A study about the use of Musicomovigrams in musical education[1]

Miguel Clemente Rubio[2]

Jose Fornari Junior[3]

Adriana N. Mendes[4]

Universidade Estadual de Campinas

Abstract: Since the turn of the twenty-first century, information and communication technology (ICT) have definitely changed the way people express learning and interact with each other in the activities of science and arts, with a particular impact in musical education. In this article, the authors treat the concept of musicomovigrams, an interactive audiovisual resource, similar to video games that can work as software tools for the development of sound perception and musical structure. This concept is based on the previous concept of *musicogram*, created by the musical pedagogue Jos Wuytack along with his concept of Active Listening (Wuytack and Boal Palheiros, 2009). The authors consider an important element of learning the concepts of Musical Forms defined by the musical educator Keith Swanwick (Swanwick, 2003). This work presents the development of the *musicomovigram* concept, a videogame

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[2] Holds a degree in musical pedagogy in the University of Jaén, Spain (2011) and undergraduate degree in Psychopedagogy - University of Jaén and Faculty of Psychology, Lisbon (2014). He studied classical saxophone (professional degree) in the Professional Conservatory of Jaén, Spain. Currently, he is a graduate student and researcher at the State University of Campinas. Rubio has experience in the area of Education, with emphasis on technologies in music education.
Email: miguelclementesaxo@gmail.com.

[3] Full-time Ph.D. researcher at the Nucleous for Sound Communication (NICS) located at the University of Campinas (UNICAMP). He developed a Post-Doc research in Music Cognition at the Music Department of Jyvaskyla University, Finland (2007) at the Music Cognition Group and Finnish Centre of Excellence, in the Braintuning project. He also developed a previous Post-Doc in Evolutionary Computation applied to Music Synthesis at NICS (2004) with grant from FAPESP. He has undergraduate degrees in electrical engineering and popular music (with modality in piano). Email: tutifornari@gmail.com.

[4] She is a Doctor in Music in the area of Theoretical Foundations of Music by State University of Campinas-Unicamp (2010), Master in Music by Syracuse University / U.S.A. (1991) and Bachelor in Piano by Federal University of Rio de Janeiro- UFRJ (1987). Assistant Professor at Unicamp since 2011, where she teaches courses to graduate and undergraduate students and develops research in Music Education. Email: aamend65@gmail.com

created through the free software eAdventure. We also intend to investigate how music teachers and students, who work and interact in musical education classrooms, are actually accepting and using ICT in their classes.

Keywords: Musicomovigram, Video game, Music education, ICT.

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One of the greatest challenges of musical pedagogy is to ensure that students are indeed developing the ability of efficient music listening, with special regard to musical structure, thus able to transcend the limits and habits of passive listening.

Traditional educators might complain about the allurement that video games pose to students, directing them away from a more conservative educational process. However, the interactive aspect of video games may become an important asset for music educators, instead of an element of rupture and student mischief. In this context, video games can turn into a great music education ally by motivating students to interact and contribute to the learning process and allowing teachers to use the students' fascination for interactivity to conquer their interest. Current technologies such as virtual reality adventures can offer great contributions to emphasize educational values and curricular contents in a playful, attractive, and innovative way.

This work presents the theoretical basis for the conceptualization, development, and use of *musicomovigrams*. They are defined here as video games distinctively developed for music education. *Musicograms* are graphic symbols and images printed on paper, representing a musical structure whose purpose is to highlight the necessary relationships contained in a musical work, in order to promote their understanding in different levels and musical elements[5]. *Musicomovigram* adds on the element of interactivity of videogames to the *musicograms,* offering increased support to music students, while broadening and deepening their musical skills.

Free software tools that can contribute to the development of interactive computational models for music teaching are largely available and can be used to favor the creative process by adding audio and video resources to Wuytack's *musicogram*. We encourage the use of such tools, which are software with public accessibility, conveniently facilitating and expanding the *musicomovigrams* concept. Moreover, using free software tools will allow programmers and music educators alike to modify, develop and distribute this resource free of charge. For this, there are accessible computational platforms that allow

[5] An interesting example of *musicogram* can be found in "Musicogramme Tritsch-Tratsch Polka Op 214 by Johann Strauss (1825-1899)", https://www.youtube.com/watch?v=8cUzsL9uDjs

the use of drag-and-drop visual programming approach, which facilitates and accelerates software application development. The open-source computing platform for the development of *musicomovigrams* is called eAdventure and can be freely downloaded at http://www.e-ucm.es/portfolio-item/eadventure/.

The main objective here is to promote the acquisition of basic musicalization notions through the application of *musicomovigrams*. The purpose of the *musicomovigram* is helping students amass essential musical notions such as perception and identifying musical form dynamically. Additional objectives are the recognition and perception of the musical form, favoring the development of a musical sight reading through the creation and interpretation of music basic elements. Lastly, we intend to achieve these goals using exclusively open-source software.

It is important that the *musicomovigrams* are used in an intuitive and playful way, creating and fostering a safe and trustworthy educational environment. Thus, for this concept development, it is necessary to take into account student's different characteristics and their heterogeneities, promoting an educational tool flexible and accessible to a variety of students.

In this work the authors intend to determine theoretical foundations for creating a videogame specifically designed for music learning. This initial research is focused on students from 8 to 10 years old, with focus on fostering musical education and motivating the focus group through the process of learning elementary concepts of musicalization.

To evaluate the results, we intend to use two questionnaires for the final analysis of satisfaction and didactic effectiveness of the music teaching experience using *musicomovigrams*. The first questionnaire will be applied at the initial phase and the second one at the end of the experiment. Both assessment documents will be divided in four sessions, each with an application time of about sixty minutes. The questions in the document will evaluate different subjects, such as content, satisfaction, and usability of the *musicomovigrams* in the classroom. The questions will use evaluation scales varying from 1 to 5. The impact of each *musicomovigram* developed for this musical education experiment will be assessed according to a thorough analysis of the student's questionnaires.

1. THE CONCEPT OF MUSICAL LISTENING

A careful definition of what is musical listening for music education arises from the need to determine which segments of a musical piece are important to be focused on in order to be later integrated into the musical education process. Musical listening is a physiological process and is strongly impacted by psychosocial student elements. There are several areas of human knowledge that are concerned with the process of musical listening. Let us consider some subjects that impact musical

listening such as musical psychology, psychometrics, music cognition based on Piaget, and others.

According to Botella and Gimeno (2015), musical psychology tries to explain qualitatively the phenomena of musical hearing and its different theoretical paradigms. Today's study of music psychology covers such large areas as perception and cognition, affective response, neuropsychology, psychoacoustics, cognitive musicology, among others. Psychometrics focuses on the quantitative (measurable) aspects of music as given through standardized tests of listening skills. This procedure is based on empirical perspective that rejects any unobservable process and focuses on hearing from the viewpoint of musical predilections. Cognitive theories based on Piaget's studies rely on subjective processes, establishing a correlation between biological development and musical abilities (Hargreaves, 2002; Swanwick, 2003).

Strong in this group of theories is the constructivist approach, for which musical hearing is a cognitive and constructive process in which the perceptive activity incorporates new ideals, facts and experiences to the cognitivist structure (Lizaso, 2003). As some research works point out, the training of attention and memory, as well as a good level of motivation, contribute to the development of musical cognition through hearing (Giráldez, 2014).

Social psychology explains the effects of environment influence on the development of "taste" (predilection) linked to individual listening. Hargreaves (2012) identifies three steps in this development. First, musical taste is shaped by the conformity of individuals to the norms of reference groups in the community. Then, in the second step, musical taste is correlated to communicative persuasion in which facts such as the prestige of the performer or his/her extramusical life comes into play. Finally, in the third step, (Marxist oriented) it is argued that the dominant upper and middle class social groups want to defend and increase their relative prestige in the cultural and social hierarchy, which is obtained by regulating the population's access to artistic training.

Other authors have also tried to elaborate detailed analysis of musical hearing establishing diverse categorizations and classifications. As an example, we can mention the results obtained by Schaeffer (1988), which distinguishes the act of hearing from that of listening. Hearing is a passive and an inevitable action. On the other hand, listening has an active sense given by hearing with attention, where the listener tries to establish a dialectical relationship to what is heard.

For Willems (2001), musical listening is a skill that is learned through an adequate, attentive, and educated hearing. The author distinguishes three dimensions in this ability. The first dimension is the auditory sensory receptivity, which is related to the correct functioning of the auditory organ (the ears). Then, the second is the affective sensitivity, which begins at the moment in which we pass from the passive and objective act of hearing to the act of listening (active and subjective), motivated by emotional content. The final is the auditory intelligence, which allows one to become aware of the

other two-dimensions. This last dimension is an abstract synthesis that works both on the sensorial and affective level and is given by comparing judgment, association analysis, memory and creative imagination.

Delalande (1998) also proposes three categories, in this case, however, considering the type of manifested behaviorism. This author makes a distinction between: 1) Listening Taxonomy, which is the seeking of a structural and formal understanding of the work, giving more attention to the broad morphological units that facilitate memorization; 2) Empathic Listening, which points to emotionally connecting the listener with music, mainly through its tensions and contrasts; 3) Figurative Listening, in which the listeners construct imaginary figurative worlds produced by sounds, such as subjective actions, scenes or plots.

David Huron (2002) deepened Delalande's approach, performing an extensive taxonomy to differentiate between 21 listening modes. These can be: 1) Distracted, when the listeners do not pay conscious attention to the sound phenomenon; 2) Tangential, in which distraction arises from the musical experience itself; 3) Metaphysical, where listeners ask themselves transcendental questions about the music they are listening to; 4) Signal, when more attention is paid to the element that precedes certain sound events; 5) Sing along, in which one sings mentally with the music; 6) Lyric, when more attention is paid to the text; 7) Programmatic, in which music causes certain reactions in the listener; 8) Allusive, characterized by relating what is heard with other works; 9) Reminiscent, when it reminds certain elements of previous listening of the same piece; 10) Identity, in which the listener asks about the identity of what he listens to; 11) Retentive, similar to the number one that takes place during musical dictations; 12) Fault, when the listener seeks performative imperfections; 13) Feature, in which the attention is focused on identifying relevant elements; 14) Innovative, which looks for characteristics not previously heard; 15) Memory scan, which occurs when the listener expects a certain event that he knows; 16) Directed, in which attention is focused on some elements, excluding others; 17) Distance, implies in realizing a global synthesis of the work during its own course; 18) Ecstatic, in which the listening act elicits some physiological response related to pleasant experiences, such as shivers; 19) Emotional, in which the listening act is deeply accompanied by feelings and emotions; 20) Kinesthetic, when it awakens the need for movement; 21) Performance, proper to the performers who listen to recordings from their performed repertoires and perform the corresponding gestures and actions.

These concepts allow us to elaborate an open and comprehensive definition, which is useful from the standpoint of musical didactics, of the musical listening concept. Thus, in the psychological plane, it can be said that musical listening tries to direct the attention to the sound stimulus in an intentional way, converting the sense of hearing into an active, internal, subjective, affective and dynamic process that allows the construction of meanings in relation to its previous cognitive

structures. The line of education and entertainment of this process makes possible to take the musical hearing towards a new level of understanding of purely musical elements, thus developing an auditory intelligence in the students. A wide range of auditory cues can also be developed, which are decisive when producing musical meanings. In relation to the sociological dimension, musical listening is conditioned by the listener's musical taste, which is influenced by questions such as adaptation to the reference group, communicative persuasion, or the association between musical styles and social classes.

2. ARTISTIC CREATIVITY

Lev Vygotsky, a famous Soviet psychologist, developed studies that help to support the concept of creativity in relation to art. This author proposes that there are four principles for artistic creativity. These principles vary according to the level of student development, and, for each period, the student presents his/her own mode of creation.

According to Vygotsky, the creative activity of the imagination is directly related to the wealth and variety of the individual's accumulated experience (material available to the imagination). Hence his studies seek to expand the child's educational experience by providing a solid foundation for his/her creative activity, which is the first part of his methodology. For Vygotsky, it seems that there is always a direct relationship between imagined products and certain phenomena of reality. Imagination is not limited to reproducing what has been assimilated in previous experiences, but departing from these experiences to create new outcomes. This process is only possible through the use of the student' s personal or social experiences. For example, we can imagine a story that takes place in a desert, without necessarily have ever being there. Imagination can be guided by the experiences of other individuals. Emotion is also present in a double meaning. On one hand, all the most frequent feelings arising from certain images consistent with some specific emotion occurs "as if the emotion could choose compatible impressions, ideas and images to subdue us at that moment". It is easy to see that the influence of emotional factors should foster the emergence of totally unexpected imaginative groupings, providing an almost unlimited space of new combinations, such as the large number of images that have the same emotional significance. This relationship between imagination and emotion is mutual. On the other hand, all forms of creative affective elements are self-implicated. This is what Vygotsky calls "law of the emotional representation of reality," which explains why works of art created by the imagination of other authors can make a deep impression on us. This is quite evident in music when we see that what we call sound stimuli can evoke deep emotions (Vygostsky, 1995).

The concept of Zone of Proximal Development (ZPD) was introduced by Vygotsky. ZPD could be defined as the distance between the actual level of development (determined by the ability of a child to perform a task autonomously) and the level of potential development (determined by the ability to do so under the guidance of an adult or a capable pair). The central idea lies in the student's ability to experience and exercise mental activity, which is the result of interaction with other people or contexts in which the student is inserted (social context). The distance between these two points defines the impact and margin of the educational action (Jobim and Souza, 1994). This principle is defined by what a student is able to do or to learn with the help of others, through interaction and shared activity, as well as what the teacher provides to the student progressively to create a structural support system needed to continue the task. In this procedure, knowledge is acquired as the student progresses and the teaching-learning process guarantees the transference of control from the specialist or teacher to the student or trainee. This mechanism is therefore responsible for the learning process. Thus, in the present research we also intend to help both students and teachers, using Vygotsky ZPD through musicovigrams, to foster creativity and motivation so that students can handle and interact with themselves.

3. MUSICOGRAM AND ACTIVE LISTENING

The work here presented arises from the attempt to correlate theoretical proposals derived from the concept of active musical listening with the creation of a particular type of graphic music scores, the musicograms. As explained before, musicograms form a musical didactic methodology, which aims to teach musical listening for children. For several years, Wuytack has developed such concepts from his own professional experience as a teacher of children and adults with different levels of musical knowledge. This approach calls for the active participation of the listener and the use of visual information to encourage musical perception. Typically, listeners who do not have musical training are not able to read a score in traditional musical notation, but with musicograms they may come to understand a simplified visual representation of the music shape piece, as well as the musical elements that emerge from it, while they are listening to music.

The ways of listening to a musical work may vary according to different variables, such as the musical genre, the listener's emotional state, or the context of the work. When listening to erudite music, whether in school or in a concert hall, listeners are expected to remain silent, but with other musical genres, such as jazz, rock or samba, they are often allowed and even encouraged to participate more actively. Therefore, something that is not necessarily assumed in a particular mode of listening, such as the body gesture, can become fundamental in another way of listening. Children have different

ways of listening to music, according to each context, which suppose several levels of attention and musical emotional involvement (Wuytack and Boal Palheiros, 2009). Some researches, such as Madsen (1997), suggest that that musicians and non-musicians focus their attention on different musical elements. Other researches point out that musicians change their focus of attention throughout the event of listening (Clarke and Krumhansi, 1990). Musicogram aims to capture the listener's attention with a graphic representation of the temporal development of a musical work, thus allowing the students to understand the different elements of music by establishing the necessary relationships through symbols or images. Thus the musicogram becomes a synthesis for the correct perception of the musical work and a form to reduce the difficulty of a complex perceptual process such as reading a musical score (Wuytack, 1996). Figure 1 shows an example of a musicogram in which it is presented the symbolic elements that represent bars, instruments, and intensities.

Fig. 1 – Example of musicogram[6]

The musicogram, as conceived by Wuytack, attempts to provide a synthesis for a natural perception of the work and the reduction of the difficulty of a complex perceptual process, as the reading of a score in traditional notation tends to be (Swanwick, 1991; Wuytack and Boal Palheiros, 2009). Wuytack had in his mind the goal of facilitating the acquisition of musical contents through the use of multimedia in the conception of the musicograms, bringing forms of visual artistic expression to the musical art, connecting visual perception with musical form, and providing students with the creative ability to represent music through images.

[6] http://ceipsanagustinmusical.blogspot.com.br/p/blog-page.html

This teaching conception presents the musicograms as visual planes containing graphic elements that aim to reduce the difficulties associated to musical writing. This difficulty arises from the fact that music elements (such as height, duration, timbre and intensity) can be easily perceived through listening, but the musical form is something cognitively more complex. In the musicogram, the information is graphically registered on paper, establishing a correspondence between auditory and visual perception in order to allow the listener/reader to anticipate what will happen in the musical work (Wuytack and Boal Palheiros, 2009). Figure 2 shows an example of one of the original musicograms drawn by Wuytack, in which Tchaikovsky's work "Suite Nutcrackers, March" is depicted.

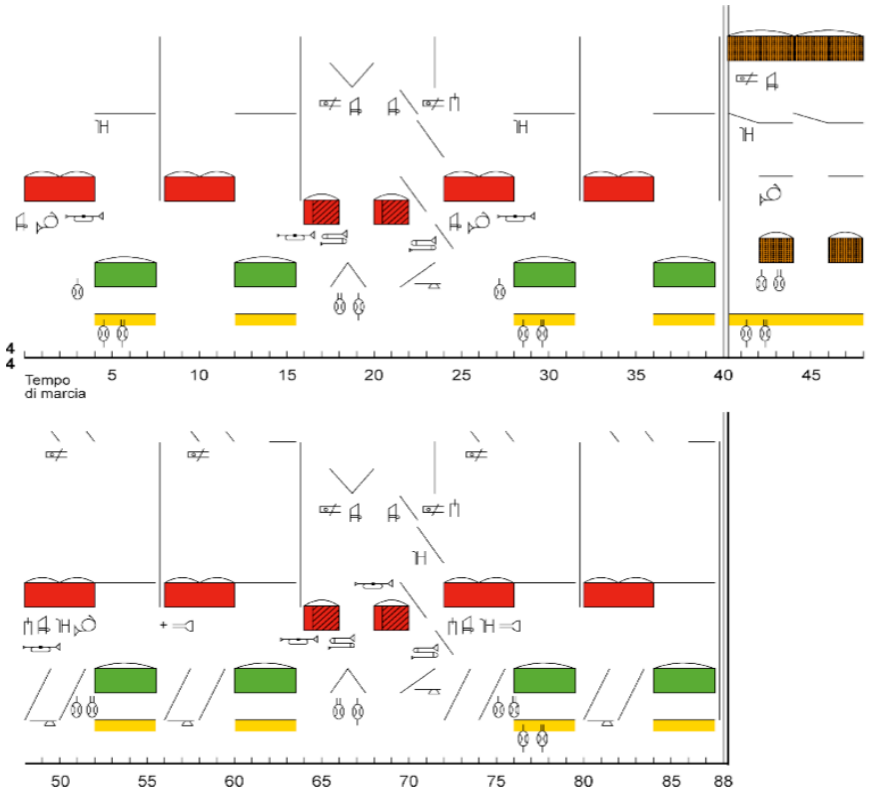

Fig. 2 – Example of original Musicogram, as drawn by Jos Wuytack

Active Musical Listening, as a conscious process of organization and construction of temporal events that appear in a musical work, relies on appreciation as an indispensable form of engagement with music. Active Musical Listening activities should lead students to focus attention on sound materials and the structure of the work (Swanwick, 1991).

One difference that is observed in music, with respect to other concrete arts such as paintings, sculpture, dance, etc., is that it can only be appreciated through hearing. Music is the art of organized sounds, as established by Edgard Varèse (Goldman, 1961). However, it is not easy to perceive the intricate musical structure through listening alone. With the use of musicograms, the ability to perceive

details of such structure during listening (through a graphic representation) is increased. The musicogram is thus a map constructed through a drawing or a set of linked images that help the listener to understand the structure of a musical work through an audiovisual process of observation and active listening (Olarte Martínez, 2009).

The fact that music is an art that occurs in the time domain makes it difficult to perceive it as a total unity (such as, for instance, a sculpture), specially when the musical piece has a longer duration (for example, a symphony), which makes it difficult to the musical mind to concentrate and apprehend the details in musical work structure, specially for children. Some researchers suggest that, for the listener's attention, local structures prevail over global ones and that listeners in general have difficulties relating events that occur far in time (Tilman and Bigand, 2004). One of the great difficulties of active musical listening is that when listening to a piece of music we cannot see, or perceive, its structure since the musical perception happens in the acousmatic[7] course of the musical work over time. Differently, a visual art occurs in the dimensions of space and its perception is predominantly visual since it occur in a certain place at an instant of time. A clear example is when we pay attention to a work of art, such as a painting or sculpture, and we can appreciate each detail randomly, spending any arbitrary amount of time to appreciate each of its constituent elements. As the analysis of such details occurs simultaneously with the perception of the totality of the work, active musical listening can be an advantage, as a form to support the perception of the totality of a musical work (Wuytack, 2009).

Outside classroom, when children listen to their favorite songs, they often use a listening mode that allows them to be physically active, such as singing or dancing along with the music. On the contrary, in classrooms, music teachers tend to use more contemplative and passive approaches, such as those that can be used to tell a story, with musical instruments that intervene in the works. According to Wuytack and Boal Palheiros (2009), it has been observed that, when studying music in the classroom, students tend to listen and understand better when teachers use strategies that are more active than passive. The fact that students are active before and during active listening greatly increases the attention and concentration of children in music.

It has always been difficult to some students, especially at the beginning of musical learning, to understand musical reading through its traditional musical elements. Wuytack and his predecessor Carl Orff were pioneers in the concept that musical experience is essential before the student is exposed to the abstract musical technique of reading a musical score. The purpose of these musical pedagogues was to teach the training of listening, allowing students to create and experience music by the process of active listening. These researchers believed that in order to understand music, students should

[7] from Greek ἄκουσμα akousma, "a thing heard", refers to the process of listening without any related visual information. http://dbpedia-live.openlinksw.com:8890/resource/Acousmatic_music

actively participate in its construction and execution. In educational terms, the idea is that students are not just passive listeners but they play an active part in the musical learning when cognitively interacting with musical sounds (Wuytack and Boal Palheiros, 2009; Mendoza Ponce, 2011). The active musical listening approach is based on three principles (Wuytack and Boal Palheiros, 2006): 1) The active participation of the listener, both physically and mentally, through the previous interpretation of graphic materials that represent the musical work; 2) The focus of the students' attention during the listening act and the conscious recognition of each part of the musical material analyzed; 3) Analysis of the entire musical form through the association of its musical elements with the symbolic graphic representations.

4. VIDEO GAMES AND MUSICAL EDUCATION

As previously stated, musicomovigrams are specialized video games developed out of the musicogram concept. The importance and application of video games as a didactic-musical strategy is currently a reality that extends far beyond the diversity found in a typical contemporary musical education classroom. Music education professionals should aim to find new horizons and contemporary methods that foster students' innovation and creativity in order to offer them an attractive and enthusiastic musical learning environment. This innovative challenge has made musical learning more attractive through the use of different technological methods and software tools created with the objective to develop the latent capacities the students already have.

Video games are primarily playful and interactive, and often have real time features that encourage users to quickly learn about their virtual environment by instigating them to make split second decisions (Pindado, 2005). Through video games, players are able to develop strategic-cognitive abilities (Siegler, 1995) including overcoming, verbal forms, attention, memory, visual spaces, interpersonal exchanging and collaborative work. These abilities can boost players self esteem, which increases every time the player reaches a certain goal. This process favors the development of psychomotor skills, understanding, initiative, decision-making, conflict resolution and even cognitive and academic skills.

Currently, a few music educators are starting to advocate about the importance of incorporating digital learning tools into the music learning process. A step forward in this direction can be achieved by simply raising awareness. The music teachers of today and tomorrow, along with other professionals of education, must acknowledge the various possibilities that digital learning systems bring to the educational process. Specifically, using educational video games as customized tools has the potential to greatly impact the music teaching and learning process in today's world.

It is known that games present the players with many possibilities of self-improvement, starting from the player's mental disposition to play until the acceptance of the possibilities of both defeat and victory. The concept of game also embraces ideas of limits upon freedom, invention, innovation and command, considering that the player has to abide by the game rules of conduct (Vygotsky, 1995). Different researchers, such as Aldrich and Prensky (2007) and Prensky (2006), discuss the possibilities of electronic games (video games) as generators of educational resources. According to them, the use of video games in music education can result in a very useful, interesting and advantageous tool for the teacher's work with the students. From the educational standpoint, results can be obtained to encourage students to deal with problems in classrooms, improving the motivation for a particular subject (Azorin, 2014).

5. CREATING MUSICOMOVIGRAMS

Digital technologies, and its offsprings such as digital TV, digital blackboard, smartphones, tablets, and the myriad of web technologies, have been pushing education in general, and music education in particular, through a series of transformations, calling for a careful discussion of educational concepts. These new perspectives make it possible for music educators to review and to expand their training, increasing their possibilities for didactic work and consolidating the formation of new technological skills. The concept of "technology in education" can be defined as the assemble of organizing and educational tools, available to the educator nowadays that favor educational practice, planning, and evaluation of teaching (Krüger, 2006). These resources can motivate pedagogues to develop and acquire skills in these new technologies, leading to the development of new, contemporary didactic resources, such as the interactive and dynamic contact of the student with multimedia materials. These resources also facilitate the development of critical thinking and creativity, allowing the direct contact of the students with the contents of musical works (Kruger, 2006). In the last decades, musicograms have taken advantage of ICTs (Mendoza Ponce, 2011). Today, the addition of video animation calls for a new concept, which shall be called here musicomovigram.

Musicomovigrams allow the presentation of unconventional scores (such as contemporary music) in an animated way, which serve to work fundamental elements, such as rhythm, pulsation, time, musical form and even timbre. These are audiovisual documents in which the music is synchronized with a graphic animation that represents some elements that can be worked by active musical listening (Mendoza Ponce, 2011). Thus, musicomovigrams can be defined as musicograms with dynamic animation provided by computational resources, which serves as an intuitive approximation to the temporal dynamics of music, thus promoting an active musical appreciation.

The theoretical basis presented here complements the idea previously proposed by Wuytack's musicograms. In order to achieve this, it is necessary to use software tools accessible to the majority of the target audience, which favor the creative process and add interactive audiovisual resources to music education.

6. DESIGNING SOFTWARE TOOLS

For the development of musicomovigrams visual programming, there are several development platforms that are easy to use and to install for most users (Jost, 2014), and some of them have the advantage of being free, open source, software. The programs that were surveyed in this project are: *Scratch* (https://scratch.mit.edu), *Kodu* (http://www.kodugamelab.com) and *eAdventure* (http://e-adventure.e-ucm.es). All of them have similar characteristics for the creation of interactive video games. The choice for the development of our musicomovigrams was *eAdventure*. This is a very easy to use tool, which allows students to create video games with small, or no background in programming, since this can be done through visual objects inside the platform. This software is developed and maintained by the e-UCM group at *Universidad Complutense de Madrid*, Spain. *eAdventure* is a research project that facilitates the integration of educational games and computer simulations based on educational processes and Virtual Learning Environments (VLE). This platform was created with three main goals in mind: 1) Reduction of development costs for educational games; 2) Incorporation of specific educational features into game development tools; and 3) Integration of the resulting games with educational material in the context of VLE. The following figures show examples of the *eAdventure* display:

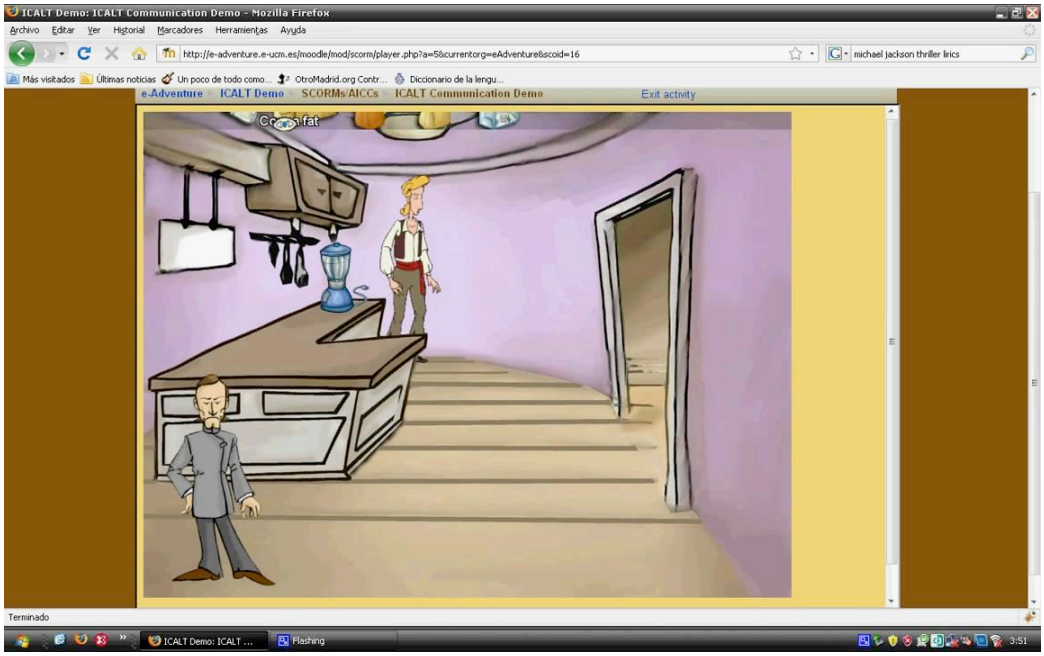

Fig. 3 – Example of a videogame developed in the framework *eAdventure*

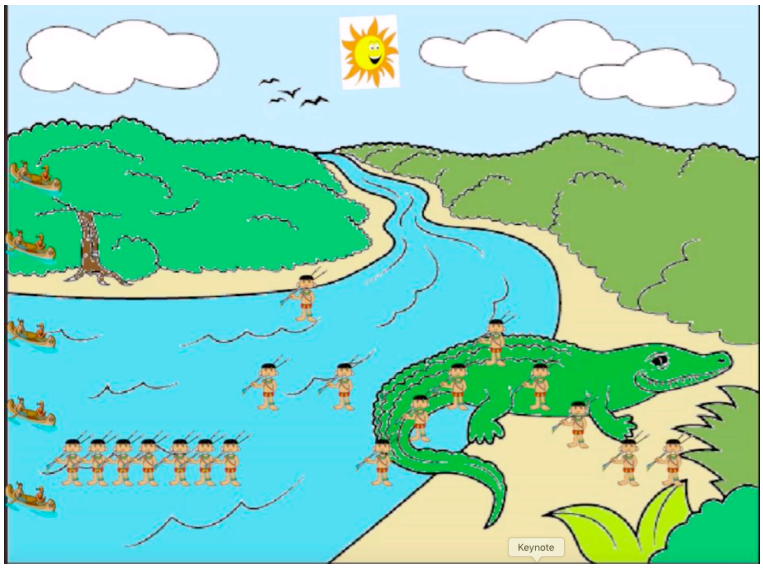

Fig. 4 – Example of a *musicomovigram* developed in the framework *eAdventure*

This software allows the user to create point-and-click graphical virtual adventures through the simple drag and drop of visual elements in the software interface, nourishing the free exploration of students. It has a powerful and simple interface, which can be used without the need of programming skills, reducing the complexity of the task and encouraging the creative process. Games created in this platform can be compacted as learning objects to be used in virtual teaching environments, such as Moodle (http://moodle.org). *eAdventure* is a web platform, thus being able to run in any of the main operating systems available (Windows, Mac OS X and Linux). A small application can be transmitted online and run locally in the user's browser, especially suitable for online education. Thus, with a

musicomovigram, it is possible to study a contextualized musical work through the creation of a virtual animated character that interacts with the students. This character may accompany the students during the whole musical adventure, for example popping up, inside the interactive environment of the video game and dialoguing with the students, explaining how to overcome the obstacles and reach the game goals. The teacher takes the role of a game designer creating the game to attend the learning necessity. For example, William Tell could be presented as the main character in a story where he invites the student to learn music with him in his adventures, through which the student would be learning history, solfege, intensities, melody, practicing with the flute and instrument sound recognition. Such game can also become an important evaluation mechanism for the teacher.

7. MUSICOMOVIGRAMS IN THE CLASSROOM

The main objective of this paper is to study the impact of musicovigrams in the classroom, with special attention to the promotion of musicalization in students so they can recognize and perceive musical forms. Recent observation strongly suggests that students' contact with musicomovigrams may facilitate the development of music perception and creativity, and promote direct contact with musical contents of fundamental musical works. It can also motivate students by making them direct participants in their own learning process. Because modern video games are strongly based in group interaction, we want to pursue the idea that musicomovigrams can foster respect and cooperation among students.

To assess these affirmations, and the degree of satisfaction and effectiveness of this experiment, two questionnaires shall be further applied to the students, one of which will be conducted at the initial phase and the other will be applied after the final phase of the interaction work with the musicomovigram. This will happen in four sessions of sixty minutes each. These questionnaires will consist of inquiries for qualitative answers with rank ranging from one to five points. They will argue about different perspectives in order to evaluate the content (questions based on specific aspects of the music, such as rhythms, duration of the figures, families of instruments), satisfaction and value (to understand how much the students liked playing with musicomovigrams, if they would be willing to repeat the learning experiment, if they would use these video games in their leisure time, etc.)

To develop this experiment the teacher must take into account the proper starting point of the learning process considering different characteristics of the students and their heterogeneities for the correct elaboration of the video games that will reach each of the students or group of students, so that everyone can take part of it. It is important that teachers aim to create and foster a secure and confident environment in which students feel excited to learn music and that all have access to entertaining and interactive musical content.

8. FINAL CONSIDERATIONS

This work introduced the concept of musicomovigrams as a tool to be developed for and used by children in their musical education. The sociocultural importance of music is well known. Since music is an integral part of human experience, it is common for children to show satisfaction in listening to and playing music. The music educator must not neglect this reality and should seek to explore the natural inclination that students have for music.

This project dealt with the theoretical conceptualization of the development of musicomovigrams in the form of video games. These are based on the same concept proposed for musicograms and are designed to be used for musical education, in principle with the main purpose of fostering fundamental music education.

The evaluation of our ideas will be done through questionnaires, designed to measure students' ability to learn elementary musical concepts through musicomovigrams. We suggest that with musicomovigrams the teachers will be able to help students in their learning process and also to promote learning autonomy. If possible, data basis of musicomovigrams will also be created, thus enabling the implementation of innovative methodologies such as the proposals of Bergman and Sams (2014). The teachers that embrace this approach may enjoy a stronger presence in the orientation and conduction of music materials and didactic resources, by being them the designers and experimental players of musicomovigrams. In this work, we also want to observe the place that musicomovigrams will have in the teaching of creativity and musical expression.

The design and application of musicomovigrams also infer the need for the creation of interdisciplinary groups with the aim of unifying forces between educators and digital artists. Those who use ICTs with pedagogical goals to enrich the digital artwork, offering aesthetic quality and the possibilities of interaction within didactic purpose, will need all the help they can obtain from their ICT colleagues.

In future works we intend to develop further musicomovigrams including more complex interactivity, as well as the possibility of offering multiplayer versions. These can also allow that several students play simultaneously within the same musicomovigram, working and improving communitarian musical aspects. In future works we also expect to use this resource for the development of even more musical aspects in the analysis, composition and performance fields.

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