A tool for the musical education of Deaf people

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Abstract

Hearing impaired people are often neglected musical education. This happens because musical activities are often focused on the development of the sense of hearing. In this work we propose the use of visual and haptic cues for musical education. These cues are generated from the real-time mapping of audio features extracted from a microphone stream. These mappings were incorporated into a mobile app and used in music lessons offered to a hearing impaired community. As a result of these lessons, participants developed the abilities of perceiving and producing rhythms, playing virtual instruments and participating in a collective musical practice.

1. Introduction

This work analyzes the use of electronic and computational resources for the inclusion of Deaf[1] students in music courses. Such an inclusion has often been perceived as impossible both by the Deaf Community, teachers, professionals and academics [1]. This idea has been perpetuating for many years, and there has been little effort on the development of musical activities aimed at the Deaf community [2].

In Brazil, music teaching in primary schools became compulsory in 2008 (Law 11768, August 18, 2008) [3]. This brought a new challenge to music educators: the inclusion of students with disabilities, especially in regards to the Deaf.

As Sá [4] points out, technological resources can be used by the Deaf to access music. This opens a new perspective in the possibilities for communication and connection. As a results, technological resources can contribute to make the Deaf more participatory in society. The development of a technological device to enable the musical education of the Deaf can rely on the idea that musical experiences are not an exclusively auditory, but also social and multisensorial.

2. Related work

There are many technology-based mapping systems that produce visual and haptic cues from musical information. Some of them target general audiences like Mitroo [5], Smith [6], McLeod & Wyvill [7], Karam et al. [8] while others, are specifically designed for Deaf users like Kerwins [9], Luiz [10], Nanayakkara [11] and Jack et al [12].

3. Proposed approach

We propose a contribution to the musical education of Deaf people comprising both a mobile application and educational remarks that can guide their use within music lessons. The development of the application and their educational counterparts was performed in music workshops in which we gathered feedback from the contact with Deaf people. We developed different interfaces to work each musical skill.

The first interface, extracts musical elements from an audio signal by transforming them into visual and vibrational elements, was aimed at facilitating musical practices comprising the production of sounds at different levels of intensity and frequency. The interface was used to observe and classify the sound production of percussive instruments at different levels of intensity, for the perception and production of rhythm at different *tempi*, fot the development of group musical activities in games of production, observation and imitation of rhythms, for the production of vocal sounds in different levels of intensity and pitch,

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[1]We stress the term Deaf (capitalized) as a recognition of the identity experienced by the Deaf subjects, their linguistic and social values

for the musical dictation of heights (bass and treble) and, finally, for activities of musical creation using voice and percussion instruments.

Interface 2, allowed the reproduction of musical rhythms, the accomplishment of collective musical practice and facilitated the interaction between the Deaf and the listeners in musical activities. By touching the finger on the device screen the user trigger haptic, visual and sonic responses related to each part of virtual drum. The interface was used in activities comprising the differentiation of the parts of the virtual drum kit according to its haptic response, the reproduction of musical rhythms at different speeds, the execution of rhythms written on a visual score and the participation in a collective musical practice.

Interface 3, allowed participants to differentiate the pitch of musical notes, play small melodic fragments,participate in collective musical practices and facilitated the interaction between the Deaf and the listeners in musical activities. This interface displays a virtual piano, by touching the finger on the screen of the device, the user receives a visual and haptic response, in addition to a sound emission for each note of the keyboard. The interface was used in educational activities involving the identification of musical notes, the reproduction of melodies from a score of colors, the execution of melodies in different *tempi* and the participation in collective musical practices.

4. Conclusion

Our proposal brings forward the possibility of using common techniques derived from traditional musical education, which facilitates its use by music instructors. We emphasize the possibility of developing musical activities for the integration between Deaf and hearing people, as all the interaction using the proposed tool relies on communication through sound. This poses an interesting road for future work.

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