

**A SOFTWARE MODEL FOR DISTANCE LEARNING OF IDIOMATIC MUSIC
EXPRESSIVITY**

***UM MODELO DE SOFTWARE PARA A APRENDIZAGEM À DISTÂNCIA DE
EXPRESSIVIDADE MUSICAL IDIOMÁTICA***

***UN MODELO DE SOFTWARE PARA EL APRENDIZAJE A DISTANCIA DE LA
EXPRESIVIDAD MUSICAL IDIOMÁTICA***



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A software model for distance learning of idiomatic music expressivity

ABSTRACT: Recent studies in linguistics and neuroscience suggest that music has characteristics in common with verbal language. In this sense, this work, coming from a doctoral project in progress by the author, proposes the creation of an application for mobile devices (app) for the musical teaching of musical expressiveness at a distance (DE) on the electric guitar or guitar, based on strategies of spoken and written language learning. The application or app will be developed from a computational representation system called "Fraseado", whose theoretical basis will be treated in this work.

KEYWORDS: Idiomatic musical expressiveness. Remote music learning software. Jazz language.

RESUMO: *Recentes estudos das áreas de linguística e neurociência sugerem que a música possui características em comum com a linguagem verbal. Nesse sentido, este trabalho, oriundo de um projeto de doutorado em andamento do autor, propõe a criação de um aplicativo para dispositivos móveis (app) para o ensino musical da expressividade musical à distância (EaD) na guitarra elétrica ou violão, baseado em estratégias de aprendizagem da língua falada e escrita. O aplicativo ou app será desenvolvido a partir de um sistema de representação computacional chamado "Fraseado", cujo embasamento teórico será tratado neste trabalho.*

PALAVRAS-CHAVE: *Expressividade musical idiomática. Software de aprendizagem musical à distância. Linguagem jazzística.*

RESUMEN: *Estudios recientes en los campos de la lingüística y la neurociencia sugieren que la música tiene características en común con el lenguaje verbal. En este sentido, este trabajo, procedente de un proyecto de doctorado en curso del autor, propone la creación de una aplicación para dispositivos móviles (app) para la enseñanza musical de la expresividad musical a distancia (DE) en la guitarra eléctrica o guitarra, basado en estrategias de aprendizaje de la lengua hablada y escrita. La aplicación o app se desarrollará a partir de un sistema de representación computacional denominado "Fraseado", cuya base teórica se tratará en este trabajo.*

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PALABRAS CLAVE: *Expresividad musical idiomática. Software de aprendizaje musical a distancia. Lenguaje de jazz.*

Introduction

Distance Learning (DE) is a modality that has been gaining notoriety mainly due to the use of the Internet as an intermediary between students and teachers. However, some types of musical content based on instrumental practice have presented problems transmitting knowledge through virtual media because the teacher does not easily systematize such knowledge through verbal language. There needs to be more study on this type of problem of transmission of practical content at a distance in Brazil, which limits the offerings of courses in EaD modality that include in their curricula disciplines that involve practical actions, especially in the area of music. According to Solti's research (2015), the difficulty of verbalization may be related to Anderson's (1981) Processual Knowledge (PC). The author divides knowledge as to the form of assimilation into two types: declarative knowledge (DK), which is the type of knowledge dependent on memory and easy to verbalize, such as memorizing important dates in history or a cake recipe, and procedural knowledge (PK), being a type of knowledge acquired, matured, and stored in the subconscious through countless repetitive actions of trial and error, therefore, difficult to verbalize. In the research above by Solti (2015), it was found that the transmission of contents related to the stylistic musical language, here called this work as Idiomatic Musical Expressiveness (EMI), can present several difficulties in understanding its procedures if the contents are conveyed through verbal protocols, while, if transmitted through conventional writing, a musical notation will also be insufficient to fully describe all the nuances foreseen in the characteristic expression of each musical style. In this work, EMI is understood as the action of interpreting a musical work within the stylistic specifications foreseen for the musical genre in question, the jazz genre. Still, on the limitations of DE as to the transmission of practical contents, individualized service through this modality may be unfeasible due to the limited time that contemporary society allows teachers to spend with each of their students. To assist in the teaching of EMI in EaD, this paper is part of the author's doctoral research and describes the first steps towards the creation of software for mobile devices that prioritizes the study of jazz EMI on the electric guitar or acoustic guitar remotely, allowing study at any time and place, and in an unsupervised way, minimizing the personal and constant dependence on a teacher to monitor the studies of the EaD student. For the development of this software, we will use the computer system called Fraseado, developed by Gonçalves (2017), based on the computational representation of musical knowledge. Our software, herein called MEDiL (musical expressivity distance learning), will use some teaching

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strategies from the DUOLINGO™¹ software, a well-known free app focused on language teaching. It is believed that because of the similarities between music and language, we can leverage language-teaching strategies to teach MLE. In the following session, we will describe some of the similarities between music and language and the teaching strategy through our app that we think is important for our project.

Music and language

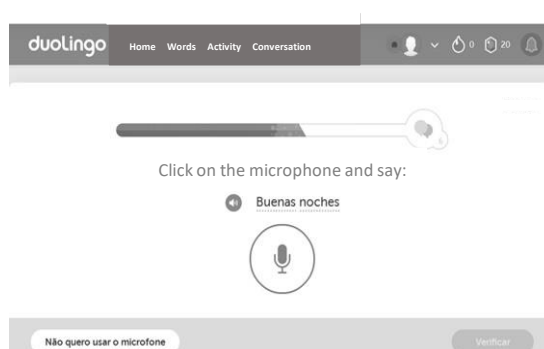
There is a discussion by several authors in linguistics and neuroscience about whether music is a form of language or not. Among these authors, we highlight those who take a position in favor of music being a form of language: Patel (2008) notes that both language and music are organized through particular systems or sets of discrete elements that, when viewed separately, have little meaning, but once combined, form structures with a huge range of meanings. For example, limb (2008), in one of his experiments, mapped the brain regions in activity through functional magnetic resonance imaging (fMRI scanner) during a musician's performance and evidenced that the brain region responsible for language was triggered while this musician was improvising. Honing (2013) characterizes music as a by-product of language because music's function is to express an idea less graphically.

From these notes, which suggest a very close relationship between music and verbal language, the idea of using written and spoken language teaching strategies for music education, especially for teaching EMI on the instruments above, has been awakened. If there are similarities between music and language, from the perspective of neuroscience and linguistics, we can appropriate some strategies for teaching spoken and written language to music teaching. In this direction, we have taken inspiration for the creation and development of our computational tool, the previously mentioned DUOLINGO app. This application employs several different strategies for developing reading and speaking of words and sentences in foreign languages, and one of these strategies, in particular, caught our attention. This strategy asks the user to verbally reproduce words and phrases of a foreign language provided by the program in audio and written form. The panel for this feature is shown in Figure 1.

¹ Duolingo is a registered trademark of Duolingo, Inc. Available at: www.duolingo.com. Access: 10 Jan. 2022.

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Figure 1 - Duolingo's verbal reproduction feature panel



Source: Resource Print

The resource analyzes the diction and generates a response to the student on whether the pronunciation is adequate or not. MEDiL plans to use a resource similar to this one for the study of licks or musical phrases for improvisation, but always aiming at the musical expressiveness of the style to be studied, which in this case will be the jazz musical genre, due to its enormous importance and influence on Western popular music², especially on Latin popular music. The idea is that the user reproduces on the electric guitar or acoustic guitar a phrase, or jazz lick, provided in musical notation, tablature, and audio. This researcher will initially record the audio of these phrases, but jazz guitar exponents from the country may also be invited for this task. We are also considering the possibility that the application will allow the user to upload the phrases they want to study, such as, for example, phrases from improvisation methods that provide them in audio format. The presentation of musical phrases in tablature is of utmost importance for a correct articulation between the notes through the use of on, glissandos³, slides⁴, ghost notes⁵, etc., because both on the electric guitar and on the guitar some of these embellishments⁶ resources cited are incident only on some strings or specific regions of the neck of these instruments. The resource will verify the musical expressiveness of the student through psychoacoustic descriptors capable of correlating the student's performance with the phrases previously recorded and stored in the application. The parameters to be analyzed, which are part of expressive performance, are dynamics, attack, articulation,

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² In this work, “Western popular music” is understood as music based on the tonal system.

³ A glissando is a technique that chromatically links one note to another. For example, the player slides his finger over the instrument's scale using a slide technique on string instruments.

⁴ The slide is a technique similar to glissando, the difference being that it occurs more quickly, and the tonal distance between the two notes is usually shorter.

⁵ A ghost note is a subtly played note, which may precede a note that the performer considers the main note, which will sound whole and complete.

⁶ Technical devices such as glissandos, slides, and ghost notes are examples of embellishments and make melodies more “beautiful” or “enhanced”.

and rubato. Dynamics is responsible for the differences in volume between notes which, with the attack, constitute the main elements of musical expressiveness in most musical styles. Articulation is the length of silence between one note and the next. Longer silence between notes is considered staccatos, while shorter times of silence are considered legato. Rubato is the main characteristic that differentiates musical genres because it is responsible for the rhythmic displacement of notes in time through note anticipations and delays. In the case of jazz, rubato happens through note anticipations in time 1 and 3 in 4/4 time signature formulas, characterizing the jazz swing. This typical jazz swing can be checked through a metric given by correlating the audio files played by the student against a database stored on an online server, where the four parameters mentioned above will be analyzed. The user will be asked to record a new file several times until the algorithm detects an acceptable degree of correlation. In the end, the application may present a score if the student's performance is adequate. If the performance does not reach the minimum quality pre-established by the application, it is invited to return to the previous steps until it reaches this stage again. The application may also suggest a new path to be taken by the student if they persist in the same mistakes at a certain stage, remembering that all these possibilities already exist in the foreign language learning application, DUOLINGO.

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Computational knowledge representation

The task of computational representation of the Phrase system for the musical knowledge in question, EMI, is aimed at manipulating musical structures through a multiparadigm approach (ANDERS; ALCORN; ANAGNOSTOPOULOU, 2003) and may use psychoacoustic descriptors for its automation (ROADS, 1996; GEBHARDT; DAVIES; SEEBER, 2016), involving information modeling so that a computational system can collect data to perform complex activities that involve reasoning and creativity (MIRANDA; ALVARO; BARROS, 2005; RAMIREZ; HAZAN, 2005). Fraseado is a programming platform with the capacity to serve as an infrastructure for the application of the Musical Knowledge representation process, whose main functionalities of the system are: 1) Sound synthesis; 2) Audio manipulation; 3) Storage, treatment, and reproduction of musical compositions; 4) Hardware and notation control; 5) Musical knowledge representation; 6) Learning and 7) Automatic composition. Similarly to Duolingo, the app used as inspiration for the present

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project, the programming language to be used is Scala^{TM7} (HORIE, 2017), but Java^{TM8} can also be used. The Java⁹ and Scala¹⁰ languages also enable cyberspace-oriented development with the wide availability of sound, visual, and interaction resources on both traditional computers and mobile devices through sophisticated means of messaging and voice and video conferencing, enabling great remote interaction between teacher and student (ANDERSON, 2003).

Final considerations

EMI is one of the most time-consuming musical skills to assimilate and mature (KRATUS, 1996) compared to the other skills required for instrumental performance. According to Dowling and Harwood (1986), humans acquire expressiveness through a long process of observation and imitation. In Limb (2008), the author compares the perceptions of musicians and non-musician people to the variations in musical expressivity in his experiment. In his research, musicians showed greater sensitivity to nuances of EMI, especially the more experienced ones, reinforcing our assumption that EMI takes time to develop, mature, and, according to the research above, be perceived. Ripoll (1991) states that people learn in a heuristic and individual way, that is, the student himself becomes the main responsible for his learning, which, in a way, endorses one of the main characteristics of the MEDiL, which is the fact that it is an unsupervised system of music teaching, i.e., without the physical presence and constant monitoring of a teacher.

Aiming to meet the needs of EaD in Brazil and in countries where territorial extension and financial conditions constitute a barrier to studies, the development of this project can be an excellent resource to serve students in a remote, automatic, and mainly unsupervised way, including for the study of other musical genres of greater rhythmic and expressive complexity, such as the Latin genres Samba, Bossa Nova, Salsa, and Merengue.

Currently, the application is still in the creation phase, with the help of external collaborators, in this case, Gonçalves (2017), and other software developers through volunteer work.

⁷ Scala is a registered trademark of Jon Steinsson.

⁸ Java is a registered trademark of Oracle.

⁹ Available at: <https://go.java/index.html>. Access: 10 jan. 2022.

¹⁰ Available at: www.scala-lang.org. Access: 10 jan. 2022.

There is also the possibility of using the programming techniques of the games known as Karaoke¹¹, which, as far as we know, use algorithms that detect the rhythmic accuracy of the singer to score that, contrary to popular belief, disregards, a priori, the tuning. The way these algorithms work will still be researched and described in the main doctoral work. In a way, the existence of Karaoke endorses the technical viability of our application since it can make a rhythmic analysis of who sings.

The path to be taken after development will be that of testing with students of electric guitar (and popular guitar as well), from which a case study can be elaborated to present the first results. Regarding questions about a possible “robotization” of the expressive processes when using MEDiL, I emphasize that the tool intends to offer complementary support to the student who is studying Jazz (or any other genre they wish to study, as long as the application is “loaded” with phraseological materials related to the genre they want to learn) in an EaD music course, because, as it seems to be the case with applications such as Duolingo, MEDiL does not intend, by itself, to be the only source of information about what they want to learn. Therefore, it is worth remembering that what interests us in the first moment of learning about expressivity is to develop the student's ability to listen to a melody, with its specific expressive characteristics of a certain musical genre, in this case, Jazz and reproduce that melody as similar as possible, because the act of copying something is an essential part of human learning in any area of knowledge.

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¹¹ Karaoke is a game where the user can sing over a soundtrack, scoring at the end according to how well they do.

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