

# A BRAZILIAN POPULAR MUSIC DIGITAL LIBRARY ORIENTED TO MUSICAL HARMONY E-LEARNING

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## ABSTRACT

This poster presents a digital library proposal conceived for people interested in acquiring knowledge about Brazilian popular music harmony, particularly in *Choro*. This Brazilian musical style is a complex popular music form based on improvisation, although it contains classical music elements such as the counterpoint. We are proposing two ways of accessing the music virtual library content: a guided navigation mode, in which users interact with a cooperative Web-based learning system; and a free navigation mode, in which users can make their own queries, both through browsers or client applications.

## 1. INTRODUCTION

Although Brazil has a variety of styles in popular music, the professional teaching of national musical traditions has been passed, almost completely, in traditional environments of musical teaching. An elementary historical description of Brazilian professional music teaching that points to social and economical topics of resources application in Music teaching demonstrate the hegemony of the so called classic music at formal education, which makes the popular music teaching away from the formal environments.

There is a large gap in the production of good educational material that focus on Brazilian music. Facing this fact, digital and organized contents, that have as main goals the rescue and broadcast of important composers of the Brazilian tradition, bring a very important contribution to the country cultural identity.

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On the other hand, the vertiginous enhancement of information available at the Web, mostly multimedia, has generated a considerable demand for tools that can access and manipulate them. Specifically, on musical information, despite the many proposals with experimental and commercial aspects, they have frustrated the public expectations.

Obviously, the amount of musical material available has followed the general tendency. Nowadays, these materials are available to computer users around the world and new musical databases continue to be created and constantly updated. Several projects show that score retrievals within musical databases can be performed through searches on the text descriptions of the musical pieces, which usually includes details such as the title or the name of the composer or performer, as in the *Lester Levy Collection Sheet Music* [12]. Listening to the scores being retrieved is also allowed in some systems such as the *Variations2* [17]. More complex retrievals based on particular melodic lines can be done in systems such as the *Themefinder* [16].

Eventhough these systems are useful to people interested in music in general, they are not able to support systems in a popular music educational context.

This work aims to design a digital library [1] framework able to provide an appropriate support to people interested in Brazilian musical culture by means of a meaningful set of musical pieces an its educational use.

We present in Section 2 our musical harmony e-learning architecture based on a Brazilian popular music digital library. In Section 3 we introduce the Harmony Trees Theory, which is where the didactical contents and the retrieval methods are based on. In Section 4 we present some considerations concerning our digital library and the principles which guided its development. Finally, in Section 5 we introduce some consideration regarding the current status of our project and draw some conclusions.

## 2. A MUSICAL HARMONY E-LEARNING ARCHITECTURE

This work proposes to put available musical material in a web portal designed to help a virtual community made up of musical harmony e-learning students [10] and people interested in Brazilian popular music [11].

The general architecture of the system is presented in Fig. 1. Its modules are made of objects disposed in a hierarchical manner. The hypermedia document is formed with web pages. In the non-guided navigation, the learner has total control of his/her own decision. In the guided navigation, the system determines which is the next document exhibited, based on the learner's profile. The mechanism of definition of the next step in a guided navigation, as well as a profile inspection by the learner, is described by Costa *et al* [8].

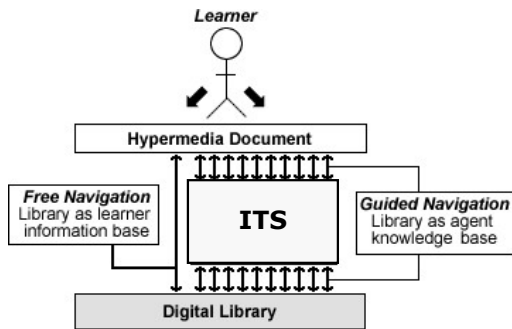


Figure 1. General overview of the system.

The Music Intelligent Tutoring System (ITS) component is centered on a multiagent-based approach. It is based on previous works [4, 6, 7], and is being developed on a agent based platform named COMPOR [2]. The ITS is defined in such a way that each agent is responsible for a certain aspect of domain's partition in musical harmony [10].

Exercises and examples may be constructed in terms of the available musical objects in the digital musical library shown in Fig. 1. In a didactic way, there is a need to assure that an appropriate exemplification of the harmony trees is given to the apprentice. The didactical contents to be presented by the ITS under development is related to Musical Harmony, and its based on the Harmony Trees Theory described in the next section. As a consequence, the mechanisms for searching and indexing excerpts of songs are based in this theory.

## 3. THE HARMONY TREES THEORY

The e-learning system we are making available is related to the Harmony Trees Theory, proposed by José de Alencar Soares (a.k.a. Alencar Sete Cordas). He is a guitar player and a music teacher, and has been building a compilation of the most common harmonic structures found in Brazilian popular music for more than fifteen years. From this compilation, he constructed a *corpus* of popular songs, used it in an informal statistical analysis and giving the probability of occurrence of particular harmonic sequences, and proposed a musical harmony

theory. This theory has been used with success to explain the harmonic structures within tonal music, particularly in the Brazilian popular music, and it has been used both in musical education and analysis. The theory is represented by diagrams, which show graphically the harmonic possibilities involved.

The diagram shown in Fig. 2 depicts the basic harmony tree, which contains the harmonic progressions found in most popular songs in the major keys. Roman numerals are used to represent chords relatively to the first degree of the key ( $\text{I}$ ). Minor chords are represented adding a letter "m" after the Roman numeral. When two Roman numerals are involved, the first one represents the degree relatively to the second one. The square shapes in the diagram represent dominant chords which prepares to the resolution (round shapes) following them. The shaded part of the figure presents the possible modulations used in Brazilian popular music. The thickness of the arrows is associated with the frequency with which a particular path in the diagram occurs in popular tunes. It can be seen from Fig. 2, for example, that the most usual progression in major keys is the sequence  $\text{I}-\text{V}^7/\text{II}-\text{I}-\text{I}^m-\text{V}^7-\text{I}$  (its instantiation in the C major key corresponds to the sequence C-A7-Dm-G7-C). Therefore, a modulation to a relative key is more common than others modulations as in, for example, the sequence C-E7-Am for the C major key.

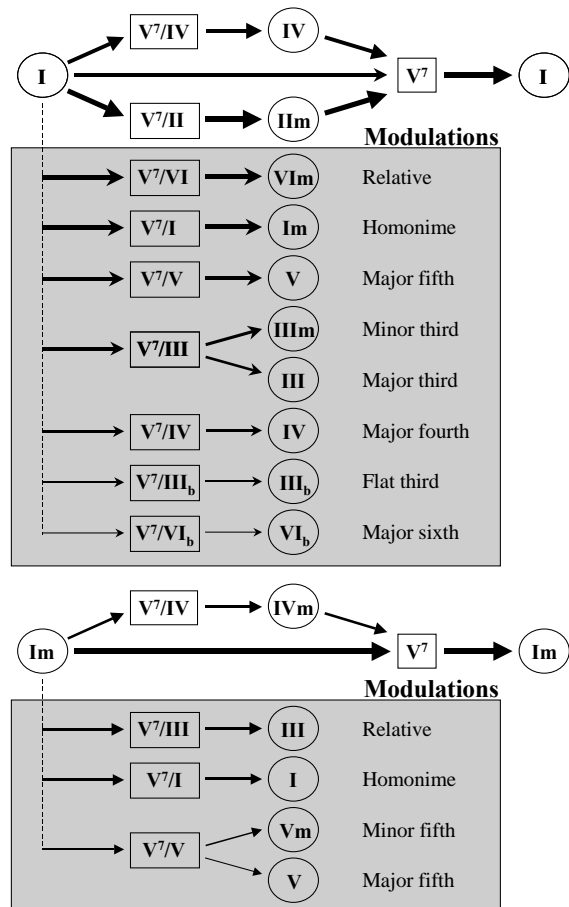


Figure 2. The basic major and minor harmony tree.

As shown in Fig. 3, more complex versions of these trees can be used to incorporate complex functions, such as dissonant chords and modal borrowing, to the scheme. For example, the sequence  $C7M-A7/b13-Dm7/9-G7/9-C7M$  can be seen as a dissonant instantiation of the path  $I-V7/II-IIIm-V7-I$  on the  $C$  major key. Another instantiation for this path can be the sequence  $C7M-C\#^{\circ}-Dm7-Ab7-G7-C7M$ , which follows one of its alternative route ( $I7M-I\#^{\circ}-IIm-VIb-V7-I$ ).

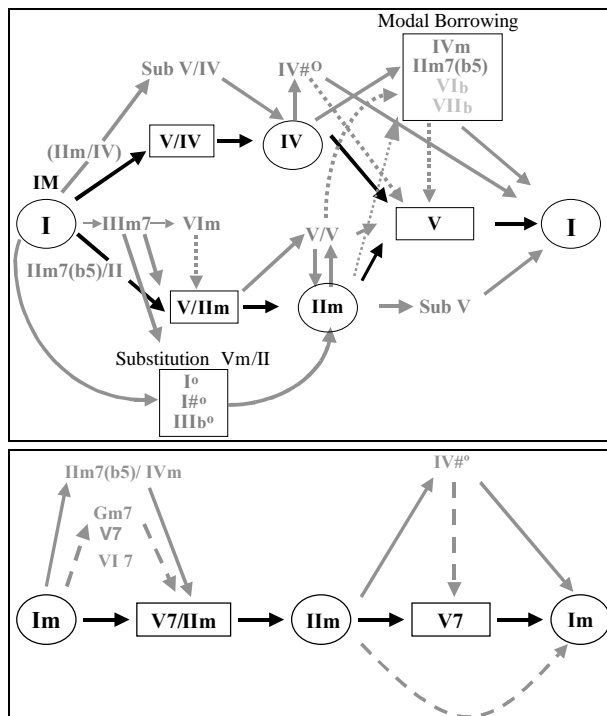


Figure 3. The extended major and minor harmony trees.

#### 4. A BRAZILIAN POPULAR MUSIC DIGITAL LIBRARY

Several works point towards the difficulties in building music digital libraries [9], particularly within the popular music area [3]. Musical harmony e-learning systems require a set of appropriate search mechanisms for a meaningful retrieval of musical objects in a digital library.

We are attempting in the design of our musical digital library to take into account some of the problems related to musical information retrieval introduced by Downie [9], which range from the complexity of musical information and of the queries to the plasticity found in music. The main guidelines of our design are:

**Focus on a single musical style.** The choice of a style lessened (but not eliminates) the difficulties related to the complexity of musical representation and musical queries. We have chosen the *Choro* [5, 15, 18], which is a Brazilian musical style. This complex popular music style is based on improvisation, although it contains classical music elements such as the counterpoint.

As a pilot project, we are making available a representative set of fifty *Choro* pieces containing, in addition to the melody line, the bass line and the associated harmony sequence as shown in Fig. 4. The choice for this particular musical style is based on the fact that this is one of the oldest Brazilian musical styles.



Figure 4. The first 4 bars from the *choro* “Naquele Tempo” by Pixinguinha and Benedito Lacerda.

**Focus on a MIR strategy.** The complexity of musical information retrieval systems is obviously related to the musical styles from the objects. We are focusing on indexing schemes appropriate to be used within musical harmony teaching based on the Harmony Trees Theory, and which are adequate to the chosen musical style.

The search mechanism we are developing is centered on harmonic sequences retrievals. In order to provide support to music learning, we are designing our search mechanism to accommodate a direct search (e.g.  $C-C7-F$ ) or a generic search (e.g.  $I-I7-IV$ ).

As a later step, we intend to provide means to accommodate also chord substitutions which follow rules such as: when using major key modes ( $I7M-IIIm7-IIIm7-IV7M-V7-VIm7-VIIIm7(b5)$ ), the first degree can be substituted by the third and sixth degrees; the second with the fourth; and the fifth with the seventh and vice-versa. This happens because chords based on these degrees share a significant number of common notes. For example, in the  $C$  major key, chords  $C$  ( $C-E-G$ ) and  $Em$  ( $E-G-B$ ) share two of the three notes. In fact, when considering the usual alterations employed by musicians, this number raises to three out of the four notes ( $C7M = C-E-G-B$  and  $Em7 = E-G-B-D$ ). Therefore a search should consider not only the original chord but also these other possible chord substitutions.

Therefore, our retrievals are made according to the Harmony Trees Theory and the mechanisms being made available are expected to retrieve musical excerpts from musical pieces based on (i) *simple chord sequences* (for example:  $C-C7-F$ ), (ii) *generic simple chord sequences* (for example:  $I-V/IV7-IV$ ), (iii) *chord sequences with dissonances or substitutions*, and (iv) *generic chord sequences with dissonances or substitutions*.

**Focus on a particular audience and functional purpose.** Our music digital library is intended to be used initially by an audience interested on Musical Harmony, or more specifically on Brazilian popular music, because of our focus on queries is based on the Harmony Trees Theory.

**Design strategy focused on the user.** Since the beginning of this project, we are collecting information from the potential users to be used in the design of the system itself. This approach aims to achieve a good acceptability of the system by its users.

*Choice of a standard format for the digital objects.* MusicXML [13] is being used as our standard format because of its portability and its acceptance in the music community [14].

## 5. CONCLUSIONS

This paper describes an effort made by a multi-disciplinary research group interested in making available a Brazilian popular music digital library which can help virtual communities interested in acquiring knowledge and sharing experiences.

Currently, our efforts are focused on building (i) a digital library containing representative musical pieces from the Brazilian popular repertoire, particularly *Choro* pieces; (ii) a Web-based course on Music Harmony based on the Harmony Trees Theory; and (iii) an environment to support virtual communities of people interested in Brazilian music. These efforts are mainly based on MSc and PhD dissertations.

We are planning to include, in the near future, retrievals based on melodic lines in such a way to accommodate applications not only musical education but also musical analysis. This would allow us to build mechanisms to support the development of didactical material intended to help the music teaching of subjects such as Brazilian popular music teaching or musical analysis. We are particularly interested in getting experimental evidence which would allow us to validate the Harmony Trees Theory.

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