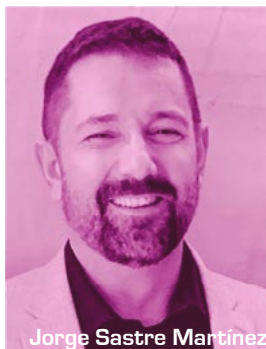# Soundcool, from art to medicine. Interview with Jorge Sastre Martínez and Roger B. Dannenberg

## *Soundcool, del arte a la medicina. Entrevista con Jorge Sastre Martínez y Roger B. Dannenberg*

**STEFANO SCARANI**

Universitat Politècnica de València
Centro Superior de Música del País Vasco Musikene
sscarani@musikene.net
ORCID http://orcid.org/0000-0003-2366-8866

Jorge Sastre Martínez

Roger B. Dannenberg

**Jorge Sastre Martínez** is a University Professor Cathedraticum, Instituto de Telecomunicaciones y Aplicaciones Multimedia (iTEAM), Universitat Politècnica de València, director of the Soundcool project. Recently received a Bankia Award for Musical Talent and a National Award for Telecommunications Engineering. He directs the PerformingARTech Group and the Soundcool project, a collaborative creation system with mobiles, tablets and Augmented Reality. Sastre was visiting scholar at Carnegie Mellon University, where he studied composition and Computer Music with professors Leonardo Balada and Roger Dannenberg, respectively, and taught Integrative Design, Arts, and Technology (IDeATe). He has been a visiting scholar at the Tecnológico de Monterrey and at New York University. Sastre has directed 17 research projects and published more than 80 articles in journals and conferences.

He has composed works for orchestra, symphonic band, ensemble, electronics, etc., in venues such as the Palau de les Arts Reina Sofía (Spain), Carnegie Music Hall in Pittsburgh (USA), Centro Nacional de las Artes (Mexico), Principal Theater of Valencia, etc. Among them, he has composed the opera The Mother of the Fishes with the collaboration of Roger Dannenberg. This opera has been performed in Spain, Mexico (https://bit.ly/335Nc2W), Romania and the United States (https://bit.ly/32VORtl). In this project the sound design is made and performed with Soundcool by students of all levels from the countries where it has been performed. https://www.linkedin.com/in/jorgesastre/

**Roger B. Dannenberg i**s a composer, performer and Emeritus Professor in the Schools of Computer Science, Art and Music at Carnegie Mellon University. He is a pioneer in the field of Computer Music and known for intelligent interactive music systems, and the co founding of Audacity, the most widely used digital audio editor. He studied composition with Paul Cooper at Rice University and orchestration with Leonardo Balada at Carnegie Mellon, where he also received a PhD in Computer Science. As a trumpet player, Dannenberg performs jazz, experimental, and classical music, and he has performed his own interactive computer music pieces in many concerts and international festivals.

SS (Stefano Scarani) - Today's society leads us to separate knowledge into areas, with the illusion that each area is really air-tight and has little to do with other seemingly distant areas. However, in recent decades, art and science seem to have met again and collaborated as they did in the Renaissance, and we are re-discovering many more common features than what appeared at first glance. In the artistic field, modern technologies have provided tools for new languages, and the very fact of living in a society strongly imbued with technology has imposed new horizons on artistic and philosophical thought. From a more strictly scientific point of view, the example carried out by the MIT MediaLab, where mixed work groups have been created between engineers and artists [NEGROPONTE 1995], has shown how, probably, many ideas need to come to the mind first as a pure fantasy, and only later be subjected to concrete investigation[1].

Nor should we forget that scientific thinking today is directed towards shared technologies, where the same invention, such as microchips, can be used in different areas, spurring further inventiveness and multiplying the gains of financial investment in research. In the digital age, we have entered a period of non-specialization of systems, since the dialogue between different objects, devices, applications, is in fact a reality.

Here is a system born within the Universitat Politècnica de València (Polytechnic University of Valencia, UPV) that has found applications in its native environment, art and education, and in new areas, including a recent focus on medicine. To obtain more information about Soundcool [CMJ, CMMAS] we opened a dialogue with two of its creators: Jorge Sastre Martínez, Director of the project and Professor at the Polytechnic University of Valencia, and Roger B. Dannenberg, from the Carnegie Mellon University of Pittsburgh, and co-creator of the famous audio editing software, Audacity.

First of all, what is Soundcool?

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1       There are many fantasy inventions born in science fiction that today have taken shape as real scientific inventions, starting from the needleless syringes or the wireless communication networks of Star Trek.

JSM (Jorge Sastre Martínez) - Soundcool [Soundcool] is a software tool created at the Universitat Politècnica de València (UPV), in collaboration with the Computer Music Project of Carnagie Mellon University in Pittsburgh (USA). It was born as a collaborative musical and audio-visual tool, initially applied above all to the educational field, and later also to the field of professional audio-visual creation (fig. 1).



Fig. 1 - Devices controlling Soundcool.

SS - How do you explain that you are currently within a public health project?

JSM - It must be considered that Soundcool is the result of joint work by specialists belonging to different areas. Its creators come from Telecommunications Engineering, Fine Arts, Pedagogy, and Music Conservatories, so Soundcool, in its essence, represents this synergy of various areas of knowledge as you described at the beginning of this interview. This interdisciplinary approach helps to create connections and possibilities where they would not normally appear.

SS - How did Soundcool get involved in a health project on neurodegenerative diseases?

JSM - Soundcool was used originally in the educational field including with people with functional diversity, and this has shown that this tool has possibilities beyond purely artistic and educational use. What we are starting at the moment is a joint work between the UPV and the Foundation for the Promotion of Health and Biomedical Research of the Valencian Community (FISABIO), with the support also of the Generalitat Valenciana (GVA), aimed at creating new therapies for patients affected by neurodegenerative diseases. There are two parallel projects: The first focuses on preliminary work to develop a new therapy for people affected by Alzheimer's, and it is a precursor to the second project, which provides for the expansion of the first to a greater number of Alzheimer's patients, and above all the expansion to therapies for different types of

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◆ Steano Scarani ◆

neurodegenerative diseases that can be treated by means of new technologies for collaborative musical and audio-visual creation. These projects are part of the POLISABIO, UPV and FISABIO framework that tries to strengthen collaboration between UPV researchers and the centers attached to FISABIO.

SS - So the two projects are related and in some way, one is the extension of the first?

JS - Yes, in fact, Soundcool has already been used in preliminary work on rehabilitation therapy at the *Nuestra Señora del Carmen* Hospital Center in València with a patient with brain damage. This made us think that this tool could be extended, and we proposed the idea to FISABIO, who put us in contact with the neurologist Dr. José Manuel Moltó, from the *Virgen de los Lirios* Hospital in Alcoy.

SS - There is a phrase that has been fixed in my memory, extracted from the text *Understanding media* by Marshall McLuhan: "That technologies are ways of translating one type of knowledge into another has already been expressed by Lyrnan Bryson in the phrase «technology is clarity and precision»" [McLUHAN, 1996 p.77]. It sounds like an encouragement to the conscious use of technologies to keep the human brain active and precise. How can Soundcool, or the new audiovisual technologies, be useful in this regard?

JS - Medical methodologies based on art therapy offer a precedent, which, unlike classical therapies, uses the creativity of the patient (fig. 2). Creative, individual or collaborative work has proven to be exceptionally motivating in mental functional diversity and education. Soundcool, thanks to its structure and thanks to the fact that it is a collaborative system, can be used through mobile devices. During the pandemic and the restrictions in effect, Soundcool has been used remotely, introducing the possibility of operating through the Internet instead of being limited to local networks. This has allowed us to carry out numerous remote experiences. Notable among these are workshops with an audiovisual concert-performance "Autumn" with music by Pedro Astasio. One of these workshops was held for the Korea Electroacoustic Music Society (KEAMS)[2], based in Seoul, Korea, with participants from Korea, Spain, the United States and Indonesia. Another performance of the same work was carried out in the MEVArt 2020[3] based at the UPV, in the Alfons Roig Auditorium, and with participants connected from Valencia, Madrid, Donostia-San Sebastian, Extremadura and Pittsburgh, with live streaming to broadcast the event.

The potential to collaborate without necessarily having physical contact is fundamental for Alzheimer's patients. These are mainly elderly people who are often residents of or visitors to communities and rehabilitation centers, which in this pandemic have been among the main locations where the virus has spread. In addition, Soundcool is extremely easy to use, and this is critical for a population that is mainly of an age for which the use of mobile phones or tablets can be somewhat new and challenging.

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2       KEAMS: [http://keams.org/]
3       Festival MEVArt VIII 2020: [https://musicaelectronica.blogs.upv.es/2020/11/18/festival-mevart-viii-streaming-musica-electronica-y-video-arte-2020/]

Fig. 2 - Art therapy applied to neuro degenerative diseases: painting a mascletà.

SS - In short, Soundcool includes a number of characteristics that make it a very useful tool in this type of application, due to the fact that it offers sound and visual creation, it is simple, it allows remote control over the Internet and also mixed local and distance control, since the main devices connected to the system are smartphones and Tablets. These devices use communication via WiFi allowing continuous control in real time either locally or over the Internet. How does Soundcool work?

RBD (Roger B. Dannemberg) - Soundcool consists of a main program that runs on a computer (fig. 3) and other apps stored in various mobile devices (fig. 1). A sound or visual project is created in the main program includes a series of basic audio and video modules such as audio and video players and effects, mixing consoles, chromakey, video selectors, etc. These modules have a visual representation on the screen where you can interconnect them to form a complex structure built from simple elements. Thanks to the use of a WiFi router, each of these modules can be controlled remotely using the Open Sound Control (OSC)[4] communication protocol with different devices running our *Soundcool OSC* application. Also, more complex but very interesting devices, such as Microsoft's *Hololens*[5], human body capture systems such as *Kinect*[6] and *PoseHook*[7], midi controllers, etc. can interface with Soundcool and act as controllers for pitch, volume, filters, video mixing and selection, and many other things.

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4       OSC, IP communication protocol: [http://opensoundcontrol.org/]
5       Microsoft Hololens: [https://www.microsoft.com/es-es/hololens]
6       Microsft Kinect 360 is now out of production.
7       Produced by Hollyhook [https://play.google.com/store/apps/details?id=com.hollyhook.posehook&hl=es_419&gl=US]
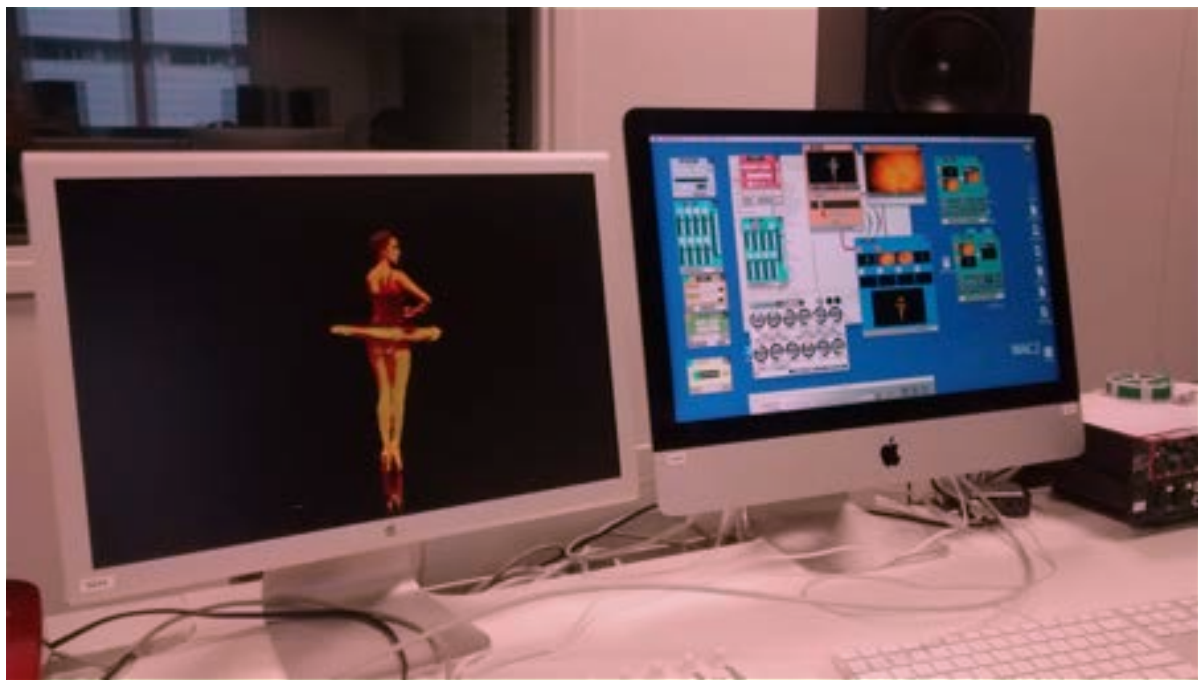
Fig. 3 - Soundcool main software controlling images.

We often run Soundcool in classrooms or theaters using a local network established by a WiFi router. In this case, only devices connect to the local network can control Soundcool. However, if the router is connected to the Internet, you get the additional possibility that participants can interact with Soundcool at a distance. Often, we stream the audio and video output from Soundcool over Zoom or a similar communication system back to the performers to close the interactive loop.

Soundcool is modular, which allows its elements to be reconfigured freely and creatively, so the system can meet the needs of classrooms, composers, video artists, and others.

SS - Soundcool manages sound and images: is everything controlled with the same devices?

RBD - Yes, the *Soundcool OSC* application for iOS and Android contains the controllers for the video modules and the audio modules. All participants connect their mobile device to Soundcool by entering the Soundcool computer's IP. In addition, in each of the sound and video modules has a port number that is also entered into the of the participant who wants to control that module. This way, one participant will not interfere with the modules controlled by the others. The whole procedure is quite simple, and we have even used it in primary schools with great success.

Soundcool is of course only one of many programs that artists can use to work with audio and video. I have been very impressed by the fact that Soundcool is almost unique in finding a balance between power and generality. There are many programs and programming languages that can literally "do anything," so they are very general, but require great effort an knowledge, hence not very powerful. Other programs are built for a specific purpose making them very easy to use, hence powerful, but they lack the generality to support creativity.  The most extraordinary feature of Soundcool is that it is very simple and at the same time allows one to configure any number of high-level interactive audio and video systems. This is largely due to the modular design, but it also

helps that modules are substantial and come with ready-made graphical user interfaces and OSC control. For example, the Generator module can generate a variety of waveforms with a volume control, frequency control, and selectable forms of modulation, all controlled on screen or using a Soundcool app over WiFi. By simply connecting this module to a Speaker module, one can already make many interesting sounds.

Sastre originally defined Soundcool to be like *LEGO®*[8] for sound, and since 2018 Soundcool also works with images and video. For example, we can create a series of audio players or other modules that receive sound from live microphones. These can be connected to effects such as echoes or pans that are controlled in real time. In turn, these effects can send their output through further transformations and ultimately a mixer where they are combined. In a performance, we have many sound sources and processing options to choose from, supporting a range of performance practice from pure improvisation to carefully rehearsed compositions. And the same happens with the images and video (fig. 4). With this level of complexity, it should be clear why Soundcool is designed for collaborative control, and why Soundcool is so effective in educational settings with multiple students.



Fig. 4 - Example of modular connection in Soundcool (Hololens video set)

**SS** - The word *real time* is a *key word*: everything that is done in Soundcool has an immediate impact on the system and on hearing or viewing the result.

**RBD** - Exactly. Each person interacts with part of the circuit that we have created, but since it is a circuit, where a sound or an image travels along a path from one processor to the next, each

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8       LEGO® is the famous construction game based on a bricks.

processor performs some intervention that affects what follows. Imagine that in an orchestra there are not only several instruments, but each instrument has several players, e.g. the violin strings are fingered by one player, the bow is controlled by another, and maybe there is another player who can tune or detune the strings, or apply a *sordina*, or prepare it as John Cage prepared the piano, by inserting a screw, some paper, or a piece of plastic between the strings. All this can be done instantly and live, allowing the performers to hear and see results immediately and interactively.

SS - Soundcool has also been used professionally in concerts and performances. The opera *La Mare dels Peixos* based on the *rondalla* of the same name by Enric Valor stands out without a doubt (fig. 5). This work was composed by Jorge Sastre and Roger Dannenberg for six voices, choir, orchestra, Soundcool, dance and images, using props from recycled materials. This opera was premiered in 2016 at the Palau de les Arts *Reina Sofía* in Valencia. It was the first opera in Valencian of the 21st century, and the first opera in Valencian performed outside of Spain according to SGAE files, with versions performed in Romania, Mexico and the United States, in addition to Spain. We have also seen various compositions such as *HoloSound* that was performed in Valencia (2018, fig. 6), in Barcelona at the Sonar Electronic Music Festival (2018) and at the World Science Festival in New York (2019); *The Spirit of the Objects* (Valencia 2019, New York 2019); *Floating in the deep blue* (Canals 2019) and *Autumn* (Seoul 2020, Valencia 2020) among others. How are professional needs as well as the need for simplicity met with Soundcool?

JSM - In recent years we have started to develop a series of modules to satisfy professional needs. These new modules allow interconnections with different devices and also with external applications. At the same time, these modules are perfectly integrated into the Soundcool system, allowing complete continuity and compatibility within the system. Since the end of 2019, we have signed an agreement with the Musikene Higher Music Center of the Basque Country [Musikene] so that in its Master and Undergraduate courses Soundcool is introduced among the tools available for musical and audiovisual composition. With this, the Musikene electroacoustics laboratory is transformed into a testing center for students, who have the versions of Soundcool not yet made public. In this way, prototypes will undergo necessary testing before public distribution.

SS – What projects are in future of Soundcool?

RBD - We are working on a version of Soundcool that is independent of Windows and macOS required in the current version. To accomplish this, we are developing a new version in HTML 5 that runs completely in a web browser. Instead of installing an application, users simply visit a URL. The first results are very positive.

JSM - For Soundcool we have many ideas for different applications of the system; we only need time and support so that they can all be realized.

Fig. 5 - La Mare dels Peixos, Palau des Arts Reina Sofia, Valencia, Spain 2019
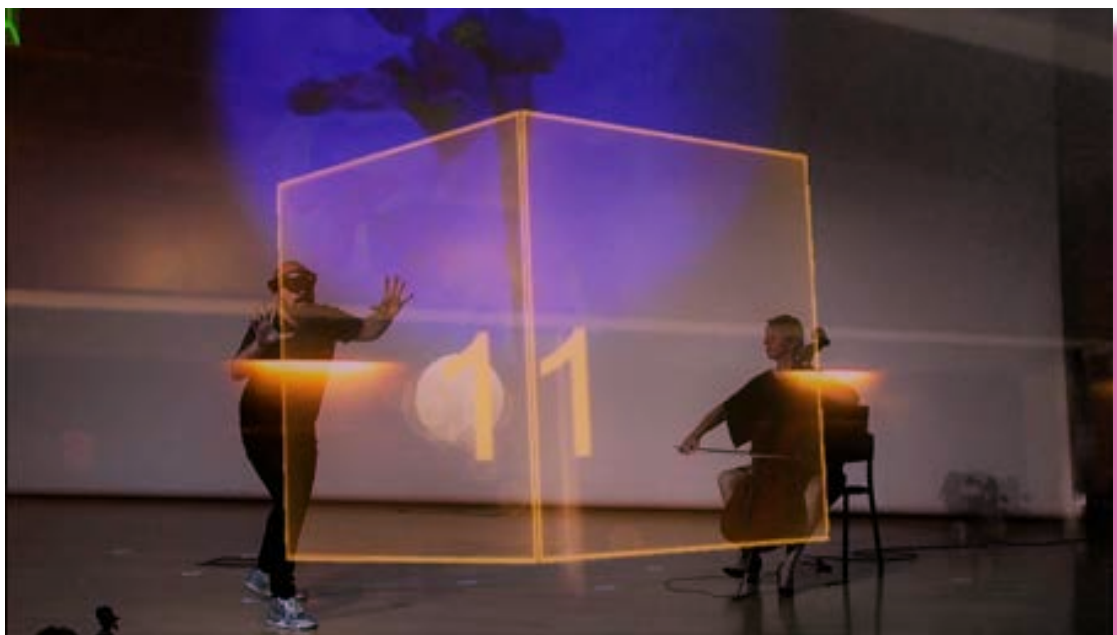
## Acknowledgements

Fig. 6 - Holosound, Universitat Politècnica de València, Spain 2018.

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[ref Soundcool], official website: [https://soundcool.org]

## Images references

Fig. 1 - Soundcool archive

Fig. 2 - Begoña Faura / AFA Canals

Fig. 3 - Centro Superior de Música del País Vasco Musikene / Stefano Scarani

Fig. 4 - Stefano Scarani

Fig. 5 - Soundcool archive

Fig. 6 - Soundcool archive