

A Musical Sonification of the Portuguese Epopee

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Abstract

Sonification is a field that has gained importance in the last few years due to the technological development in the areas of sound synthesis and manipulation. This area can be seen as the auditory counterpart of Information Visualization and it has real meaning when the data sets are too ample and complex to be seen graphically. This paper describes work in progress on the development of a musical sonification of *The Lusiads*, a Portuguese epic poem by Luís de Camões. This work intends primarily to create and explore new ways of reading the Portuguese epopee.

Introduction

In the late 50s, sound waves were digitally represented for the first time (Duarte 2014). This event made sound synthesis and sound composition possible by a computer, which changed both the music and computing world and led to the emergence of the Sonification area.

Sonification can be briefly described as a subtype of auditory display that uses non-verbal sounds to represent information (Barrass and Kramer 1999; Kramer et al. 2010; Minciacchi and Rosenboom 2015; Neuhoff 2011). It consists in the transformation of data and its relationships into acoustic signals (Frazier 2013). This area assumes that the sound is capable of representing data and providing support for information processing and analysis to a form that can be understood by the user (Frazier 2013; Hermann and Hunt 2005; Kramer et al. 2010; Minciacchi and Rosenboom 2015; Park et al. 2010; Vicinanza 2014).

This field is very interdisciplinary because it joins different concepts, such as perception, acoustic, design, arts and engineering, which leads to the necessity of connection between all these areas to develop auditory systems (Kramer et al. 2010). The huge progress of computers in the last few years led to the generation of large amounts of data and changed the way we learn, communicate and explore the world around us (Hermann and Hunt 2005; Kramer et al. 2010).

Although Information Visualization showed up to assist researchers in the analysis of large volumes of data, its

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techniques become sometimes insufficient due to the exponential increase of information that the user wants to access (Hermann and Hunt 2005; Kramer et al. 2010). In this way, sound can be a solution to this phenomenon: New forms of representing larger and dynamic data can be created through Sonification, without becoming too complex for the user understanding (Kramer et al. 2010; Minciacchi and Rosenboom 2015). Sonification provides two new dimensions to transmit data: the sound itself (and its characteristics) and the idea of time. A sonification project can show huge amounts of data in just a few minutes, giving a general overview of the information, as well as the existing trends and patterns. Also, the interdisciplinarity of this field provides conditions to use sonification to improve visualization systems. Powerful audio technologies have also been developed, which, more than ever, show the importance of sound as a data representation technique (Kramer et al. 2010).

The work presented herein explores the field of Sonification applied to poetry. The project intends to transform the characteristics of a well-known Portuguese poetry book, *The Lusiads*, into music. This project was motivated by the will to create a different sonification process, which can take advantage of the sound characteristics to provide poetry information. In this way, it will be created a musical output that reflects not only the sequential structure of the poem, but also its external structure. To better explain the work in progress, the remainder of this paper starts by providing an overview of works in Sonification, namely in Musical Sonification. This is followed by a description of the main aspects of *The Lusiads*. Then, there is a description of the general features of the project and what has already been developed. The paper ends with a conclusion, where the Sonification area and the results obtained so far with this work are objects of reflection.

Applications of Sonification

The main area where Sonification is used is in scientific research: engineering, construction of artificial models, seismic or medical studies (Barrass and Kramer 1999; Frazier 2013; Kramer et al. 2010). Sonification has also a great importance in areas where vision cannot acquire information, such as manufacturing and production control, traffic and visual impairment situations (Barrass and Kramer 1999; Begault et al. 1996; Kramer et al. 2010; Krygier 1994).

Sonification is mainly applied to larger, complex and dynamic datasets (Frazier 2013; Kramer et al. 2010; Minciocchi and Rosenboom 2015), as it can provide alternative ways of representing information, where the size is reduced without a significant loss of information and various dimensions can be simultaneously represented (Hermann and Hunt 2005; Kramer et al. 2010).

This work explores a Musical Sonification, an approach in Data Sonification that intends to take advantage of the act of listening to music and the aspects involved in this action (Ben-Tal and Berger 2004). It is possible to use the changes over the course of a music such as frequency, amplitude, timbre to create a mental image that can be used to represent data.

There are a few projects that explored this type of sonification. Between 1999 and 2000, Marty Quinn created a musical performance, *The Climate Symphony*, where the data of an ice core extracted in Greenland was transformed into sound (Quinn 2001). This ice block provided information of the climate history for the past 110 000 years, which after being sonified allowed to understand the climate evolution in the world. Another interesting project is the sonification system, *Text-to-Music*, which intends to offer a new way for helping people to appreciate Chinese poetry (Huang, Lu, and Ren 2011). This system maps the characteristics, dynamics and relations of the verses into durations of musical elements (Huang, Lu, and Ren 2011; Ren, Phil, and Huang 2007). This allows to sonify the poem according to its pronunciation, which is an aspect that has a great importance in the analysis of Chinese poetry (Huang, Lu, and Ren 2011). *Hard Data* is also an important project in this area because it musically explores the statistical data of the war between Iraq and USA (DuBois 2009a; 2009b). This sonification system was developed by Luke Dubois in 2009 and was initially a public timeline to allow anyone to create his/her own musical version of these data (DuBois 2009a). However, during the development of the project, Dubois created a website with his own version of the data sonification and then created a string quartet version for the Mivos quartet, which focuses on the casualty statistics. Another exploration in this area is the *Quotidian Record* project, where Brian House creates a musical composition that features a continuous year of his location-tracking data (House 2012b; 2012a). Brian develops an algorithm that identifies the locations by latitude and longitude and associates each one with a musical duration or harmonic relation. The musical result is recorded on a vinyl that contains the markings of the time and the names of cities to which he traveled.

A Sonification of *The Lusíads*

The project that is being developed intends to transform the main features of the poem, *The Lusíads*, into sound. We intend to build a software application that allows the user to experience the poem in an innovative way and to obtain different types of information depending on the custom navigation performed by the user.

Before introducing the sonification model, a description of *The Lusíads* structure and main characteristics will be given.

The Lusíads

The Portuguese epic poem *The Lusíads* by Luís de Camões (1524-1580) has been the subject of numerous analyses over time (Sena 1980). The poem was first presented by Luís de Camões to Dom Sebastian I to whom he dedicates the poem, and was published in 1572.

The poem is inserted in the epic genre, a literary genre that comes from the Greek-Latin Antiquity (Camões 2011; Gaio nd; Pais 1994). This book is like Virgil's *Aeneid* or Homer's *Iliad* and *Odyssey*, i.e., an epopee, as it is written in verse, in a high style, and intends to magnify the achievements of the heroes, in this case, the Portuguese people.

Camões narrates the travel of Vasco da Gama to India and through this story he tells the Portuguese deeds and extols the strength of his people (Sena 1980).

Poem Characteristics

The poem, in terms of external structure, has a total of 1102 stanzas of eight verses each and is divided into 10 cantos (Gaio nd; Pais 1994). The verses are decasyllables because they contain ten syllables and the stanza has a rhyme scheme constant throughout the all poem (Fig. 1), consisting of crusade rhymes in the first six verses and paired rhymes in the last two – *a b a b a b c c* (Gaio nd; Pais 1994).

As armas e os Barões assinalados	a
Que da Ocidental praia Lusitana	b
Por mares nunca de antes navegados	a
Passaram ainda além da Taprobana,	b
Em perigos e guerras esforçados	a
Mais do que prometia a força humana,	b
E entre gente remota edificaram	c
Novo Reino, que tanto sublimaram;	c

Figure 1: Excerpt of a stanza and the rhyme scheme.

The internal structure of the poem follows the epic genre rules (Gaio nd; Pais 1994):

1. *Proposition*, where the poet presents what is going to sing;
2. *Invocation*, a section where the poet asks for support and protection to deities (nymphs of the Tagus river);
3. *Dedication*, where the author dedicates the poem to someone, in this case Dom Sebastian I;
4. *Narration*, which represents the story itself.

The Lusíads can be also divided into four narrative plans, which intersect over the narrative (Fig. 2) (Michelli 2003; Sena 1980):

1. *Travel plan*, that consists in the narration of the events of the trip from Lisbon to India;

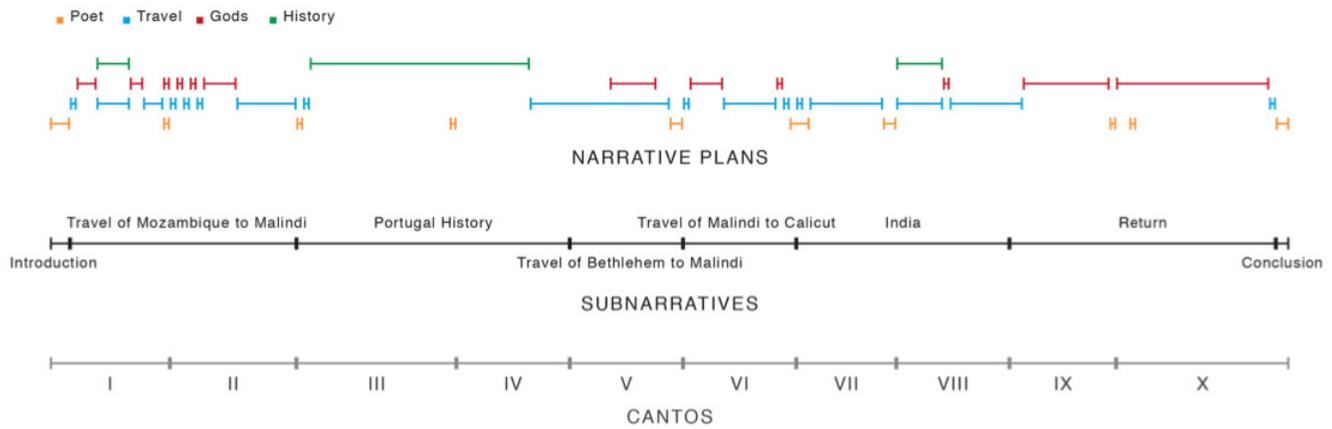


Figure 2: Structure of the poem.

2. *Gods' plan*, that includes the gods' interventions, intersected with the travel plan, where the gods make decisions that affect the fate of the Portuguese people;
3. *Portugal History plan*, which is the narration of Portugal's history by Vasco da Gama to the King of Malindi;
4. *Poet plan*, essentially located at the end of each canto, where Camões reflects about the state of the world;

Different characters are responsible for the narration. The most frequent ones are Luís de Camões, the main narrator, and Vasco da Gama.

Dataset

The characteristics to be sonified can be divided into three different areas (Fig. 3):

1. *External structure*, where is intended to explore the verses characteristics and the rhyme scheme for creating the rhythm;
2. *Internal structure*: exploration of the subnarratives of the poem, the intersection between the different narrative plans and the subunits or episodes that divide the poem;
3. *Sequential structure*, where is intended to identify the different narrators of the book and also analyze the different story times, since there are prophecies to tell facts that occurred afterwards.

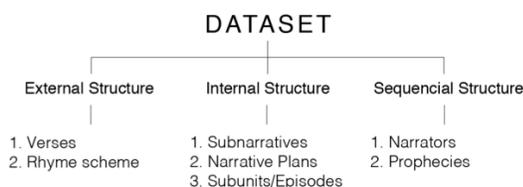


Figure 3: Dataset divided in areas.

General features

The sonification system under development has interactivity as a core functionality. It is intended that the user can navigate in the system to get different types of information depending on what he/she exploits, which enables a custom experience of the Portuguese epopee. In this way, the application will offer three types of zoom, whose information will have different levels of specificity:

1. *Zoom 0*: Where the user can listen to the whole book and only the higher level divisions of the poem will be sonified.
2. *Zoom 1*: This type of zoom will be available after selecting a canto or subnarrative, which will be sonified.
3. *Zoom 2*: Level of higher detail, which is activated after the choice of a subunit or a specific episode and will offer a sonification of the selected excerpt.

The project will also have a visual component to work as a label and to guide the user through the sonified information, which will improve the process of sound visualization.

First Prototype

At this stage of development, there is an implementation of zoom 0, which was done using Processing and the MidiBus library to create the MIDI notes and MIDI messages and to establish the connection with a sequencer (currently Ableton Live Lite 9). In zoom 0 only three types of information are used (Fig. 4): the main narrators (Luís de Camões and Vasco da Gama), the frequency of the narrative plans during the poem and the presence and intersection of the various subnarratives along the text.

The output at this zoom level is a sound file of 120 bpm, with 80 bars. The harmonic structure is cyclic, based on a simple pattern of 8 bars mapped from the rhyme scheme of the poem (*a b a b a b c c*): *a* is mapped to *C major*, *b* with *F major* and *c* with *G major*. The result is a cyclic chord progression (*C F C F C F G G*), one chord/bar, which results in a music in *C Major*, with no modulations.

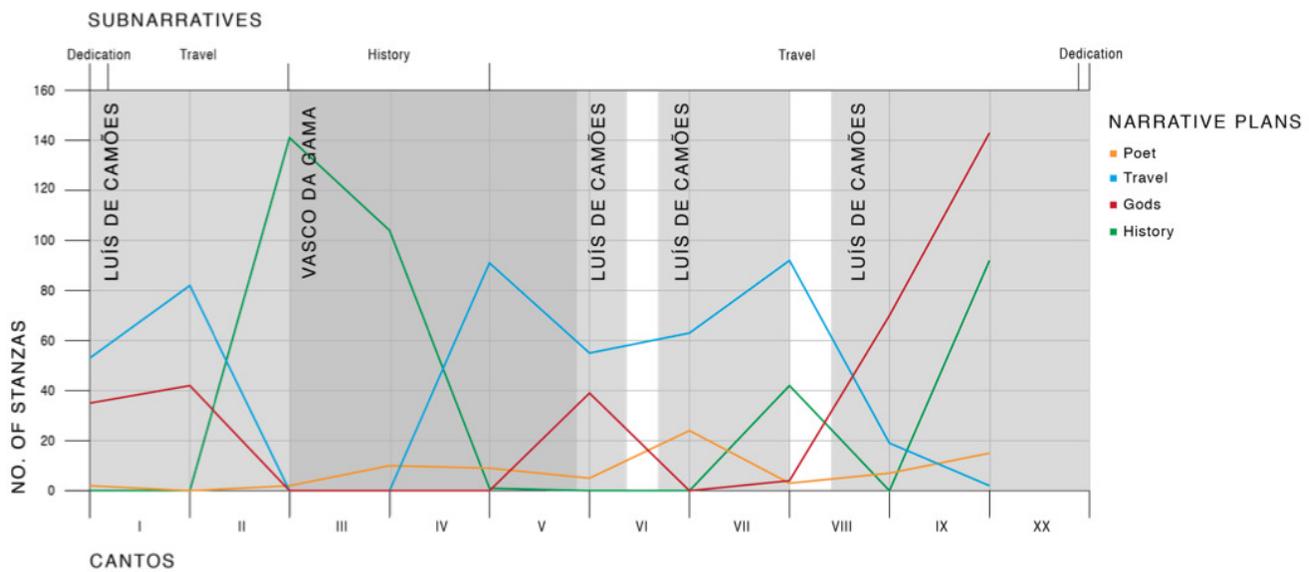


Figure 4: Sonified characteristics.

The melody is computed at the bar level: for each bar, a variable sequence of 10 notes (6 eighth notes and 4 sixteenth notes) of the chord's scale is generated. The first and last notes are always the tonic of the scale. This melody is played by two different melodic instruments, which correspond to the two main narrators:

1. Luís de Camões - Tuba;
2. Vasco da Gama - Flute.

The four narrative plans are associated, each one, with a different percussion instrument, playing during the entire piece. Each instrument follows a different rhythmic pattern. The volume of the sound changes according to the variation of the number of stanzas that the respective plan has in each canto:

1. Travel Plan – Bongo;
2. Gods Plan – Xylophone;
3. Portugal History Plan – Clog boxes;
4. Poet Plan – Claves.

The subnarratives were grouped into three groups:

1. Dedication, which includes the Introduction and the Conclusion of the poem.
2. Travel, which includes Travel of Mozambique to Malindi, Travel of Bethlehem to Malindi, Travel of Malindi to Calicut, India and Return.
3. History, which includes Portugal's History.

Each group is associated with a harmonic instrument, which plays, in the presence of the specific subnarrative, the chords of the corresponding rhyme (*a* with the *C* chord, *b* with the *F* chord and *c* with the *G* chord):

1. Dedication – Harp;

2. Travel – Violin;
3. History – Cello.

In this way, the goal in zoom 0 is the user to be able to distinguish the different narrators, the intensity of each narrative plan and to understand the evolution of the story by the intersection of the subnarratives.

The sound file associated with zoom 0 is available at <https://soundcloud.com/ngela-coelho-438647153/sonification-lusiadas> and it is recommended to follow the sonification with Fig. 4.

For the other zooms the goal is to follow a similar system of division by types of instruments and explore the other characteristics of the poem such as the intersection of the narratives plans, the types of subunits, the other narrators and the prophecies.

Reflection and Conclusions

How to choose the best sonification technique for a dataset? Can all kinds of data be sonified? Can a sonification system be understood without a visual component? How to make the sound representation easy-to-understand? Will the technology be prepared for the integration and expansion of Sonification?

These are some of the issues that emerge from the analysis of the Sonification field. It is necessary to investigate and explore these questions in order to establish suitable methodologies and identify the most promising techniques to address them. During the development of this project was realized that in most cases, the questions that appear during a sonification project are answered by the type of data that is being sonified. Each kind of information requires a different approach to achieve the best possible result.

The work presented herein intends to explore the Sonification area in a field where its application is not common:

poetry, more specifically the epic poetry. The main goal is to transform *The Lusíads* into different types of sound according to the level of detail chosen. Although this is a work in progress, the project is allowing us to experiment and test alternative configurations for the sonification. For instance, it is allowing us to understand the number of different instruments that the sonification should use in the poem representation, how to use them and how to represent so many levels of information. While the proposed zoom 0 meets the goals that were originally established, it is mandatory to analyze how the project will be received by the user, the best way to communicate and validate it. By the end of this project, it is expected that with the final application the sound result will be better understood, due to the interaction system that will be created for the user navigation and the visual component that will help to follow the auditory product.

To be able to prove the usefulness of the application, it is also imperative to validate it with final users. We intend to assess whether the different levels of detail of the story are perceived from the sonification and to what point relevant information is retained.

This application is intended to not only be an innovative sonification process, but also to be a design product, which can communicate information and also be able to produce a new vision of a book so well-known in the Portuguese literature.

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