Soundcool: collaborative sound and visual creation

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Introduction

Soundcool is a free system for musical, sound and visual collaborative creation through mobile phones, tablets and other interfaces developed by the Performing Arts and Technology Group (PerformingARTech) of the Universitat Politècnica de València (UPV) with the collaboration of Carnegie Mellon University. The PerformingARTech group is a multidisciplinary team of researchers with artistic and technical expertise led by Dr. Sastre, see team at http://soundcool.org.

Fig. 1: Soundcool application for PC or Mac: audio modules on the left,
and video modules on the right.

The Soundcool system can be downloaded from http://soundcool.org, and consists of a set of modules such as virtual instruments, players (audio or video), live audio (microphone) or video (camera), audio and video effects, mixers, etc. that work on Mac or PC computers. Soundcool modules are opened from the application (see Fig. 1) and can be interconnected with each other. For example, a sound source, such as a virtual instrument or a microphone, can be connected to a delay effect, which will be applied in real time to that source. The main advantage of Soundcool is that each of these modules can be controlled with the mobile phones or tablets of the participants, enabling collaborative creation, with both educational and professional applications, see introduction to Soundcool at https://youtu.be/zoZaVK7ysRM.

In the educational field, it should be noted that Soundcool, in addition to being free, is innovative with respect to other methodologies. Soundcool is a modular multimedia system of collaborative creation that uses mobile phones and tablets, technologies with which younger generations are very familiar. Soundcool has free online instruction in the form of MOOCs (Massive Open Online Courses): "Musical creation with Soundcool: Introduction" and "Soundcool 2: Video modules and
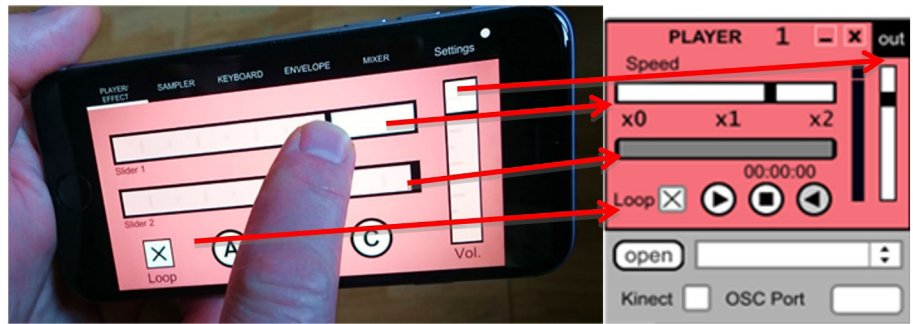
Fig. 2: Example of mobile / tablet touch interface (left) for Wi-Fi control of the Soundcool audio player in the computer (right).

creative proposals" in the prestigious international platform of online courses edX https://www.edx.org. The videos of these courses are on the YouTube channel of the project at https://bit.ly/2lJUi6S (Course Introduction to Soundcool) and https://bit.ly/2UdeJcr (Soundcool Course 2). In addition, the system uses resources available in many educational centers and by many individuals, such as PC or Mac computers, microphones, webcams, speakers, etc. The mobile phones and tablets that we use were selected because they are widely available among students or their families, eliminating the need for schools to acquire them.

Soundcool uses the Open Sound Control protocol (OSC, http://opensoundcontrol.org/introduction-osc) to extend the Soundcool application running on a laptop or desktop computer with multiple graphical interfaces running on mobile phones and tablets. The mobile app developed for Soundcool is available for free in the Apple Store for iOS and Play Store for Android. Each of the control screens on mobile phones or tablets is similar to the Soundcool modules that work on the computer. As an example, see the player module and its corresponding control screen on the mobile phone in Fig. 2.

When Soundcool was created, the Xbox 360 Kinect interface was also allowed to control the modules. In the professional field, a Soundcool control system was developed in 2018 using the Augmented Reality Hololens glasses https://www.microsoft.com/en-CY/hololens, see Fig. 3.
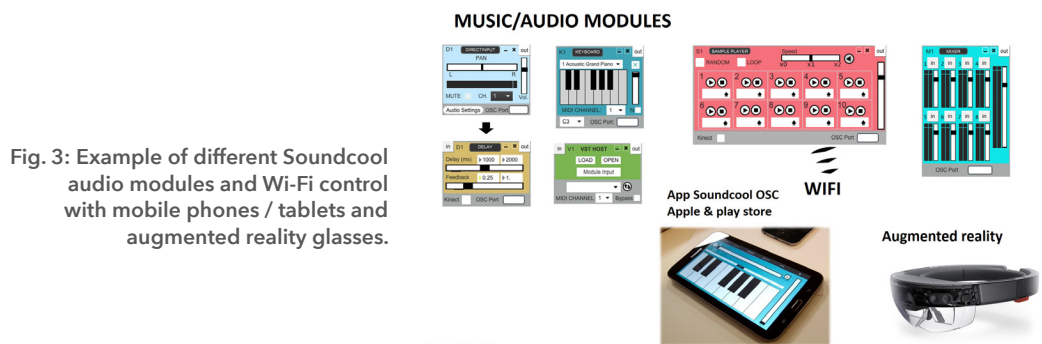
MUSIC/AUDIO MODULES

Fig. 3: Example of different Soundcool audio modules and Wi-Fi control with mobile phones / tablets and augmented reality glasses.

Professor Roger Dannenberg of Carnegie Mellon University (CMU) has collaborated with the Soundcool project since its inception in 2013, (SASTRE et al., 2013, SASTRE et al., 2015). That year, Dr. Sastre was awarded a scholarship to conduct a research stay with Dannenberg and his group. The objective proposed by Dr. Sastre for the stay was to create a system for the collaborative creation of sound and music. After the stay, with the collaboration of the team in Spain, Soundcool 1.0 was born that same year. Prof. Dannenberg has numerous contributions in the field of Computer Music internationally. He is co-creator of the free audio editor Audacity, with more than

350 million downloads. Invited to a class with Soundcool in 2016 within a European Erasmus + education project in Spain, he indicated that he had not seen anything comparable to Soundcool, see https://youtu.be/LHdzQe05SLo, and decided to go from being an external consultant to participate actively in the project.

Prof. Dannenberg points out that Soundcool is at an optimum point of balance between ease of use and generality. Thus, there are other systems, such as Max by Cycling '74 or textual languages dedicated to computer music, which, although they are more general than Soundcool, have a much slower learning curve. Alternatively, there are systems that, being simpler, are less functional.
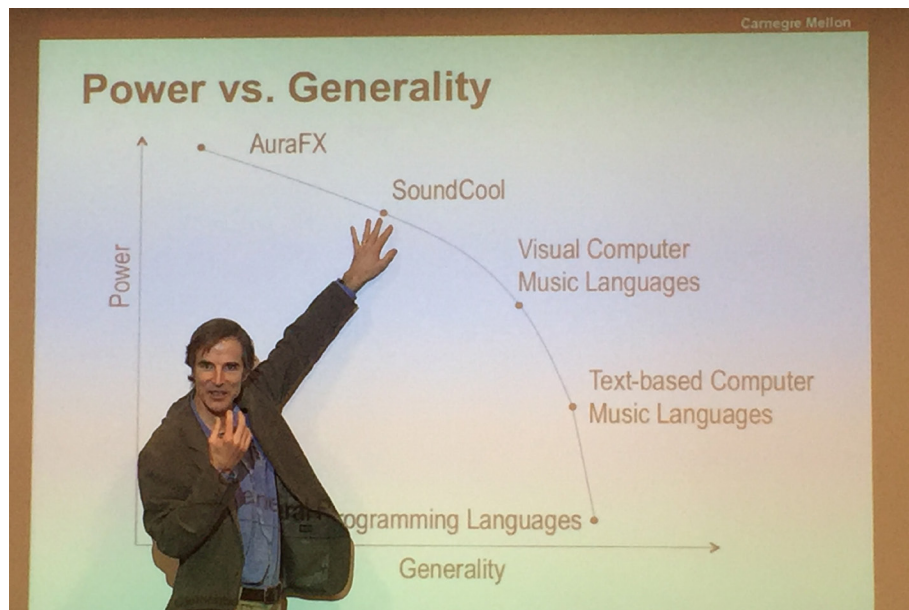

Fig. 4: Roger Dannenberg compares the simplicity and functionality of Soundcool with other systems of similar uses, being these more complex or less functional.

The Soundcool project has received awards such as the 2017 NEM Art prize for European creative industries from the New European Media association (https://bit.ly/2H9OEYT). Soundcool has also received the 2016 SIMO Education award, the Technology for Teaching Hall, for the best experience in programming and robotics (https://bit.ly/392znCG).

Soundcool has also been used with people with functional diversity, and the Soundcool group specializing in this has received awards such as the UPV Social Council Award in the category of University Social Responsibility for its work with ICTs and functional diversity, or the Orange Foundation Award in Use of ICT for Accessibility and Personal Autonomy for the Best Final Project, received by the work entitled "Analysis, Design and Development of Virtual Reality Applications for the Rehabilitation of Children with Mobility Issues." The project was developed by the student Mrs. Marta Martí Marqués with two tutors: Carlos Hernández of the UPV and member of the Soundcool research team, and Catherine Holloway of the University College London (UCL, UK), ranked first in education in the QS World University Rankings by Subject (https://bit.ly/2Q6wXO6).

In addition, Dr. Jorge Sastre, director of the project, has received the Bankia Award for Musical Talent from the Valencian Community as Best Researcher, especially for his work with Soundcool (https://goo.gl/DB6dEF). The project "ExperimentArts: music, creativity and collaborative learning," a group that worked with Soundcool in

Fig. 5: New European Media Association (NEM) https://nem-initiative.org.

its beginnings in 2013, also received a Bankia prize in the modality of best musical educational project. The system has been presented in numerous international publications, festivals, conferences, courses, as described in the publications section at http://soundcool.org.

Educational activities

European Erasmus+ educational projects such as *Technology to Support Learning and Creativity: Building European Networks through Collaborative Music Creation (2015-1-ES01-KA201-016139), Music Technology (2017-2-IT03-KA105-011802),* or *Music Classroom: Creativity and Learning (2017-1-ES01-KA101-036693)* have adopted Soundcool for different European primary, secondary and music schools in countries such as Italy, Spain, Romania, Portugal, etc.

Fig. 6: images taken in different countries of the activities and workshops of Soundcool within the Erasmus+ projects.

Fig. 7: examples of educational activities carried out.

Spanish, Italian, Portuguese, Romanian, American, etc. students have made numerous shows and artistic musical, audiovisual, theatrical, soundtracks, operas, etc. with Soundcool (see Fig. 6). Many projects are shared on the YouTube project channel https://www.youtube.com/c/soundcoolproject in the playlist of "Concerts, operas, theater and events with Soundcool" (https://bit.ly/2FQNr6s, see Fig. 7).

In 2016, the opera "La Mare dels Peixos" (The Mother of Fishes) was premiered at the Palau de les Arts in Valencia (Spain) with students from primary, secondary and music schools, together with singers and a professional orchestra (https://bit.ly/2TS2HDz). This is an opera inspired by the "rondalla" of the same name, by the Valencian writer Enric Valor, that narrates a traditional Valencian story. The musical composition was made by Jorge Sastre and Roger Dannenberg, and the premiere was made within a European project with funding from multiple entities. A new performance was performed at the Palau de les Arts in May 2019, this time with students of Soundcool creation from the CEIP Juan Esteve de Albal (Spain), see Fig. 8.

The first act is self-contained and brief, and can be performed separately. It has been interpreted by high school students in Romania (in a Romanian translation), also within a European project (https://youtu.be/4iRMnYJwxII), with students of music schools in Spain (https://bit.ly/2HUSfcX), and was also performed in English as *The Mother of Fishes* in 2017 as a preview of the opera with university students from the Puebla campus of the Technological Institute of Higher Studies of Monterrey (ITESM, Mexico, https://bit.ly/2YLQyUL). It should be noted that according to the international rankings ITESM is currently the best private university in Mexico and one of the best Latin American universities, being in the Top QS World of the 50 best universities in the world (https://bit.ly/2Ayzj0U) . The pre-release of the first act of the opera of 2017 in Puebla engaged many disciplines and was tackled with great enthusiasm on the part of the students.

After the preview, we proposed to ITESM to make a new version of the opera based on pre-Hispanic culture, so that they could make the story and production completely their own. Thus, on October 30, 2018 a workshop of the full opera was made. You can see the workshop teaser at https://youtu.be/kfMLDTcO0SU with elements of Prehispanic culture.

Fig. 8: new performance of the opera La Mare dels Peixos (Mother of the Fishes) at the Palau de les Arts in Valencia (Spain) in May 2019

Fig. 9: preview at ITESM Puebla of the opera The Mother of Fishes, Act I, see https://youtu.be/-IrpiP5Zl3M

Fig. 10: workshop of the opera The Mother of Fishes in Puebla, Act III.
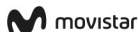
Fig. 11: performance of the opera La Mare dels Peixos (The Mother of Fishes), Act II, Centro Nacional de las Artes (CENART) Nov. 16, 2019, production of ITESM Mexico City Region and CENART.

Fig. 12: Performance of the opera La Mare dels Peixos (The Mother of Fishes), Act III, Centro Nacional de las Artes (CENART) Nov. 16, 2019, production of ITESM Mexico City Region and CENART.

In all the performances of the opera, all the sound effects are created by the students of each center and country, and interpreted using Soundcool with mobile phones and tablets. By being part of the creation itself in a collaborative way and with mobile devices, the level of involvement of students has exceeded all our expectations. Given the success of the opera workshop in Puebla, the Mexico City Region of the ITESM produced the premiere in the Valencian language with the collaboration of the Centro Nacional de las Artes from Mexico in the fall of 2019, see https://youtu.be/KhYiZmgMVno. The premiere is also planned in the US in 2020 with the collaboration of Carnegie Mellon University, a prestigious university in international rankings (https://www.cmu.edu/about/rankings.html), where Soundcool is also being used in classes. Students of the Creative and Performing Arts Magnet school (CAPA) of Pittsburgh (USA) will participate in this production. To prepare for this, Prof. Dannenberg will teach Soundcool to students at CAPA.

Other Spanish universities adopted Soundcool, such as the University of Cantabria, the University of the Balearic Islands or the Universitat Politècnica de València (UPV), a prestigious university in the international rankings https://www.upv.es/estudios/grado/upv-rankings-en.html. The UPV is the only polytechnic university in Spain with a Faculty of Fine Arts. Due to the collaboration between engineers and artists, the Faculty of Fine Arts of the UPV has been the best in Spain for the last 16 years (https://bit.ly/2UMcvU3). This collaboration between art and technology is also prevalent at Carnegie Mellon University where engineering and arts also coexist on the same campus. This type of collaboration between art and technology is what has allowed the birth of Soundcool.
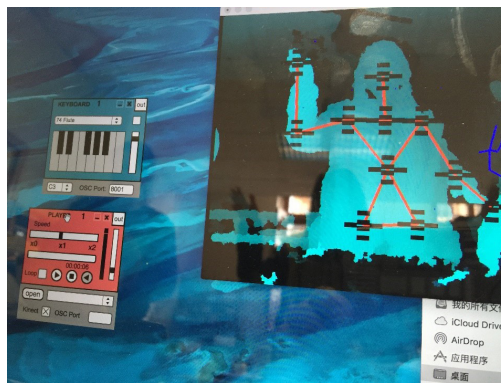
Activities for functional diversity

The Emosons group of the UPV is part of the Soundcool team and has experience in the use of ICT for functional diversity (BRICEÑO et al., 2014, HERNÁNDEZ et.al. 2014, BRICEÑO 2017, HERNÁNDEZ et al., 2018), and the group has received prizes as mentioned earlier. The group has applied Soundcool to people with autism, Down syndrome, and people with partial and total blindness in "La Torre" Occupational Center of Valencia (Spain). Excellent results have been obtained, resulting in a doctoral thesis (BRICEÑO 2017) and a publication (HERNÁNDEZ et al., 2018).

In the case of partial and total blindness, the Xbox 360 Kinect video game interface was initially used because it allows control of the Soundcool modules through body movement. However, this resulted in a separation between students with blindness and the rest of the students who used tablets. To enable one more integrated group, embossed templates were made for the tablets to allow the use of Soundcool by people with blindness.
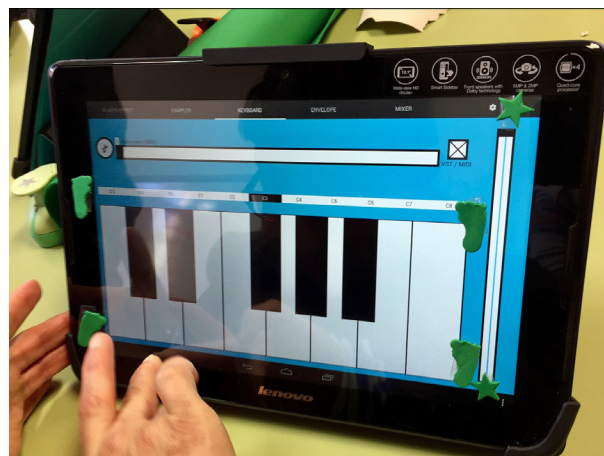
On the occasion of the Fallas de Valencia festivities, a virtual Valencian "mascletá" was performed with Soundcool at the "La Torre" Occupational Center of Valencia. This event is typical of the Fallas and consists of exploding powerful firecrackers and fireworks in the afternoon. It lasts approximately 5 minutes and usually has sections, a variety of sounds and a certain rhythm, as if it were a percussion piece. The activity was so successful (see https://youtu.be/97Dc0lHwGcQ) that it was introduced as a simple introduction experience to Soundcool in the online course mentioned earlier.

Other centers with students with functional diversity are interested in the use of Soundcool, and some of them have made experiences such as "El Pez Arco Iris" (The rainbow Fish), a musical theater performed by students of Special Education of CEIP Fabián and Fuero de Villar del Arzobispo of Valencia (https://youtu.be/-OT9V0y4_VA).

Fig. 13: control of Soundcool modules through Kinect and body movements.

Fig. 14: tablet fitted with tactile stickers to facilitate the use of modules for students with partial blindness.

Fig. 15: virtual mascletá with Soundcool in the occupational center La Torre de Valencia. Tablet embossed template for blind participants (bottom left).

Professional activities

In the professional field, Soundcool has been used in festivals such as the Electronic Music Festival Sonar in Barcelona (Spain) and the Kikk Festival in Namur in Belgium. The most important project has been the use of Augmented Reality (AR) to control Soundcool, in which an experimental application was created where a dancer manipulated three-dimensional figures located in the perceptual space generated by the AR glasses. Through Wi-Fi, these figures controlled different modules of the Soundcool application that were running on the computer, such as sample players for sample reproduction (yellow cubes in the Figure 16, each corresponding to a sound sample), virtual instruments (blue spheres that activated notes of a piano keyboard) or the control of effects sliders (green and blue bars, etc.).
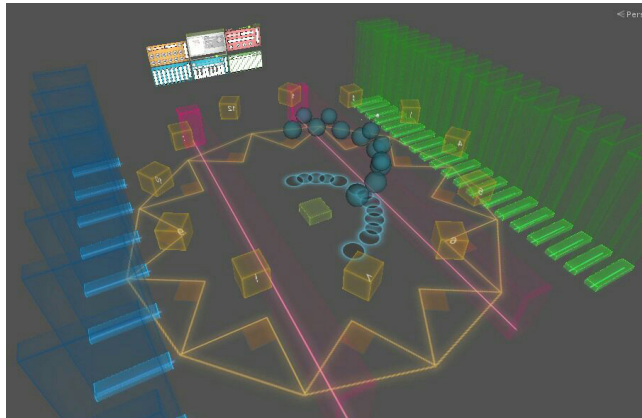

Fig. 16: Soundcool AR virtual controls: sliders (e.g. green bar), virtual instrument keyboards (blue spheres), and sample reproduction (yellow cubes).

This first use of Soundcool with AR was created for a Soundcool demonstration commissioned by the MarketLab organization of the Sonar Electronic Music Festival of Barcelona. For this festival the audiovisual work HoloSound was prepared, using a style of electronic music and video suitable for the festival. The demonstration featured the control of various Soundcool modules by the movement of a dancer that activated the virtual geometric figures located in the AR space mentioned above.
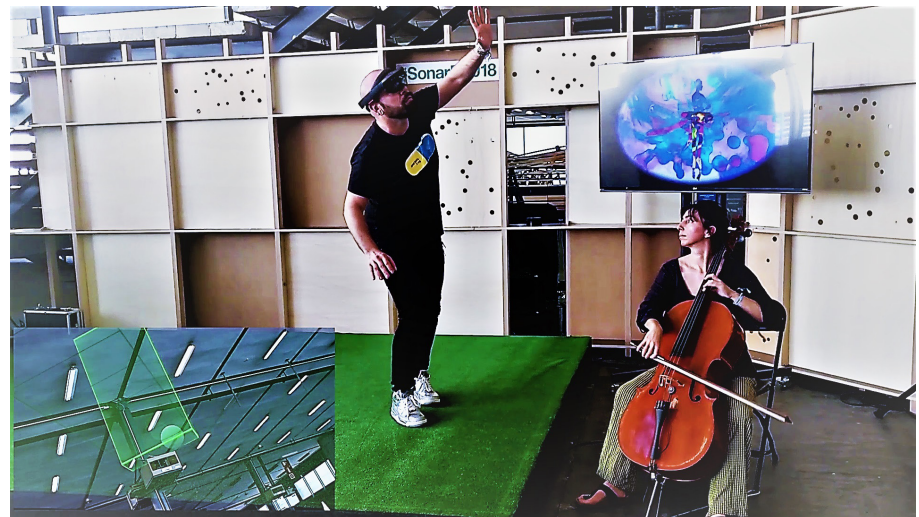
Fig. 17: HoloSound in the MarketLab of Sonar + D: bottom left from the figure you can see the control by the dancer of a virtual green bar connected to a Soundcool control.

HoloSound was premiered at the MEVArt 2018 Festival of the UPV in June (https://youtu.be/ZJF4kl8-TDI), and subsequently performed at the opening ceremony of the 50th anniversary of the UPV (https://youtu.be/ V-B1gE448tw), in the MarketLab of Sonar (https://youtu.be/Ql_J5KQlll0), attracting the attention of artists and engineers. This was the first work in which video creation was made with Soundcool, by the video artist and composer Stefano Scarani, member of the team. HoloSound was also performed in the World Science Festival in New York (https://youtu.be/l34X-qxln0Y), and Prof. Jorge Sastre has been invited by New York University as a Visiting Scholar for collaboration with Soundcool.

Fig. 18: HoloSound at the World Science Festival in New York.

In March 2018 the performance of "Hope" took place at the Falla Palleter in Valencia within the "Plantar la Esperanza"[1] solidarity project for breast cancer research. This work had dance, interactive video projections with dance, music and sound effects made with Soundcool (https://youtu.be/SFseQG5Mr-0), and was performed again in February 2019 in Las Naves (Valencia), within the theatrical work "Utopia."

Fig. 19: "Hope" in the Palleter's Falla (Valencia).

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[1] "Planting Hope": In the festival of the Fallas, monuments called fallas are built or "planted" and subsequently burned. Hence the play on words between planting the falla and planting hope.
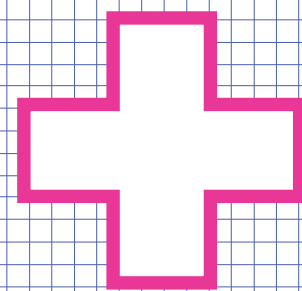
Fig. 20: Echoes for Guitar and Soundcool by Pedro Astasio,
Auditorium 400 of the Real Conservatorio Superior de Música Reina Sofía de Madrid
(Royal Superior Conservatory of Music Queen Sofia of Madrid).

The same day of the premiere of HoloSound at the MEVArt Festival in Valencia, the work "Echoes" for Guitar and Soundcool, composed by the composer Pedro Astasio, was also premiered at the Auditorium 400 of the Real Conservatorio Superior de Música Reina Sofía de Madrid (Royal Superior Conservatory of Music Reina Sofía).

In March 2019, the premiere of the work "Floating in the Deep Blue" by Stefano Scarani and Jorge Sastre, by the percussionist Joan Soriano, took place in the ninth edition of the festival SOXXI Cultura y Artes Contemporáneas of the Vila de Canals (Valencia). This is a work for vibraphone, Thaï Gongs and live electronics made with Soundcool and controlled by the soloist with 4 phones / tablets. It was a great challenge for the composers, since the soloist had to also control the electronics (https://youtu.be/KPSiPHTfvzo).

Fig. 21: Joan Soriano representing the piece
"Floating in the Deep Blue" for percussion and Soundcool live electronics
at the IX Vila de Canals International Festival.

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Conclusions

Soundcool started as a small project to implement a free system of collaborative creation that was proposed in 2012 and awarded grant support in 2013, and since then it has not stopped growing. Its use is expanding in primary schools, secondary schools, music schools and universities. It has been shown in research publications that the pedagogies based on collaborative creation with Soundcool increase the motivation of the students, who have performed musical, sound, audiovisual, theater, soundtracks, educational operas, etc. (see the publications section in http://soundcool.org.) At the school level, Soundcool is being used in music, plastic arts, arts, language classes, etc. At the university level, Soundcool has been used in Computer Music classes, Digital Music Production Engineering, Audiovisual Production, Music Technologies, etc. Inclusive pedagogies with Soundcool have demonstrated their suitability to improve the abilities of students with autism, Down syndrome, partial or total blindness, etc.

Currently, techno-art projects are being carried out with conservatories of music, dance and drama schools. The system has been presented in numerous publications, in festivals, conferences and universities. Soundcool has received letters of support from professors from prestigious universities such as University College London, Nanyang Technological University, Berklee College of Music, the Technological Institute of Higher Studies in Monterrey, or the Real Conservatorio Superior de Música Reina Sofía de Madrid.

In the professional field, Soundcool has the advantage of being a very simple system that is also very flexible, allowing it to be easily used by artists not versed in programming. Soundcool facilitates making electronics, including acoustic or virtual instruments with live processing, video creation and audiovisual creation individually or collaboratively, in musical, audiovisual, theatrical, operatic, etc. works, controlling the system with mobile phones or tablets.

The success of the system has been possible thanks to the collaboration of a multidisciplinary group of engineers, artists, musicians, composers and pedagogues, where many of the team members themselves are also multidisciplinary, combining artistic and technical proficiency.

Fig. 22: Roger Dannenberg and Jorge Sastre along with part of the cast of the opera La Mare dels Peixos (The Mother of Fishes) performed in the Centro Nacional de las Artes (CENART) on Nov. 16. 2019, production from ITESM Mexico City Region and CENART.

Acknowledgments.

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