notational variants. Both tree structures represent a hierarchy of binary concepts. The time-span trees represent an opposition of head versus elaboration of harmonic structure, while the prosodic trees represent strong versus weak linguistic stress (Lerdahl and Jackendoff, 1983).

Lerdahl and Jackendoff conclude that both theories are closely related in form, yet they differ in substance. However, the comparisons in form are important to our topics of interest and support further research relating linguistic stress and musical phrasing (see §3.5).

Chapter 3 - Language in the Musical Interpretation of a Song by Saxophonists

Chapter 3 establishes a link between seminal concepts from language and music interpretation that will latter support a research experiment (Chapter 4).

3.1 Basic Linguistic Terms

Language is articulated through phonetics or speech sounds (ODO, 2013). Phonetics are the basic unit of spoken language and phonetics can be divided into two groups: (i) vowels, such as: a, e, i, o, u, and (ii) consonants, such as b, d, n, r, c. Vowels and consonants are the elementary units of spoken language and are therefore called segmental aspects of language. The combination of various phonemes allows the creation of higher-level elements of the language called syllables. Groups of syllables form words and consequently groups of words form phrases (see Figure 7 for an overview of the hierarchical organization of linguistic elements and their relationship).

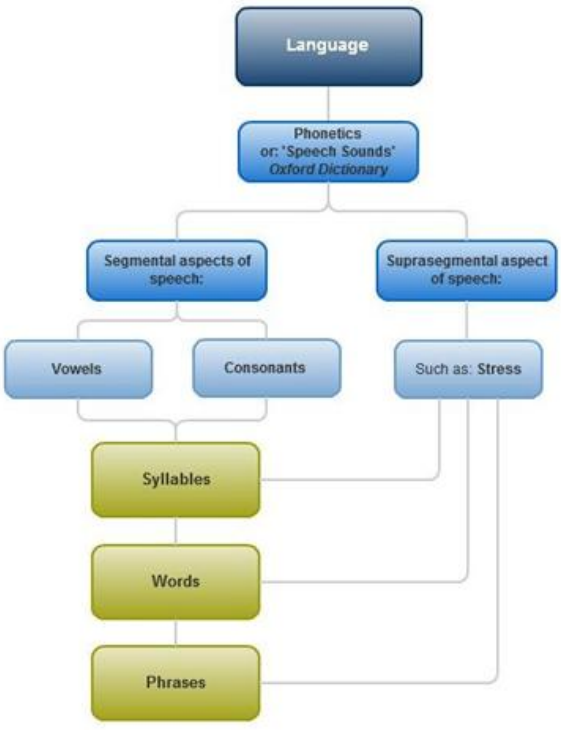

Figure 7. Overview of the hierarchical organization of the basic linguistic elements and their relationship.

Prosody is the patterns of stress and intonation in language (ODO, 2013). Prosody can be improved through intonation, loudness, timing and stress. These properties of spoken language are called supra-segmental aspects of speech, as they tend to form patterns that vary independently of the segmental aspects or extend over several segments (IPA, 1999).

Before analyzing music through a linguistic approach, one needs to understand the basic elements of language. The International Phonetic Association (hereafter, IPA) promotes the study of phonetics and its various applications. The IPA was founded in 1886 and developed a series of symbols that cope with the wide variety of sounds found in languages all over the world since then. In 1999, the IPA published the *Handbook of the International Phonetic Association, a Guide to the Use of the International Phonetic Alphabet* (1999), which has a great importance for this research as it promotes a clear and basic knowledge about language and particularly about phonetics. Of notice is that the acronym IPA not only refers to the name of the association, but also to their work, namely the International Phonetic Alphabet.

The present research establishes a link between some linguistic and musical elements. This parallel can be described as the basis of the ´linguistic approach to music´, which will be further discussed (see § 3.2).

3.2 Parallels between Linguistic and Musical Terms

The IPA distinguishes vowels from consonants by the way they are produced in the mouth. Speech involves narrowing and opening of the vocal tract (IPA, 1999).While consonants involve narrowing or ‘stricture’ of the airflow, vowels imply a more open articulation. The IPA makes a distinction between vowels and consonants in their alphabet reflecting the different ways they are produced in the vocal tract. Figure 8 establishes a parallel between linguistic and musical terms of interest here.

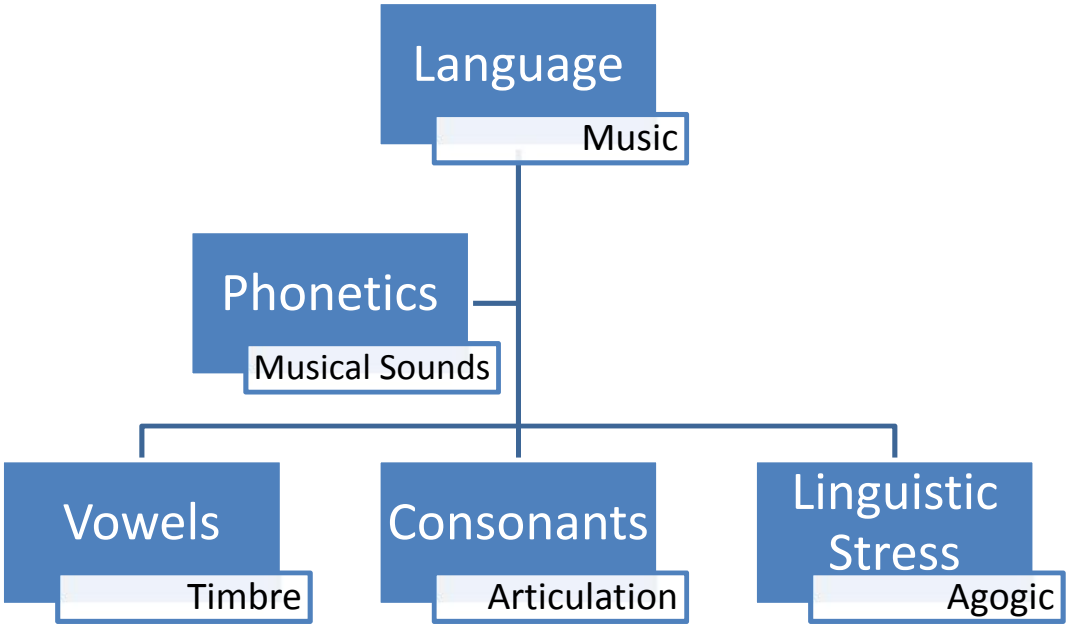

Figure 8. Parallel between linguistic and musical terms.

Vowels imply an open articulation, which means that little or no narrowing is necessary for the production of vowels in the mouth. The most common approach to saxophone playing implies a similar position, *i.e.*, an open or slightly narrowed position of the vocal tract. In order to produce a sound on the saxophone a constant airflow from the lungs to the mouthpiece is necessary, which is only possible with an open vocal tract. However, to maintain the airflow constant for a certain amount of time, it is important not to open the vocal tract as wide as possible because the air will disappear in a very short amount of time. A slightly narrowed vocal tract will be more effective to maintain a stable airflow.

The production of consonants differs substantially from vowels, since it involves narrowing or ´stricture´ in the vocal tract. Each consonant involves a closure of the vocal tract, followed by an opening of the vocal tract. For example, producing the word ´banana´ involves three closures of the vocal tract followed by three openings of the vocal tract (IPA, 1999, p.6). A similar process happens in order to produce saxophone articulation. The tip of the tongue touches the reeds and stops the airflow for a moment, followed by a sudden release of air. This results in an articulation.

Linguistic stress is the emphasis given to a particular syllable or word in speech. Stress improves communication because it enhances the most important words of a sentence. The use of stress in language improves the natural flow of speech. Linguistic stress is comparable with agogic in music. Agogic is the emphasis given to a certain note by expressive means. The slight lengthening of a note underlines the importance of a certain note and improves the direction of a musical phrase. The use of dynamics, accentuation, vibrato, color and intensity may also contribute to the enlightenment of a particular note.

Analyzing linguistic stress and relating the stressed syllables or words of song lyrics, to agogic in music, might improve the musical phrasing.

The following sections (§ 3.3 - 3.4) will further explore the relationship between vowels and timbre, and consonants and articulation. The established correspondences are based on the place and manner of articulation of the vowels and the consonants, related to the formation of timbre and types of articulation of the saxophone. Section 3.5 details the relationship between linguistic stress and agogic, and how it improves musical phrasing.

3.3 The Impact of the Four Extreme Vowels in Shaping the Saxophone Timbre

Vowels imply an open articulation. It means that little or no narrowing is necessary for the production of vowels in the mouth. Figure 9 depicts the most extreme tongue positions in the mouth for producing vowels. The IPA (1999) describes these four vowels as the four extreme vowels because in order to produce them the tongue assumes the most possible extreme positions in the mouth (see Figure 9).

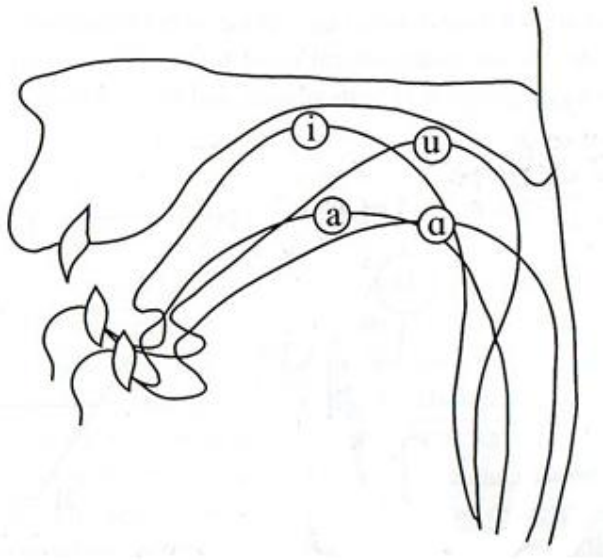

Figure 9. Place of the tongue during the production of the four extreme vowels (IPA, 1999, p. 11).

The position of the vocal tract during the vowels' production is comparable with the position of the vocal tract while playing a wind instrument such as the saxophone. Saxophonists commonly control the vocal tract opening by the position of the tongue in the

mouth (see §2.2.2). This is comparable with the production of different vowels due to different tongue positions in the mouth.

The IPA distinguishes the following four tongue positions depending on how close the tongue is from the palate: (i) close, (ii) open, (iii) front and (iv) back. A close position means that the tongue is close to the hard palate, while an open position means that the tongue is far from the hard palate. The front and back positions of the tongue depend of the position of the tongue towards the front or the back part of the mouth. A front position means that the tip of the tongue is in front of the mouth. A back position means that the tip of the tongue is in the back part of the mouth. Table 1 describes the tongue positions in the vocal cavity for each of the four extreme vowels.

Table 1. Overview of the four extreme vowels and their tongue positions according to IPA (1999).

Vowel	Word Example	Tongue Position
i	´s**i**´ (French)	Close and front.
α	´c**a**lm´ (English)	Open and back.
u	´y**ou**´ (English)	Close and back.
a	´c**a**t´ (English)	Open and front.

I have raised the hypothesis that the use of the four extreme vowels will shape significantly the saxophone timbre. Researchers such as Ioan (2007) and Liebman (1994) support this hypothesis. Ioan (2007) states that singing vowels has a positive influence on the flute sound (see Figure 1). Moreover, Ioan demonstrates that the use different vowels impose significant changes in the flute timbre through spectral analysis. Liebman (1994) uses vowels in order to change the tongue position of a saxophonist in order to create different color shades.

My personal experience while playing with the four extreme vowels denotes considerable changes in my sound each time I change to a different vowel. I expect that other saxophonists will have the same experience. Table 2 shows the expected results on the saxophone timbre when a saxophonist imitates the tongue position of the four extreme vowels.

Table 2. Overview of the four extreme vowels and the expected results on the saxophone timbre.

Vowel	Expected results in the saxophone timbre
i	Projected and very compact sound
α	Very open sound without projection
u	Projected and round, brilliant sound
a	Brilliant sound without projection

3.4 The Impact of Consonants in Shaping Articulation on the Saxophone

The production of consonants differ significantly, namely because they demand narrowing the vocal tract. The IPA categorizes the consonants according to the following two parameters: (i) place and (ii) manner of articulation. The place of articulation describes where the tongue touches the mouth in order to produce a consonant (Figure 10 depicts the various elements that compose the vocal tract). For example, the place of articulation of the consonant ´d´ is alveolar. In order to produce the consonant ´d´ the tongue has to touch the alveolar ridge in the mouth. The manner of articulation describes how a consonant is produced in the mouth. For example, the consonant ´d´ implies a plosive way of articulation. This means that in order to produce the consonant ´d´ the tongue touches and releases the alveolar ridge in the mouth. This results in a sudden release of air, which is called a plosive manner of articulation. The other manners of articulation are nasal, trill, tap or flap, fricative, lateral fricative, approximant and lateral approximant (IPA, 1999).

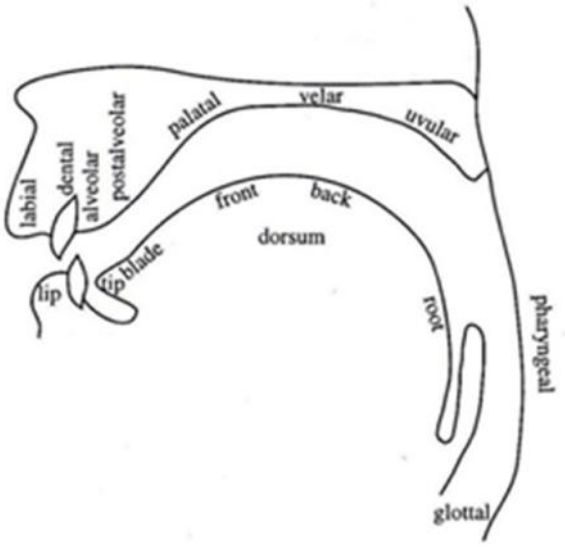

Figure 10. Vocal tract with labels for place of articulation (IPA, 1999, p. 7).

Table 3 demonstrates some examples of consonants and their manner and place of articulation, according to the IPA (1999).

Table 3. Examples of consonants and their manner and place of articulation according to IPA (1999).

Consonant	English Word Example	Manner of Articulation	Place of Articulation
b	´**b**ear´	Plosive	Bilabial
d	´**d**ear´	Plosive	Alveolar
f	´**f**at´	Fricative	Labiodental
j	´**y**ou´	Approximant	Palatal
l	´**l**ie´	Lateral Approximant	Alveolar
n	´**n**o´	Nasal	Alveolar
t	´**t**oe´	Plosive	Alveolar

I have raised the hypothesis that the use of different consonants results in different saxophone articulations. I feel supported in this hypothesis by researches such as Ramos, Liebman (1994) and Quantz (2001). Liebman proposes the use of consonants such as ´d´, ´t´, ´k´ and ´n´ in order to produce different types of articulation (§ 2.3.3). Ramos states that the use of vocalization gives a clear imagination of sound and improves the clearness of the articulation (§ 2.3.3).

I have tried to establish a link between all consonants and different type of articulation in the saxophone. In order to do so, I studied the manner and place of articulation of each consonant as described in the IPA, and attempted to replicate it as different modes of articulation. I discovered that consonants have an influence on my saxophone articulation in two different ways:

1) Consonants help discovering and improving different articulations on the saxophone;
2) Consonants are a useful support to develop extended techniques on the saxophone.

An extensive explanation of the two aforementioned topics follows.

3.4.1 Consonants as Strategy to Improve Saxophone Articulation

I have tried to apply any kind of consonant of the alphabet as modes of articulation in the saxophone. This helped me to think about how I articulate. The systematic approach to articulation is interesting, because it offers a different way of understanding and developing a saxophone articulation. Traditional indications such as legato, staccato and tenuto are necessary and indicate very clearly the type of articulation a composer wants to hear. However, these indications do not function as strategies to develop articulation. Consonants help to feel the position of the tongue in the mouth and help to create a clear concept of the articulation. In this way, consonants can be used as a complementary strategy to explore the many possibilities of saxophone articulations.

From all existing consonants, saxophonists may use the consonants ´d´ and ´t´ to improve existing saxophone articulations (see Table 4). These two consonants are directly applicable to the saxophone articulation because their manner and place of articulation stands very close to the embouchure of a saxophonist. Table 4 demonstrates the two consonants and their expected results on saxophone articulation.

I expect the consonant ´d´ to result in a type of articulation comparable to tenuto and the consonant ´t´ in a type of articulation comparable to staccato. In my experience, the application of these consonants in the saxophone articulation helps to define saxophone articulations such as tenuto and staccato. By imitating the place and manner of articulation of the consonants ´d´ and ´t´, I created a clearer concept of tenuto and staccato, which resulted in a clearer articulation on my saxophone.

Table 4. Overview of two directly suitable consonants and the expected results on the saxophone articulation.

Consonant	Expected saxophone articulation
d	Short, soft and clear articulation (*tenuto*-like)
t	Very short and clear articulation (*staccato*-like)

Both consonants (´d´ and ´t´) have a plosive manner of articulation and are produced at the alveolar ridge in the mouth. The consonants are directly applicable as modes of articulation because of the following two reasons:

(1) the place of the articulation of the consonants is in front of the mouth and the application to the saxophone articulation will be close to the tip of the mouthpiece and the reed (see Figure 11);
(2) the manner of articulation of the consonants implies a stricture of air by holding the tip of the tongue to the hard palate (alveolar ridge) followed by a sudden release of air. This is very much comparable with the stricture of the airflow by holding the tip of the tongue against the tip of the reed, followed by a sudden release of air in order to produce a saxophone articulation.

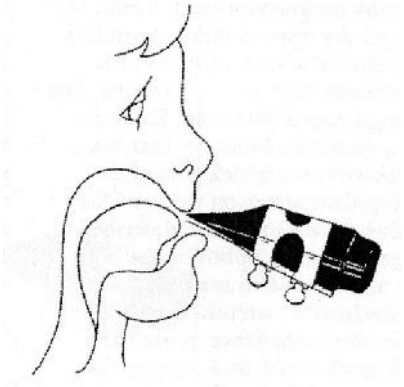

Figure 11. Position of the saxophone mouthpiece in the mouth.

I can conclude that imitating the production of consonants on the saxophone results in a clearer articulation. In addition, imitating the sound result of not-directly suitable consonants a saxophonist can develop a greater variety of articulations.

3.4.1.1 Consonants as Strategy to Discover Different Articulations on the Saxophone

I noted that many of the consonants were not directly applicable as modes of articulation in the saxophone because they imply a manner and/or place of articulation that conflict with the saxophone embouchure or the airflow. Among the consonants that are not directly suitable for the saxophone articulation I may mention: ´b´ (plosive, bilabial), ´c´ (plosive, palatal), ´f´ (fricative, labiodental), ´g´ (plosive, velar), ´h´ (fricative, glottal), ´l´ (lateral approximant, alveolar), ´m´(nasal, bilabial), ´n´ (nasal, alveolar), ´p´ (plosive, bilabial), ´s´ (fricative, alveolar), ´v´ (fricative, labiodental), ´x´ (fricative, velar) and ´z´ (fricative, alveolar).

The fact that not all consonants are directly suitable as modes of saxophone articulation did not prevent me from trying to imitate the sound result of the consonants. In other words, I did not try to imitate the place and manner of articulation of this group of consonants; instead, I tried to imitate its sound result. With this strategy, I have discovered different types of articulation on the saxophone, which I did not use before. An example is the consonant ´n´. The place of articulation of this consonant is on the alveolar ridge in the mouth and the manner of articulation is nasal. This means that the articulation of the consonant ´n´ implies a closure of the tip of the tongue to the alveolar ridge and a lowering of the velum (soft part of the palate at the back of the mouth), which results in a contribution of the nasal cavities to the sound. The place of articulation of this consonant is not a problem in the imitation to the saxophone articulation. However, the manner of articulation is nasal, and this is impossible to imitate on the saxophone, because playing saxophone implies a direct

airflow through the mouthpiece in the mouth. However, the sound result of the consonant ´n´ could be described as soft and long and this sound result is possible to imitate on the saxophone.

Studying with the consonant ´n´ allows the saxophonist to explore possibilities of a tenuto-like articulation. In order to discover if the consonant ´n´ results in a very soft and long articulation, a group of saxophonists will experiment with the consonant in Exercise 2 of the research experiment. Furthermore, they will describe their experiences as to the sound result of the consonant 'n' in Chapter 4. The expected saxophone articulation may vary from person to person depending to several factors such as mother tongue and desired modes of articulation. Besides, the description of any kind of sound is highly subjective. For example: saxophonist David Liebman describes that the consonant ´n´ results in a very intense articulation or ´slap-tonguing´ (Liebman, 1994, p. 27), while in my opinion this consonant results in a soft and tenuto-like articulation.

Table 5. Overview of some of the not-directly suitable consonants and the expected saxophone articulation.

Consonant	**Expected Saxophone Articulation**
n	Very soft and long articulation
h	Articulation using only the airflow
b	Long and fat articulation

In sum, the consonants that are not directly suitable as modes of saxophone articulation, can be useful as sound references (or sound images), which can be imitated on the saxophone to discover different articulations. Table 5 demonstrates three examples of these types of consonants and their expected sound results.

3.4.2 Consonants as Strategy to Develop Extended Techniques on the Saxophone

Despite the focus on saxophone articulation, the use of consonants may be fruitful for training several extended saxophone techniques. Therefore, I will provide limited information concerning the use of consonants as a strategy for improving extended techniques on the saxophone.

Extended saxophone technics imply radical changes to the most common tongue position while playing, and many saxophonists have difficulties producing them. The use of consonants such as ´j´, ´k´, ´t´ and ´r´ can be very helpful in the study of technics such as vibrato, double-tonguing and Flatterzunge. For example, the consonant ´r´ helped me to develop my Flatterzunge. In order to produce the consonant ´r´ my tongue touches the alveolar ridge of my mouth. The air that passes through the mouth is interrupted by the tip of my tongue, which results in a tap of trill manner of articulation. When I place my tongue slightly on top of the tip of the mouthpiece and try to imitate the consonant ´r´, the sound result is a Flatterzunge.

Table 6 shows some of the consonants, which might be helpful in the development of extended saxophone technics.

Table 6. Overview of four useful consonants to develop extended saxophone technics.

Consonant	**Word Example**	**Place and Manner of Articulation**	**Saxophone Technic**	**Reference**
j (+ ´u ´)	´**y**ou´ (English)	Fricative, palatal	Vibrato	Ramos, 2013
k + t	´s**k**a**t**e´ (English)	Plosive, velar / Plosive, alveolar	Double-tonguing	Liebman, 1994
r	´**r**aam´ (Dutch)	Tap or Trill, alveolar	Flatterzunge	Empirical research

It is very important to realize that the expected result of each consonant strongly depends on the saxophonist´s mother tongue. Since my mother tongue is Dutch, the consonant ´r´ as I pronounce it will result in a Flatterzunge when I imitate the consonant on my saxophone. However, the Dutch ´r´ differs very much in pronunciation from the English and the Portuguese ´r´.

3.5 The Impact of Linguistic Stress on Musical Phrasing

The third hypothesis raised in this dissertation states that saxophonists improve musical phrasing of song transcriptions by imitating the flow of a linguistic phrase of the song lyrics. Specifically, by linking linguistic stress with musical agogic, the musical phrasing improves.

Before exploring the link between linguistic stress and agogic, it is important to deepen our understanding of the function of both features.

3.5.1 The Function of Stress in Language

Linguistic stress exists at several levels. The prosodic tree structure demonstrated in Figure 5 depicts the difference between strong and weak stress in one single word. This type of stress functions at a word-level. It makes words more understandable and distinguishes homonyms. For example: the word ´record´ with stress on the first syllable means the best performance of a kind, while ´record´ with stress on the second syllable means the conversion of a sound or a performance in a permanent form (ODO, 2013). Wrong stress placement can lead to misunderstanding, while an appropriate placement of stress will lead to a clear understanding (Edwards, 2003).

A second type of stress occurs at a sentence level. This type of stress is called phrase or sentence stress and it aims at improving the meaning of phrases. Sentence stress increases the focus of the listener to the most important features in a message. Stress increases the understandability of people and improves communication. As Harold T. Edwards mentions, “Speech that is devoid of stress is unfocused, monotone, uncommunicative, and hard to understand. Speech that has carefully placed and efficiently used stress is natural, interesting, and communicative” (Edwards, 2003, p. 332).

3.5.2 The Function of Agogic in Music

Agogic is a term coined by the German musicologist H. Riemann in 1884. It denotes small tempo changes. An agogic accent enhances expressivity using timing deviations, *e.g.* lengthening of a note to improve the articulation and the musical expression (Schouten, 1993). The use of dynamics, accentuation, vibrato, color and intensity will increase the emphasis given to each note.

Agogic can increase the clearness of a musical phrase. By giving emphasis to the most important notes of a phrase, the musical structure and natural flow of the phrase become clearer. This improves the communication between the musician and his/her public. Both music and language involve communication. However, the communication of music and language is not literally comparable.

3.5.3 Communication in Music and Language

Language supports communication. Speaker and listener normally understand the same message when speaking the same code. Communication in music is not as simply understood as speech. Musician and public can relate certain associations, thoughts and feelings to music, but these associations occur in the heads of the musician and the public and can be different from person to person (Boucourechliev, 1993).

Boucourechliev states that language and music are not comparable. For instance, a verb in language does not relate to any feature in music. This does not mean that researchers should not study the relation between both fields. “However, comparing both systems, the spoken and the musical, and their specifications, will unveil new ways and formulate further questions” (Boucourechliev, 1993, p. 9).

The importance does not lay in the direct comparison of language with music, but in the discovery of new ways of looking to language and music by comparing them with each other. For instance, the analysis of linguistic stress helped me to understand that stress improves the communication and the meaning of a sentence. When I started to play song transcriptions, the analysis of the stress in the lyrics, inspired me to approach the study of musical phrasing in a different perspective.

3.5.4 Comparing Agogic and Stress

Agogic and stress present many similarities. First, both language and music use the emphasis of an element to sign the importance of a certain element, stress in linguistics and agogic in music. The consequent distinction between more or less important elements of the music structure, improves the communication of the music. Agogic and stress both involve increasing the amplitude and duration of a particular element of the phrase. The most noticeable difference between both terms is that stress in language also involves the use of a higher pitch, while in music the pitch is commonly unchangeable.

Second, both features are part of a phrase, or a so-called time-span. Differently said, both stress and agogic increase the understanding of a phrase. Edward Cone describes a musical time-span with a very clear metaphor:

> If I throw a ball and you catch it, the completed action must consist of three parts: the throw, the transit, and the catch. There are, so to speak, two fixed points: the initiation of the energy and the goal toward which it is directed; the time and distance between them are spanned by the moving ball. In the same way, the typical musical phrase consists of an

> initial downbeat (/), a period of motion (~) , and a point of arrival marked by a cadential downbeat (\) (Cone, 1968, p. 26-27).

Similar to Cone (1968), Lerdahl and Jackendoff (1983) state that a musical phrase has a beginning and a structural ending or cadence, which are parts of a time-span. Lerdahl and Jackendoff demonstrate that the time-span reduction tree of a musical phrase and the prosodic tree structure of word-stress, are comparable with each other in form. The tree-structures of both theories are notational variants (§ 2.3.4). However, the elementary units of the analyzed material differ.

In this way, it is possible to conclude that in a musical phrase, some notes should have stronger emphasis due to their importance in the musical structure. In spoken or sung phrases, a similar situation occurs with stress: some syllables or words receive more emphasis, because of their importance in the sentence. As stress improves the communication in a linguistic phrase, agogic can improve the flow and direction of a musical phrase (see Figure 12).

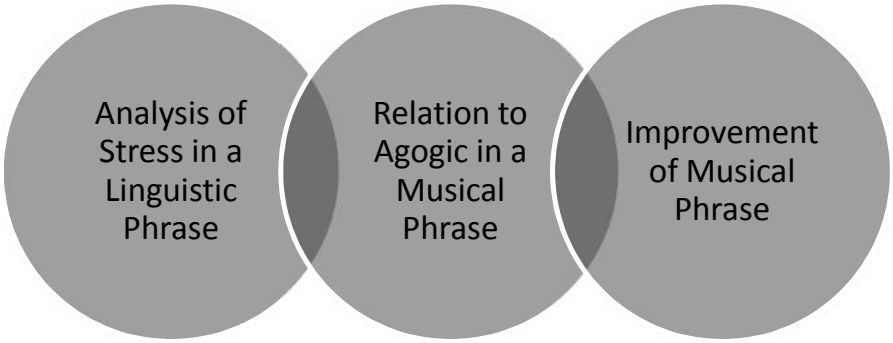

Figure 12. Overview of the proposed hypothesis regarding linguistic stress and musical phrasing.

By analyzing stress in a linguistic phrase (for example, in lyrics), and making the connection to agogic in a musical phrase, a musician will improve the direction and flow of the musical phrasing. I have developed an exercise to clarify the study process systematically, which I will demonstrate in Chapter 4 (see also Appendix 6).

Chapter 4 – Experiment Protocol

Chapter 4 presents an experiment I developed in order to measure the influence of phonetics in timbre formation and articulation, as well as the influence of linguistic stress in musical phrasing.

Introduction

The Handbook of the IPA (IPA, 1999) allowed me to establish connections between linguistic and musical terms; in particular, it gave me a deeper understanding of a practice that I have been exploring for years, *i.e.*, the transcription of Rachmaninoff songs. The IPA constitutes the base of the so-called linguistic approach to music analysis.

Given my interest in the transcription of songs, I started to envision ways to include the lyrics in my musical interpretation. I started to analyze the sounds of the words and the flow of the phrases as a way to get a deeper understanding of the composition.

I created a systematic approach to study songs transcription on the saxophone in three major steps. First, I listen to the original song. Second, I create a phonetic transcription of the lyrics of the songs. Finally, I start to imitate the singer, repeating each phrase. This study approach helped me to listen to the speech sounds and to understand the flow of the phrases. I could connect with some ease the speech sounds to saxophone timbre and articulation, as well as the flow of the phrases (linguistic stress) to my musical phrasing (agogic).

My study became even more efficient after I developed a concise set of exercises, which are the base of the research experiment. Every step of the exercises has a clear objective. The exercises help to analyze the lyrics of the Rachmaninoff's songs and consequently to improve the musical interpretation of the song's transcription.

I developed four exercises that reflect the study approach mentioned before. The participants studied the exercises during the experiment period in order to evaluate its validity for the saxophone community. In addition, I recorded the participants before and after the exercises in order to let a panel of experts blindly compare both versions. Both experts and participants filled in a questionnaire after their participation in the research experiment.

4.1 Aim

The aims of the exercises are to discover the relationship between the following three pairs of elements:

1. vowels and saxophone timbre;
2. consonants and articulation;
3. linguistic stress and musical phrasing.

4.2 Exercises

The objective of the exercises is to discover the relationship between (i) vowels and saxophone timbre – exercise 1 and 1b, (ii) consonants and articulation – exercise 2, and (iii) linguistic stress and musical phrasing – exercise 3. The exercises intend to improve the saxophone timbre through the study of vowels, articulation through the study of consonants, and musical phrasing through the study of linguistic stress.

All exercises switch between saxophone playing and singing. Singing forces one to create a sound image before playing. It is my conviction that singing is essential in the education of every musician. The final goal of the exercises is to imitate on the saxophone the sung sounds or sound images created beforehand, and therefore the exercises do not aim at training a highly singing performance.

4.2.1 Exercise 1

Exercise 1 explores the relation between vowels and saxophone timbre and aims at discovering a wider palette of colors on the saxophone. Each vowel implies a different tongue-position in the mouth cavity (see § 2.2.2), which consequently results in a different tonal shading on the saxophone. Therefore, it is expected that the participants can achieve different tonal shadings with different vowels.

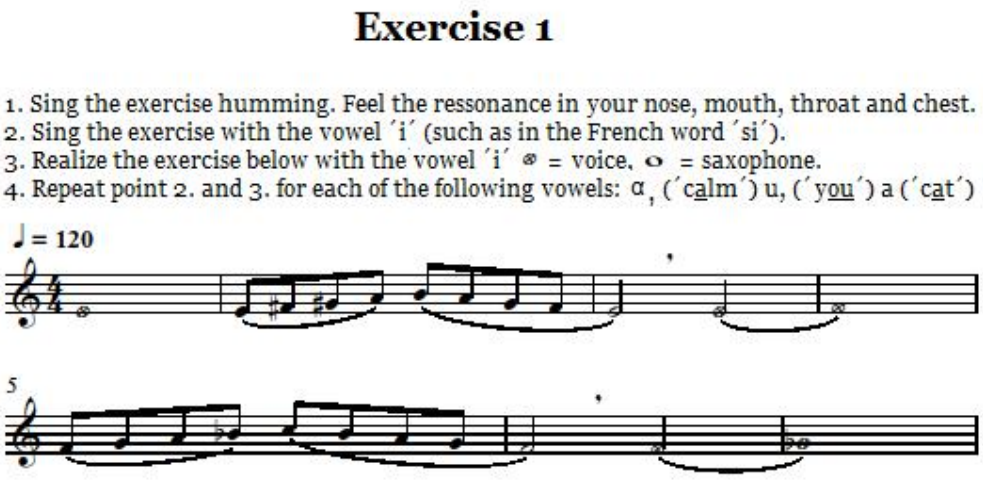

Figure 13. Short version of exercise 1 – vowels and timbre.

The objectives of exercise 1 are:

1. Feeling the vocal resonance in the vocal tract (nose, mouth, throat and chest).
2. Relating the tongue position of a vowel to a specific timbre on the saxophone.

Exercise 1 is based on warming-up exercises for singers and works as a great warming-up exercise for saxophonists. Each participant is asked to sing the exercise humming and to try to feel the vocal resonance in the nose, mouth, throat and chest. The humming helps to feel the vibrations in the different cavities of the body where the air passes through. Resonating cavities in the body can function as extra resonating cavities, which increase the resonance while playing the saxophone (Ioan, 2007).

Next, the participant is asked to sing the exercise with the vowel ´i´ (as in: ´si´) and later on with the vowels ´ɑ´ (´palm´), ´u´ (´you´) and ´a´ (´cat´). The objective is for the participant to feel the tongue position of each vowel precisely in the mouth while singing. The four extreme vowels ´i´, ´ɑ´, ´u´ and ´a´ are selected for this exercise, because they require the four most different tongue positions in the mouth during the vowel production. (IPA 1999; see § 3.3)

During step 3 and 4 of Exercise 1 the participant is asked to switch between singing and playing saxophone. The idea is for the participant to maintain the shape of the mouth cavity equal during the vowel singing and during the saxophone playing. Every extreme vowel will change the position of the tongue; consequently, the vocal cavity changes and thus the partials of the saxophone sound will change (see § 2.2.2). I aim at four different timbres because of the four extreme vowels.

Of course, a saxophonist will have more difficulties to maintain the mouth cavity in the shape of a vowel than for example a singer, due to the saxophone embouchure. Some

vowels will be easier to reproduce then others. However, the smallest change of the tongue in the vocal cavity has a major influence on the saxophone timbre. The final objective is not to perfectly imitate each vowel while playing the saxophone, but to use the vowels as a strategy to discover a wider color palette on the saxophone.

4.2.2 Exercise 1.b

Exercise 1.b is an extension of exercise 1. This exercise maintains the focus on the relation between vowels and saxophone timbre and tries to encourage the participant to discover a wide variety of color shades on the saxophone (see § 2.2.2 and § 3.3).

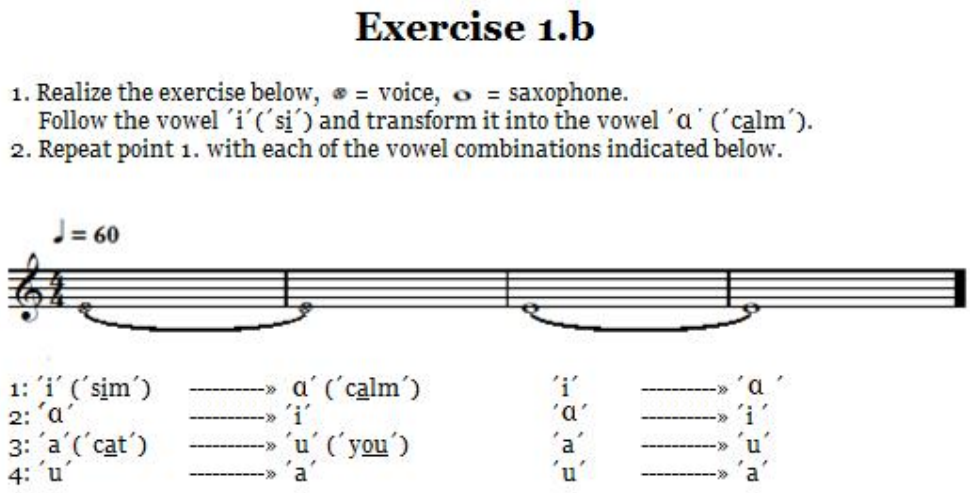

Figure 14. Short version of exercise 1.b – vowels and timbre.

The objectives of Exercise 1.b are:

1. Discovering a wide variety variety of tonal shades on the saxophone by transforming one vowel into another.
2. Feeling that small change in the vocal cavity has a direct influence on the saxophone timbre.

Exercise 1.b is again a combination of singing and playing. The participant is asked to sing the vowel ´i´ and to transform this vowel slowly into the vowel ´ɑ´ (as in: ´calm´). Afterwards the participant is asked to repeat this process while playing the saxophone. I expect the participant to feel the changes of the vocal cavity caused by the tongue position, and to relate this to changes in the saxophone timbre.

I suggested the following vowel combinations: ´i ´ and ´ɑ´, ´ɑ´ and ´i´, ´a´ and ´u´, ´u´ and ´a´. As shown in section 3.3, these vowel combinations are opposites. ´i´ for example is a vowel with the tongue position close to the hard palate of the mouth and the tip of the tongue is in front of the mouth. ´ɑ´ is the total opposite vowel in comparison to ´i´ because the tongue position of the vowel ´ɑ´ is with the tongue far of the hard palate of the mouth (open) and the tip of the tongue closer to the back of the mouth. The vowels ´a´ (open, front) and ´u´ (close, back) are opposite vowels as well (see §3.3).

4.2.3 Exercise 2

Exercise 2 explores the relation between consonants and saxophone articulation. The aim is to increase the articulation possibilities of the participant and to train clearer articulation. Each time the participant changes to a different consonant, the position of the tongue changes and this will have an immediate influence on the saxophone articulation (see § 2.2.3 and § 3.4). The switch between singing and playing will help the participant to feel the tongue position of each consonant in the mouth cavity, before imitating the consonant with the saxophone.

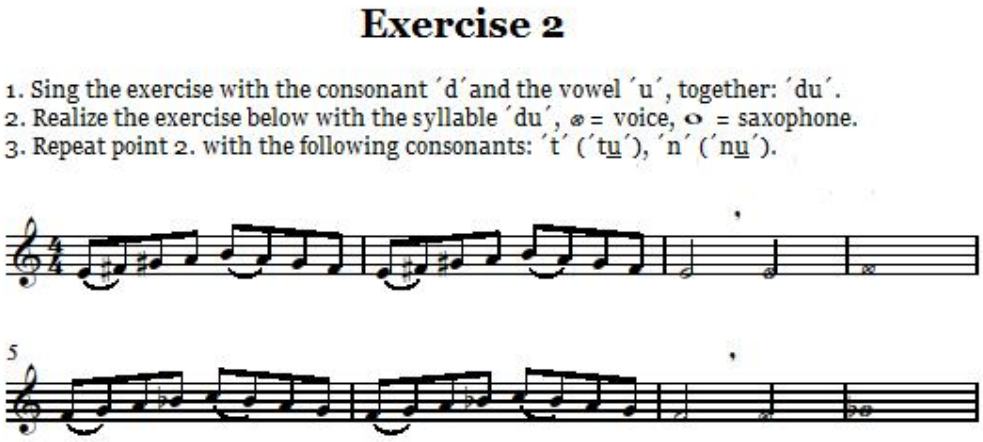

Figure 15. Short version of exercise 2 – consonants and articulation.

The objectives of Exercise 2 are:

1. Increase of the articulation possibilities and clearer articulation.
2. Relating place and manner of articulation of each consonant to a specific type of articulation on the saxophone.

Exercise 2 is based on a warming-up exercise for singers and the structure is similar to exercise 1. The participants are used to traditional indications of articulation such as, legato, staccato and tenuto. These indications are necessary, but cannot be used as a strategy to improve articulation. The use of consonants in the training of articulation offers a non-traditional approach to articulation. Based on empirical research (see § 3.4) I expect that this exercise will help participants in the process of studying articulation on the saxophone.

During the first step of Exercise 2, the participant is asked to sing the exercise with the consonant ´d´ and the vowel ´u´, which together form the syllable ´du´. The ´u´ is a close vowel produced in the back of the mouth (see § 3.3). Based on empirical research and on the experts´ judgments, this vowel will result in a projected, voluminous, warm and bright sound and that´s the reason why I chose for this vowel in Exercise 2.

As the participant sings the exercise, he/she needs to switch between legato and accentuated notes due to singing with longer syllables (legato) and shorter syllables (accentuated notes). The result in something like: ´du - u – du – du – du - u – du – du´. While the participant sings the exercise with the syllable ´du´, he/she has to think about the articulation from a completely different perspective, namely outside the saxophone and from a singer´s point of view. This will help the participant to create a clearer image of the articulation before playing (see § 2.2.1). Besides, the constant switch to singing helps the participant to feel the place and manner of articulation of the consonant repeatedly in the mouth. The goal is for the participant to maintain the position of the tongue of the consonant the same while playing saxophone.

During step 3 of Exercise 2 the participant is asked to repeat step 2 with the consonants ´t´ and ´n´. The consonants ´d´ and ´t´ are similar because both are produced in a plosive way, which means that the airflow is stopped using the hard palate, followed by a sudden release of air (see § 3.4). This manner of articulation is perfectly applicable in a saxophone articulation (see § 3.4.1). The participants can experience the feeling of the consonants in the mouth, and try to imitate the consonant´s tongue position literally.

The consonant ´n´ differs from the consonants ´d´ and ´t´ because producing the consonant ´n´ requires a nasal manner of articulation (see § 3.4). This means that the resonances of the nasal cavity will contribute to the sound of the consonant due to the raising of the soft palate in the back of the mouth (IPA 1999). The consonant ´n´ is not directly applicable to the saxophone articulation (see §3.4.1.1), but I chose this consonant for the participant to imitate the sound of the consonant and to discover a new type of articulation. I aim at an imitation of the sound-result of the consonant ´n´ rather than the imitation of the tongue-position.

4.2.4 Exercise 3

Exercise 3 aims at relating linguistic stress to agogic in order to improve musical phrasing. In addition, Exercise 3 combines the skills of exercise 1 and 1b: vowels and timbre, and 2: consonants and articulation.

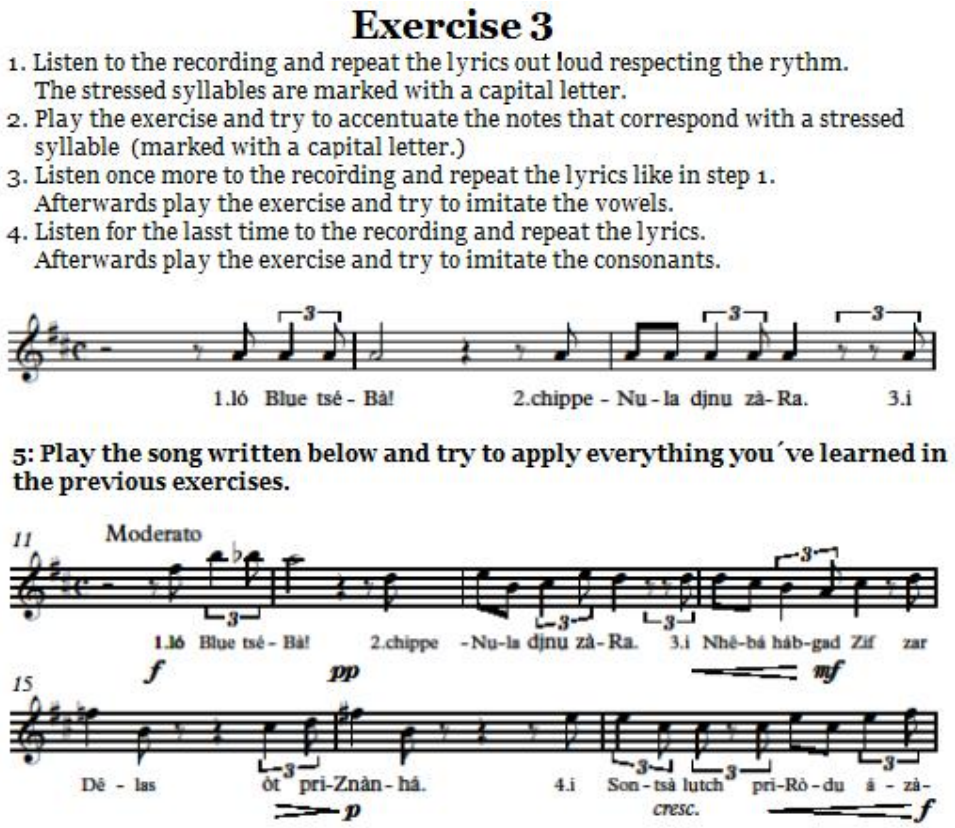

Figure 16. Short version of exercise 3 – linguistic stress and musical phrasing, vowels and timbre, consonants and articulation.

The objectives of Exercise 3 are:

1. Improving musical phrasing through the analysis of linguistic stress and the use of agogic.
2. Using skills of previous exercises to improve the musical interpretation of a song transcription.

Exercise 3 establishes a bridge between the previous exercises, and the interpretation of a song transcription by saxophonists. I have used the first part of a song transcription of *Morning* Op. 4 No. 2 by Rachmaninoff written between 1890 and 1893 (Rachmaninoff, 1998).

During Exercise 3, the participant has to focus on many things at the same time namely musical phrasing, timbre and articulation. To simplify the study process, I have changed the notes of the song fragment used in step 1 – 4 of Exercise 3, to one single note. The rhythm and the song lyrics maintain equal and respect the original version of the song. Later on, during step 5 of Exercise 3, the participant will play the song transcription in its complete and original form.

The notation of the lyrics is in phonetic sounds of the participant´s mother tongue. This means that the participant can say the words as if reading his/her own language, which will result in a reasonable Russian pronunciation.

During the first step of Exercise 3 the participant is asked to listen to a recording. This recording is a spoken version of a fragment of the song lyrics (see Figure 17), which I recorded in April 2013 with the help of my Russian friend Anna Muralova. After listening to the recording, the participant has to repeat the lyrics aloud respecting the rhythm of the song. This will help the participant to notice the syllables with linguistic stress and to feel the flow of the phrases. Syllables marked with a capital letter represent the syllables with linguistic stress. The syllables appear directly under the corresponding notes to make the combination between the notes and the syllables as clear as possible for the participant.

During the second step of Exercise 3 the participant is asked to play the song fragment and give emphasis to the notes (for example with agogic accentuation) that correspond with a syllable with linguistic stress. The aim is for the participant to imitate the flow of the spoken phrases in their musical phrasing.

At the third step of Exercise 3 the participant is asked to listen to the recording once more and to repeat the lyrics aloud. Afterwards the participant hasto play the song fragment and imitate the vowels with his/her saxophone timbre. This part of exercise 3 is can be challenging; the participant has to change the tongue position constantly because of the continuous change of vowels. I expect that this will result in the use of many different tonal shading by the participant.

The fourth step of Exercise 3 is very similar to the third step. The participant has to listen to the recording, say the lyrics aloud, play the saxophone and imitate the consonants with his/her articulation. Not all consonants are directly applicable as modes of saxophone articulation (see § 3.4.1.1) but the imitation of the sound-result and/or tongue position of the consonants will help the participant to discover a greater variety of saxophone articulation.

The fifth step of Exercise 3 is a conclusion of all the previous exercises. The participant has to play the original song fragment and to include all the skills trained in the previous exercises. The aim is for the participant to train the ability of applying any kind of

timbre and articulation and to improve the quality of the musical phrases according to the musical context.

4.3 Participants

The experiment has been proposed to 13 trained saxophonists, who at the time were enrolled in a bachelor or master degree in music performance. Table 7 enumerates all participants and provides some basic information such as participant number, age and years of saxophone playing experience.

Table 7. Overview of the participants´ age and years of experience in saxophone.

Participant´s Number	**Year of Birth**	**Years of experience**
1	1990	11
2	1992	9
3	1993	13
4	1988	16
5	1992	11
6	1992	11
7	1989	15
8	1991	12
9	1991	8
10	1993	10
11	1986	14
12	1991	15
13	1991	12

The choice of the participants felt on this group of people, because they are all at a similar stage of development and therefore their results can be comparable. It is assumed that all participants have a basic knowledge of the three parameters in study, *i.e.*, timbre, articulation and musical phrasing, given their education background (graduate and post-graduate level).

I have chosen a convenience sample procedure given the accessibility and proximity of the participants. From the 17 participants to whom the experiment has been proposed,

only 13 have successfully finished it. Four participants did not conclude the experiment in due time and thus were not considered in the analysis of the results.

4.4 Recording Material

I have tried to maintain the recording circumstances as equal as possible during the recordings of the participants. However, because of the different locations were the participants lived and studied I was not able to record all of the participants in the same space. Yet, most of the recordings maintain the same acoustic circumstances.

Except for participant 10, I recorded all participants with a Zoom H1 recorder. The distance between recorder and each of the participants was more or less one meter and a half.

4.5 Experts

A group of experts evaluated the results from the experiments. The experts comprise a group of eight experienced saxophonists and saxophone teachers from Portugal and The Netherlands. The experts teach at both undergraduate and post-graduate levels at the Superior School of Performing Arts (ESMAE) at the Polytechnic Institute of Porto, Aveiro University and the Fontys Conservatory of Tilburg. The experts are from different locations in Portugal and The Netherlands and most of them teach and perform for more than 10 years.

Table 8 below presents the experts who participated in the evaluation of the experiment, regarding name, gender, age, and years of experience as a teacher and as a performer.

Table 8. Overview of the panel of experts in the devised experiment.

Expert´s Name	**Gender**	**Nationality**	**Years of teaching experience**	**Years of performance experience**
Ana Irene Rodrigues	Female	Portuguese	5	15
Andreas van Zoelen	Male	Dutch	18	17
Fernando Ramos	Male	Portuguese	13	20
Francisco Ferreira	Male	Portuguese	26	26
Henk van Twillert	Male	Dutch	35	44
JaapDijkhuizen	Male	Dutch	15	15
Jody Vianen	Female	Dutch	8	8
Romeu Costa	Male	Portuguese	11	23

Table 8 enumerates all experts who participated in the evaluation of the experiment. In addition, Table 8 provides information concerning name, gender, age, and years of experience as a teacher and performer of all experts.

4.6 Questionnaires

I have developed a questionnaire for (i) the participants (see Appendix 1) and (ii) the experts (see Appendix 2). I asked the participants to write about their experiences after fulfilling the experiment. I asked the experts to listen to the participant´s recordings and to evaluate them by filling in the questionnaire. Besides the participant´s recordings, I have sent the experts seven small sound fragments. Four sound fragments contain recordings of myself playing with the four extreme vowels (i, a, u, α) used in exercise 1, 1b, and 3. The other three sound fragments contain recordings of myself playing with the three consonants (d, t, n) used in exercise 2 and 3.I have asked the experts to describe respectively the quality of the sound and the articulation of these sound fragments.

4.7 Procedures

Part I

I contacted two saxophone teachers at the superior schools of Porto (ESMAE) and Aveiro (Universidade de Aveiro) and these teachers gave me full support to record the majority of their students. I contacted the students and granted them anonymity.

Stage overview:

S.1 Before playing, the participants got the opportunity to listen to the original song, *Morning* Op. 4 No. 2 by Rachmaninoff (Rodgers, J. et. all, 1994-1995) and to read the notes of the song transcription (see Figure 17).

S.2 Afterwards, I recorded the participants playing a fragment of the song *Morning* Op. 4, No. 2 by Rachmaninoff which I transcribed for saxophone (see Figure 17).

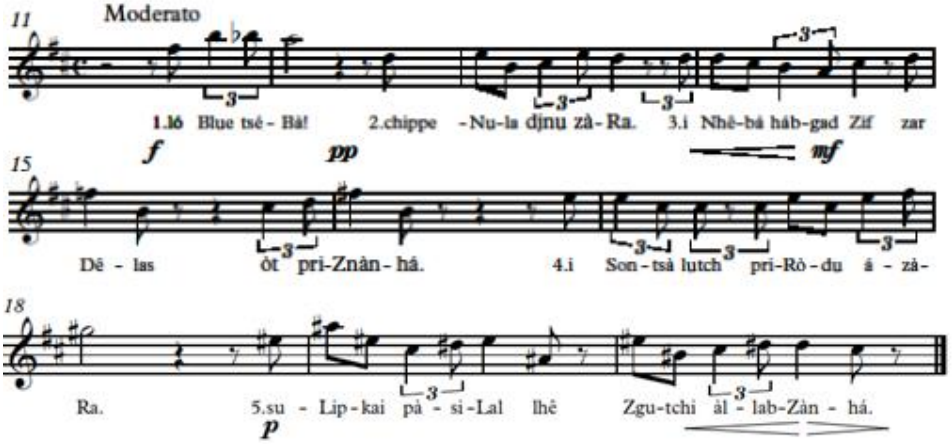

Figure 17. Fragment of the Song *Morning* Op. 4 No. 2 by Rachmaninoff used for the recordings of the participants before and after exposure to the exercises.

S. 3 After the first recording, I asked the participants to study the four exercises during a period of approximately three to four weeks.

S. 4 After the exposure to the exercises, I recorded the participants a second time. The participants played the same music fragment (see Figure 17).

S. 5 After the second recording, each of the participants filled in a questionnaire with questions about their experiences while studying the exercises (see Appendix 1). With the participants´ questionnaire, I aimed at answering the following questions:

1. Did the student think he/she developed a richer tone and/or a greater variety of timbres through the vowel exercises?
2. Did the student think he/she developed a greater variety of articulation through the consonant exercises?
3. Did the student think he/she got a better understanding and practice of musical phrasing by analyzing linguistic stress?
4. Did the student think he/she improved the general interpretation of the song of Rachmaninoff?

Note regarding stage 3: the participants had the exercises for a different number of weeks. Six of the participants (group 1) were exposed to the exercises for three to four weeks, while seven of the participants (group 2) were exposed to the exercises for seven to eight weeks. The reason for the long exposure of the exercises to the second group is that I recorded the participants of this group before they went abroad for three weeks. One week after their arrival, I reminded this group of studying the exercises. Although the participants of the second group had the exercises with them for a longer period, they busy with school activities abroad and during this period, they did not practice the exercises. For that reason, the experts have analyzed all of the participants as one group. After all, all of them did study the exercises for 3 until 4 weeks.

Part II

S.6 A panel of experienced saxophonists evaluated the recordings of each participant before and after exposure to the exercises. The evaluation takes in account the following parameters:

1. **saxophone timbre –** the richness of the saxophone timbre (balanced in harmonics and full of different color shades);
2. **saxophone articulation –** the use of different types of articulation;
3. **musical phrasing –** the quality of the musical phrasing (the use of agogic accents).

S.7 Experts filled in a questionnaire (see appendix 2), which contains a short description of the research experiment and an explanation of the evaluation procedure. The experts evaluated the participants with a five points scale (1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent).

The experts have listened to two recordings per participant, one before and another after the exposure to the exercises.

Table 9. Participants´ number and the order of their recordings as presented to the panel of experts.

Participant´s Number	**1**	**2**
1	After	Before
2	After	Before
3	Before	After
4	Before	After
5	After	Before
6	Before	After
7	After	Before
8	After	Before
9	Before	After
10	After	Before
11	After	Before
12	Before	After
13	Before	After

The order of the recordings per participant (before and after) was presented to the panel of experts in a randomized order to maintain maximum objectivity (see Table 9).

4.8 Results and Discussion

This section examines the evaluation results of the experiment by the experts and the participants´ questionnaire. The experts´ evaluation shows a slight tendency for improvement, despite the fact that the difference in the pre and post-exercises evaluation was non-significant. But perhaps most important, as we shall see in this section, is the fact that both the participant's reactions to the experiment the subjective feeling of effects it had on their performance were quite positive.

The majority of the participants (eleven of thirteen) indicated that their interpretation of the song fragment generally improved after they have studied the exercises, namely as regards the timbre, the articulation and the direction of the phrases. Most participants mentioned that the exercises obliged them to vocalize, which resulted in a greater timbre and articulation variety. In addition to this, one participant mentioned that the exercises helped him to play big interval jumps more homogeneously and two stated that the exercises provide a practical strategy to study timbre and to explore a personal saxophone sound. Another remark mentions that not all vowels and consonants are directly applicable, but that the proposed study approach is useful to create a clearer concept of timbre and articulation. The participants commented that they learned a lot from the experiment and some of them suggested they would like to continue their study with the exercises.

There are several reasons, which might explain the difference between the objective results of the experts´ evaluation and the subjective feelings of the participants reported in the questionnaire. On the one hand, participants might have had a shorter amount of time of exposure to the exercises than necessary. In this way, one might speculate that the results of the experts´ evaluation could eventually be more expressive if the participants had more time to study the exercises and internalize new learned approaches to timbre, articulation and musical phrasing. In addition, changes in timbre, articulation and musical phrasing are small and delicate. On the other hand, participants had to focus on timbre, articulation and musical phrasing and this might have been too much information at the same time. This does not make the changes less important, on the contrary, but the differences might have been more difficult to notice by the panel of experts.

4.8.1 The Influence of Vowels on the Saxophone Timbre

The results of the experts´ evaluation as to timbre show that the participants only slightly improved their timbre after studying the exercises (see Figure 18).

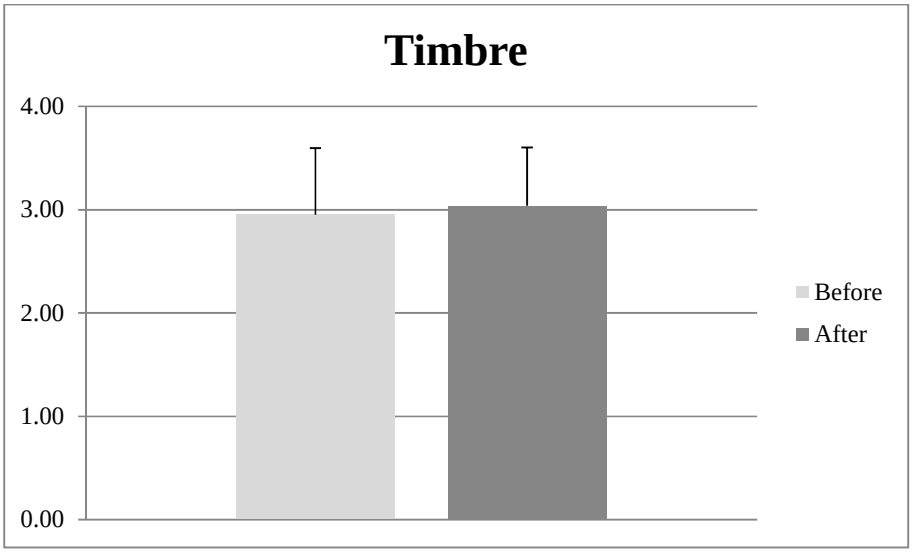

Figure 18. Experts' evaluation before and after exposure to exercises (vowels and timbre).

A paired-samples t-test was conducted to compare the students' grades prior to (mean=2.95, sd.= 0.64) and after (mean=3.04, sd.= 0.56) playing the exercises for timbre. Results were *non-significant* for a level of 5%.

The results from questionnaires of the participants indicate that the exercises with vowels were helpful for all of the participants to explore a bigger variety of tonal shadings on the saxophone. Therefore, it can be concluded that the exercises proposed were useful for the participants to explore different timbres. Similarly, the totality of the participants noticed perceivable sound differences each time they changed to a different vowel.

In addition, a majority of the participants (eight of thirteen) pointed out that the exercises made them more aware of timbre possibilities and helped them to create a clearer sound image. A small group of participants (five) even mentioned that their timbre changed positively after the exposure to the exercises.

These results are in line with Ioan (2007), Liebman (1994) and Ramos (2013). According to the authors, the first step to get to explore timbre is to create a clear image of sound and then to further explore the timbre possibilities on the instrument. Although Ioan (2007) focused on the flute practice, the exercises she suggests in her research seemed to have the same positive results.

The majority of the participants indicated the vowel ´u´ as their favorite vowel. Participants commented that the vowel ´u´ gave a warm, full and dark saxophone timbre and a projected sound. This preference of the participants differs from Liebman and Ramos who propose the ´i´ (as in the word ´she´) as the ideal tongue-position in order to create maximum velocity of air, and minimum waste.

Although the vowel ´i´ (as in the word ´she´) is more closed (IPA, 1999) and offers an optimal airflow according to Liebman (1994) and Ramos (2013), the majority of the participants of this study (eight of the thirteen) referred to ´u´ as the vowel which is comfortable to imitate on the saxophone and results in a warm saxophone sound. A possible explanation for this difference is that this research experiment did not focus on the projection of the saxophone sound. The participants evaluated their own sound by listening to themselves while playing. The sound of the vowel ´u´ may result in a full and warm sound close to player, but will probably have less projection especially in a larger room, then the vowel ´i´.

There was no general tendency regarding to the vowels the participants did not like. A small group of participants (five of thirteen) did not like to imitate the vowel ´a´ on the saxophones. The main pointed reason was the too open sound result, the not functionality of the vowel in combination with the mouthpiece and reed choice and the too open throat which tires the player. This dislike is in line with Liebman (1994) and Ramos (2013) who propose a not too open tongue-position in order to maintain stable airflow. The other participants did not like the vowel ´i´ (four of thirteen) and the vowel ´e´ (two of thirteen); one participant did not like the vowel ´u´.

4.8.2 The Influence of Consonants on the Saxophone Articulation

The experts´ evaluation demonstrates a slight tendency to improvement after the participants studied the exercises (see Figure 19).

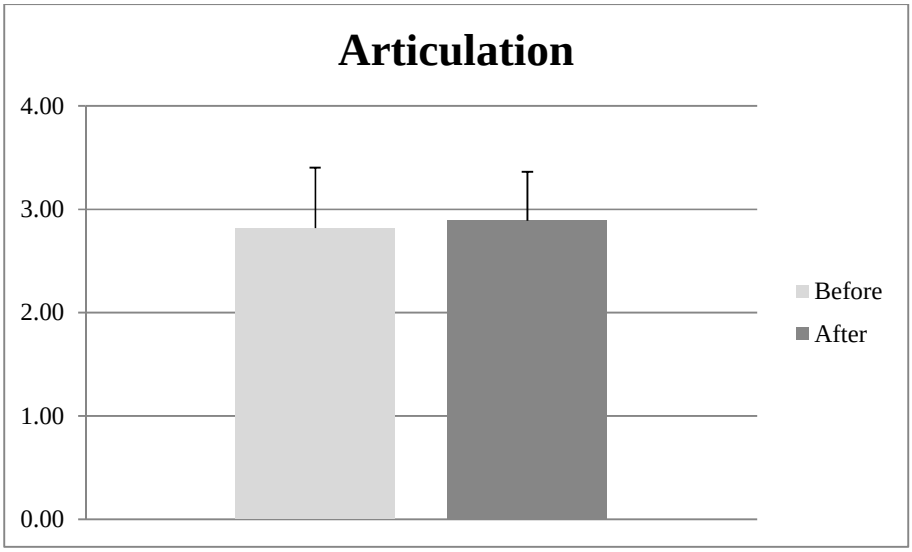

Figure 19. Experts' evaluation before and after exposure to exercises (consonants and articulation).

In order to ascertain possible differences, a paired-samples t-test was conducted to compare the students' grades prior to (mean=2.82, sd.= 0.59) and after (mean=2.89, sd.= 0.47) playing the exercises for articulation. Results were *non-significant* for a level of 5%.

Results from the questionnaires indicated that the great majority of participants (eleven of thirteen) referred that the exercises regarding consonants and articulation were helpful to explore a bigger variety of articulations on the saxophone. Some of the participants (five of thirteen) commented that they were already familiar with the use of consonants as modes of articulation, because of their work with Fernando Ramos.

The results of the participants´ questionnaire regarding the relation between consonants and articulation were generally in line with researchers such as Liebman (1994) and Quantz (2001). Liebman and Quantz both propose the consonants ´t´ for *staccato* and lighter articulation, and ´d´ for softer, *tenuto*-like articulation. Liebman (1994) also proposes the consonant ´n´ for intense articulation. The participants mentioned that the consonants ´d´ and ´t´ were easy to apply as modes of articulation on the saxophone. The consonant that the majority of the participants (seven of thirteen) preferred to use was ´d´. Reasons for that choice as indicated by the participants were the soft and clear articulation results on the saxophone.

Almost half of the participants (six of thirteen) indicated that their articulation had changed after they studied the exercises. Two of this group of participants mentioned that the exercises were helpful in order to create a clear concept of articulation and that they consequently gained more control.

The totality of participants had never used the consonant ´n´ as mode of articulation on the saxophone. They noted that this vowel as the vowel they least liked to use. The overall reason for the dislike of the consonant ´n´ was the difficulty of imitating the consonant on the saxophone. However, three participants indicated the consonant ´n´ as their preferred mode of articulation. The few participants who liked to play with the consonant ´n´ mentioned different articulation results. Two participants liked to use the consonant ´n´ because they stated it offers an equal and clear articulation. However, another participant liked the consonant ´n´ for a different reason, namely because he stated that if offers a faster *staccato* with a soft attack. The results regarding the consonant ´n´ aren´t in line with Liebman (1994), who indicates that one might use the consonant ´n´ for intense articulation.

An explanation for these different opinions might lay in the fact that the consonant ´n´ cannot be imitated literally (see § 3.4.1.1) because the manner of articulation of the consonant is nasal according to the IPA (1999), which means that the nasal cavities contribute to the sound of the consonant. When a saxophonist tries to imitate this consonant literally, the tongue might stop the airflow. Probably most saxophonists imitated the consonants literally, while it would have been better to imitate the sound result of the consonant.

The majority of the participants (eleven of thirteen) noticed the positive effects of using consonants as a strategy to discover a bigger variety of articulation and mentioned they would like to continue exploring the articulation possibilities.

4.8.3 The Influence of Linguistic Stress on Musical Phrasing

The experts´ evaluation results indicate that the participants slightly improved their musical phrasing after exposure to the exercises (see Figure 20).

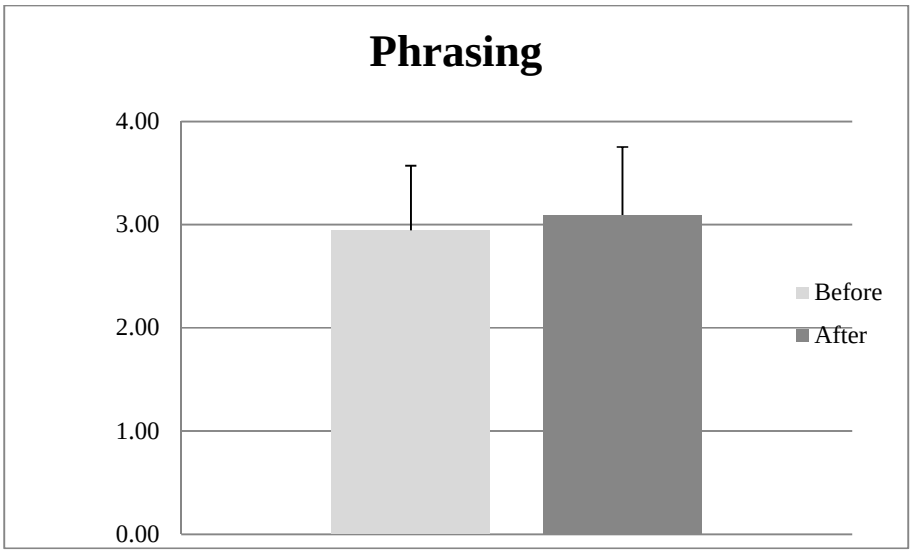

Figure 20. Experts' evaluation before and after exposure to exercises (stress and musical phrasing).

In order to ascertain the degree of difference between the means, a paired-samples t-test was conducted to compare the students' grades prior to (mean=2.95, sd.= 0.62) and after (mean=3.09, sd.= 0.65) playing the exercises for phrasing. Results were *non-significant* for a level of 5%.

Results from the participants' questionnaires, indicate that the exercises relating linguistic stress and musical phrasing helped them to improve musical phrasing. Most participants (twelve of thirteen) mentioned that their phrasing in the song fragment of Rachmaninoff improved after they analyzed the linguistic stress of the song lyrics. This result is surprising, because none of the participants had ever used linguistic stress as strategy to improve musical phrasing. Half of the participants (seven of thirteen) thought their musical phrasing improved in general and some of them (two of thirteen) argued that they expect the exercises to improve the interpretations of especially Romantic music and song transcriptions.

The results of the experts´ evaluation and the participants´ questionnaire are in line with the presented hypothesis that comparing linguistic stress and agogic in music might improve the direction and quality of musical phrasing.

Chapter 5 - Conclusion

5.1 Summary

The present thesis made use of linguistics and the singing practices as a strategy to improve a saxophonist´s performance of a song transcription. The method adopted compares linguistic and musical features in a non-direct way; however, their association raises very important issues for a saxophone performance.

In Chapter 2, I presented the studies of Rascher (1994) and Ioan (2007) which indicated that singing is important in the process of creating a clear sound image. According to Ioan (2007), playing with vowels influences the resonance in the vocal cavity and therefore reinforces the partials of the flute tone. In addition to this, I presented Liebman's strategy for discovering different tonal shadings and maximum air velocity on the saxophone by using various tongue positions (Liebman, 1994). It is possible to conclude that vowels have a strong influence on tone producing and that studying with vowels helps developing a personal sound on the saxophone. As far as the consonants are concerned, Liebman (1994), and Quantz (2001) propose the use of consonants as a means to improve the clearness and the various possibilities of articulation of flute and saxophone players.

Another important point mentioned, was that according to Lerdahl and Jackendoff (1983) the tree structures that encode the time-span reduction of musical sequences and prosodic structures are comparable in form, yet different in substance. However, the structure of both elements may be comparable, which supports further research relating linguistic stress and musical phrasing.

In chapter 3, I addressed musical features and their parallel to linguistic features according to the IPA (1999), which provided fundamental information of vowels, consonants and linguistic stress for the present thesis. The production of vowels is comparable to the production of the saxophone timbre because both imply and open and/or slightly narrowed position of the vocal tract. One might use all vowels of the alphabet as strategy to develop timbre. However, in the presented thesis, I selected the four extreme vowels (IPA 1999) because they imply the four most contrasting tongue positions in the mouth, which consequently results in four different saxophone timbres.

Consonants are comparable to saxophone articulation because generally both involve the alternation of narrowing or closure of the airflow followed by an opening of the airflow. Based on the human physiognomy and the saxophone embouchure position, I could state that a small group of consonants, namely ´d´ and ´t´, are literally applicable as modes of articulation on the saxophone as their manner and place of articulation lay close to the position of the tongue of a saxophonist when playing. Other consonants, namely ´j´, ´k´, ´t´

and ´r´ can be used a strategy to develop extended techniques on the saxophone. The remaining consonants of the alphabet, such as ´n´, aren´t directly implacable as modes of articulation, but one might imitate the sound result of certain consonants to discover a larger variety of articulation on the saxophone.

Both agogic and stress use the emphasis of an element to sign the importance of a certain element, stress in linguistics and agogic in music. Both features are part of a phrase, or a so-called time-span.

As regards to (i) the influence of vowels on the saxophone timbre, the results of the participants´ questionnaires are indicated that the totality of participants referred sound differences each time they changed to a different vowel. Furthermore, the majority of the participants pointed that the exercises made them more aware of timbre possibilities and helped them to create a clearer sound concept. In this way, it might be concluded that the proposed vowel exercises helped all of the participants to discover a bigger variety of tonal shadings on the saxophone. However, according to the experts´ evaluation, the difference in the evaluation prior to and after the exercises was *non*-significant. One possible explanation might be that perhaps the participants would need more time to interiorize the new study approach. This is certainly a way to proceed in a future research, together with a bigger sample of both participants and experts.

The results of the experiment also showed that the influence of (ii) consonants to articulation is less significant than the influence of vowels to the saxophone timbre. Although most of the participants indicated in the questionnaire that the exercises regarding consonants and articulation were helpful to explore a bigger variety of articulation on the saxophone, it did not show in the recordings as evaluated by the experts. Additionally, the majority of the participants indicated that their articulation did not change after studying the exercises, but some of the participants argued they were already familiar with the strategy of using consonants as modes of articulation. Nevertheless, most of the participants mentioned that the exercises were helpful for them, because it made them aware of different articulation possibilities. In sum, they gained a better control over their articulation and discovered new types of articulation. Based on the participants´ questionnaires and on their slight progress, it might be argued that with more time the participants might develop results that are more significant as far as articulation is concerned.

Regarding (iii) the influence of linguistic stress to musical phrasing, the results of the experiment show that the analysis of linguistic stress in song lyrics improves the musical phrasing of the same song. The exercises regarding linguistic stress and musical phrasing helped the participants to improve their musical phrasing of the song fragment and the experts´ evaluation shows that a small majority of the participants improved on that aspect too. However, a considerable group of the participants probably would have needed more time to interiorize the exercises regarding linguistic stress to improve their musical phrasing significantly. Almost all participants indicated in the questionnaire that their interpretation of the song fragment improved after exposure to the exercises. A small majority even thinks their musical phrasing has changed in general, also in musical pieces that are not songs.

The present research presented a strategy of studying through a systematic set of exercises, which measured the relation between linguistic and musical features. The results indicated that the use of vowels, consonants and linguistic stress is functional and might improve the performance of a song transcription. The participants stated that the research exercises were helpful to them, because they were able to create clear images of timbre and articulation and consequently gained more control about the two topics. In addition to this, the strategy of analyzing linguistic stress improved the musical phrasing of a majority of the participants, as stated by them. The relation between linguistic stress and musical phrasing through agogic is an area scarcely investigated. This research established a first step, which shows room for further research possibilities.

In the future it woud also be useful to measure the influence of vowels, consonants and linguistic stress on, respectively, timbre, articulation and musical phrasing on the saxophone, I would suggest repeating the experiment applying a convenience sample procedure with some differences. First, I would suggest accompanying the participants during the study of the experiment exercises, for example in the context of saxophone lessons. Second, in order to stimulate the interiorizing process and to achieve significant results, the exposure time to the exercises should be larger. Thirdly, I would suggest the imitation of the sound results of the group of consonants that is not literally imitable in the research exercises about articulation.

Likewise, it would be interesting to investigate the relation between vowels and sound projection. Furthermore, from an educational point of view, it would be interesting to investigate the possible influences of linguistic features to musical features with beginners and to evaluate the development of timbre, articulation and musical phrasing. Finally, I would suggest an expansion of the research to evaluate the strategy of applying linguistic features into the study of musical features to not only saxophone players, but to woodwind players in general.

5.2 Personal Note

During my master study at ESMAE in Porto, I mainly worked on my development as a saxophone player and the thesis. I wanted to investigate a topic, which would help me to develop myself as a saxophonist. During the process of the investigation, I have tried to apply my own hypothesizes in my daily study. This, in combination with my saxophone lessons, helped me to achieve the goal I set for myself at the beginning of my master study namely to develop the ability of playing with a wider variety of tonal shadings, a feature that my teacher also supported. In addition, I was able to improve the clearness of my articulation and the quality of my musical phrasing. In this way, the strategy of studying with vowels, consonants and linguistic stress really helped me to develop myself as a musician. My master recital contained a variety of pieces which are all somehow related to language and/or singing. I have added a small selection of my recital to this thesis. The recital was recorded at Café Concerto at ESMAE in Porto, Portugal on July 5, in 2013.

1. Tre Pezzi I (1956) – Giacinto Scelsi (1905-1988)

Tenor Saxophone – Tine Trijntje van den Geest

2. Pas de Deux (1994) – Alexander Raskatov (1953)

Voice and Chimes – Jenny Moreno,

Saxophone Tenor and Soprano – Tine Trijntje van den Geest

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Appendixes

1. Questionnaire for participants of the research experiment

Questionnaire

Questions about exercise 1

1. In exercise 1 you were asked to play with the vowels: i, a, u, e. Is there a vowel that you liked to use and why?

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2. Is there a vowel that you didn't like to use and why?

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3. Did you discover a bigger variety of saxophone timbres by experimenting with different vowels?

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4. In exercise 1b you were asked to change from vowel to vowel. Did you notice any differences in your sound each time you changed to a different vowel?

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…….

5. Do you think your saxophone timbre has changed in general after studying the vowel exercises? If yes, did it change in a positive or negative way?

……
……
……

Questions about exercise 2

6. In exercise 2 you were asked to play with the consonants: d, t and n. Is there a consonant that you liked to use and why?

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7. Is there a consonant you didn't like to use and why?

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…….

8. Did you notice a different kind of saxophone articulation each time you changed to a different consonant?

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9. Did you discover a bigger variety of articulation by experimenting with different consonants?

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10. Did your articulation change in your daily practice? If yes, did your articulation change in a positive or negative way?

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Questions about exercise 3

11. Do you think your musical phrasing improved by analyzing the linguistic stress of the song lyrics of Rachmaninoff?

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12. Do you think your musical phrasing improved in other pieces that are not songs due to the exercises you have done?

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13. Do you think your interpretation of the Rachmaninoff songs improved in general after doing exercise 3? If positive, what aspects improved due to the exercises?

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Final questions

14. Did you learn anything from this experiment? If positive, what have you learned?

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15. Do you have any more comments that you would like to share regarding this experiment?

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……
…….

Thank you very much for your participation!

Participant's Number:

……

Date and Place:

……

Signature:

……

2. *Questionnaire for the jury of the research experiment*

Questionnaire

Description of the done experiment

This experiment aims to discover the relationship between vowels and timbre, consonants and articulation and linguistic stress and musical phrasing. The experiment exists of four different exercises (1, 1b, 2 and 3).

1. Exercise 1 and 1b explore the relation between vowels and saxophone timbre.
2. Exercise 2 explores the relation between consonants and saxophone articulation.
3. Exercise 3 combines the previous exercises and explores the relation between linguistic stress and musical phrasing.

A group of 13 bachelor and master students participated anonymously in the experiment. I have recorded each of the participants playing a fragment of a song by Rachmaninoff (Morning, Op. 4 No. 2, 1890-1893) which is a part of exercise 3. Before playing the participants had the time to listen to the original song and to read the notes. After the first recording the participants were asked to study the four exercises during a period of three to four weeks. After this study period I recorded the participant a second time playing the same music fragment.

Your role in the experiment

I would like to ask you to analyze the results of my experiment. Together with other experienced saxophonist I hope you can give an objective opinion about the recording before and after the exercises. I will give a short description about the analyzing process.

Thank you very much for your participation!

Tine van den Geest.

Description of the analyzing process

Please listen to the recordings and fill in the questionnaire. The recordings are marked by numbers but the recording order (before or after the study period) is mixed.

The parameters that we are measuring are:

4. **Saxophone timbre –**The richness of the saxophone timbre(balanced in harmonics and full of different color shades).
5. **Saxophone articulation –**The use of different types of articulation.
6. **Musical phrasing –**The quality of the musical phrasing (the use of agogic accents).

Evaluate each participant with a note in a scale of 1 to 5:

1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent

Feel free to leave comments with your opinion about the participants and their parameters.

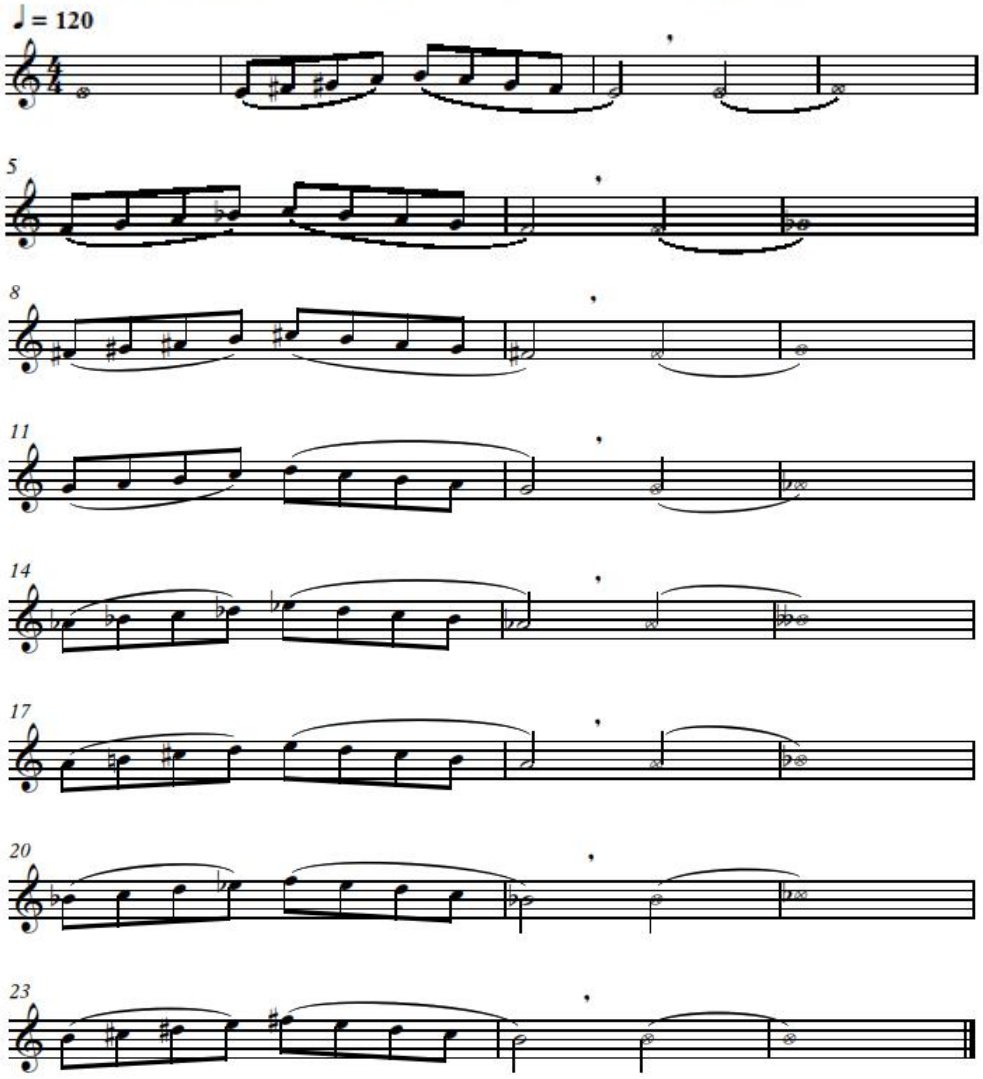
Participant 1 / Recording 1					
Parameter	**1**	**2**	**3**	**4**	**5**
Timbre					
Articulation					
Phrasing					
Participant 1 / Recording 2					
Timbre					
Articulation					
Phrasing					
Comments:					

Participant 4 / Recording 1					
Parameter	**1**	**2**	**3**	**4**	**5**
Timbre					
Articulation					
Phrasing					
Participant 4 / Recording 2					
Timbre					
Articulation					
Phrasing					
Comments:					

3. *Exercise 1*

Exercise 1

1. Sing the exercise humming. Feel the ressonance in your nose, mouth, throat and chest.
2. Sing the exercise with the vowel ´i´ (such as in the French word ´si´).
3. Realize the exercise below with the vowel ´i´ 𝅘𝅥 = voice, 𝅝 = saxophone.
4. Repeat point 2. and 3. for each of the following vowels: ɑ, (´calm´) u, (´you´) a (´cat´)



4. *Exercise 1b*

Exercise 1.b

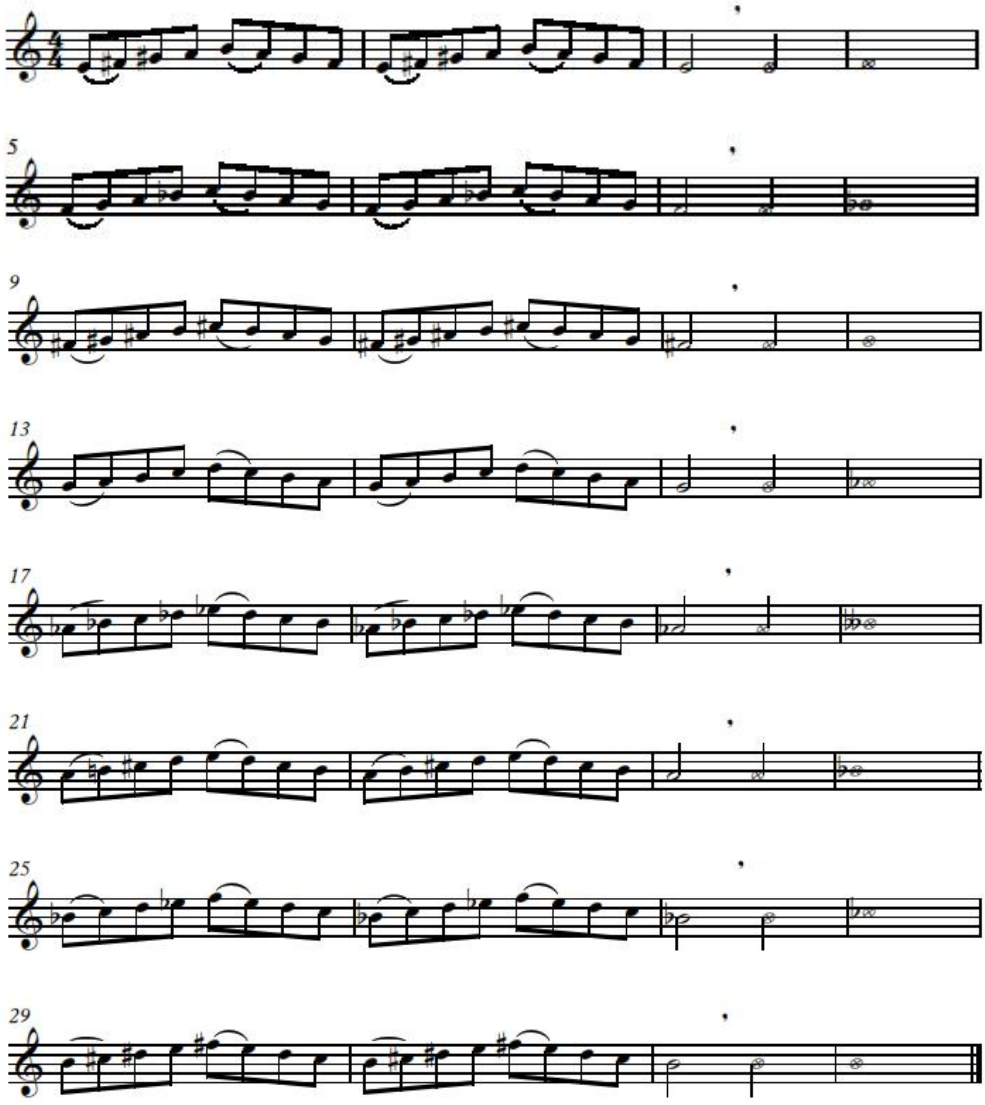
1. Realize the exercise below, 𝅘𝅥 = voice, 𝅘𝅥 = saxophone.
   Follow the vowel ´i´(´si´) and transform it into the vowel ´ɑ´(´calm´).
2. Repeat point 1. with each of the vowel combinations indicated below.

1: ´i´(´sim´)	----------»	ɑ´(´calm´)	´i´	----------»	´ɑ´
2: ´ɑ´	----------»	´i´	´ɑ´	----------»	´i´
3: ´a´(´cat´)	----------»	´u´(´you´)	´a´	----------»	´u´
4: ´u´	----------»	´a´	´u´	----------»	´a´

5. *Exercise 2*

Exercise 2

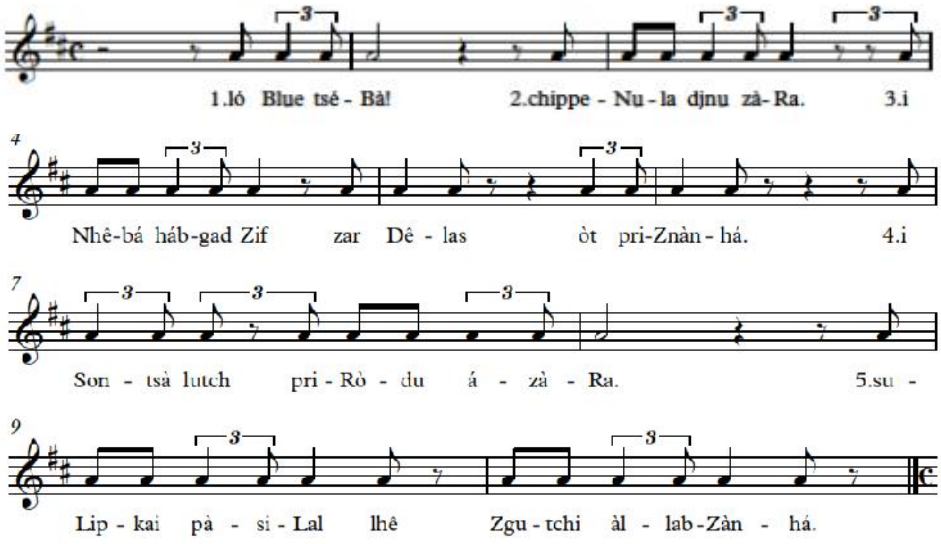
1. Sing the exercise with the consonant ´d´and the vowel ´u´, together: ´du´.
2. Realize the exercise below with the syllable ´du´, 𝄞 = voice, 𝅝 = saxophone.
3. Repeat point 2. with the following consonants: ´t´ (´tu´), ´n´ (´nu´).



6. *Exercise 3*

Exercise 3

1. Listen to the recording and repeat the lyrics out loud respecting the rythm.
   The stressed syllables are marked with a main letter.
2. Play the exercise and try to accentuate the notes that correspond with a stressed syllable (marked with a main letter).
3. Listen once more to the recording and repeat the lyrics like in step 1.
   Afterwards play the exercise and try to imitate the vowels.
4. Listen for the lasst time to the recording and repeat the lyrics.
   Afterwards play the exercise and try to imitate the consonants.



5: Play the song written below and try to apply everything you´ve learned in the previous exercises.