

Agile seed funding 2020 recipient report

Project title: A concrete explanation to sound directivity of musical instruments and musicians/instruments interaction with rooms

Project participants: Alain Berry, Olivier Robin, Lévy Leblanc (Université de Sherbrooke), Philippe-Aubert Gauthier (Université du Québec à Montréal)

Abstract: Jürgen Meyer often demonstrated the interaction between music and acoustics using concrete examples (a musical ensemble plays a piece for the same audience but in different rooms). This project follows this idea. Two players of the same instrument play the same piece in either a hemi-anechoic or a reverberant room (side-by-side rooms, a musician per room). Three objectives are pursued (1) defining five ideal pieces and instrument (2) 3D-printing sound directivity patterns of chosen instruments and (3) preparing a didactic document for the event. People will be able to see and hear sound directivity, while better understanding room-instrumentalist relationships.

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As a preamble, the COVID-19 pandemic has deeply modified the conditions of this project. The planned demonstrations could not be organized given the sanitary measures. We had to move from an initial 'event' idea (including an audience) to binaural recordings made with a single musician in an anechoic room and a reverberant room. We finally focused on two instruments (the classical guitar and the trombone), and managed to setup videos recorded with binaural heads (see Figure 1). In complement to binaural music pieces, 3D-printed sound elements (acoustic wavelengths, directivity patterns for the trombone, see Figure 2) were used at the end of each video as a support for scientific explanations.

The funds were mostly used to pay salary for a first CIRMMT member (handle of 3D-printings, setup of recordings, trombone playing for videos). This project was also finally linked to another agile seed project (Evaluation of three acoustic manikins for binaural recording and research/popularization purposes), and the remaining funds were used to pay a complementary salary for a second CIRMMT member,

The main outcomes of the project are:

- Four videos (of approximately 5 minutes each), including a teaser, see Figure 3, that will be made available during Summer2021 session, and will support research outreach.
- Training of two CIRMMT members (Lévy Leblanc, and Pierre Grandjean).
- Two presentations at the CIRMMT RA1 Workshop: Spatial Audio Processing for Sound and Music Applications (February 26 2021), given by Olivier Robin (Explaining sound directivity: from backup alarms to musical instruments) and Pierre Grandjean (A concrete explanation to sound directivity by using binaural rendering),
- The development of interdisciplinary research with the participation of a student from École de musique, Université de Sherbrooke.

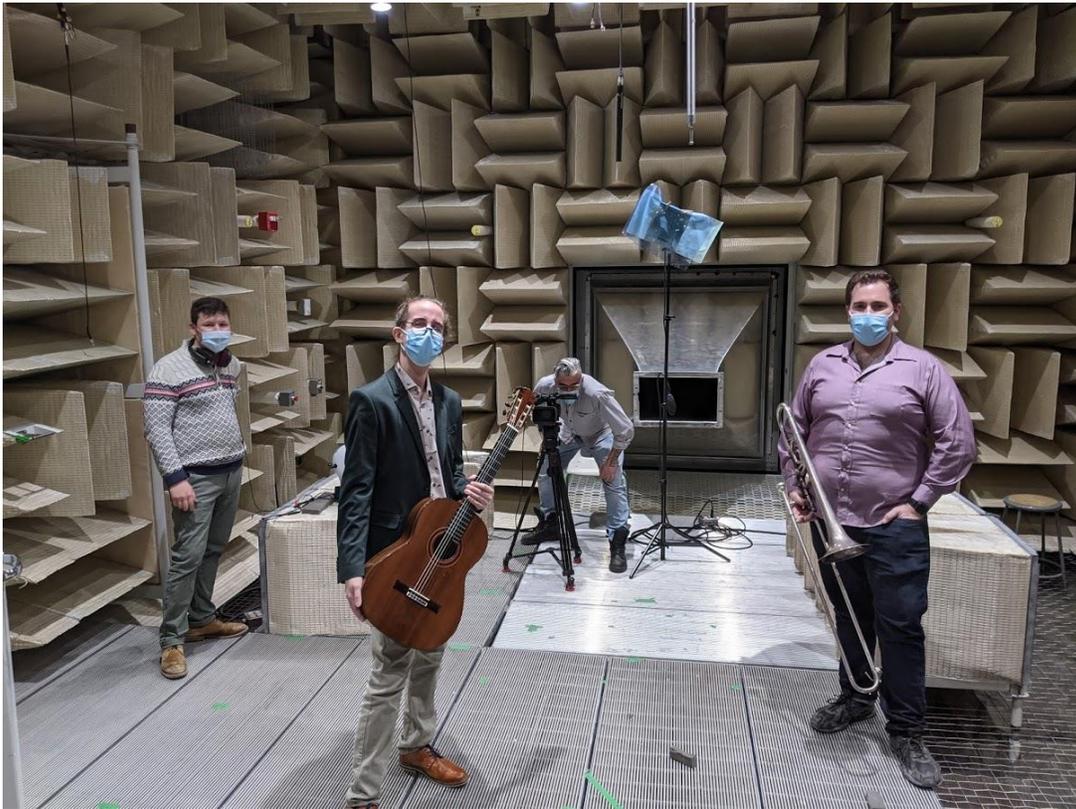


Figure 1: (From left to right) Pierre Grandjean (binaural recordings), Tommy Dupuis (classical guitar), Marty Kanathakatsus Meunier (video recording and editing), and Lévy Leblanc (trombone player) at the end of the audio and video recordings in the anechoic room.

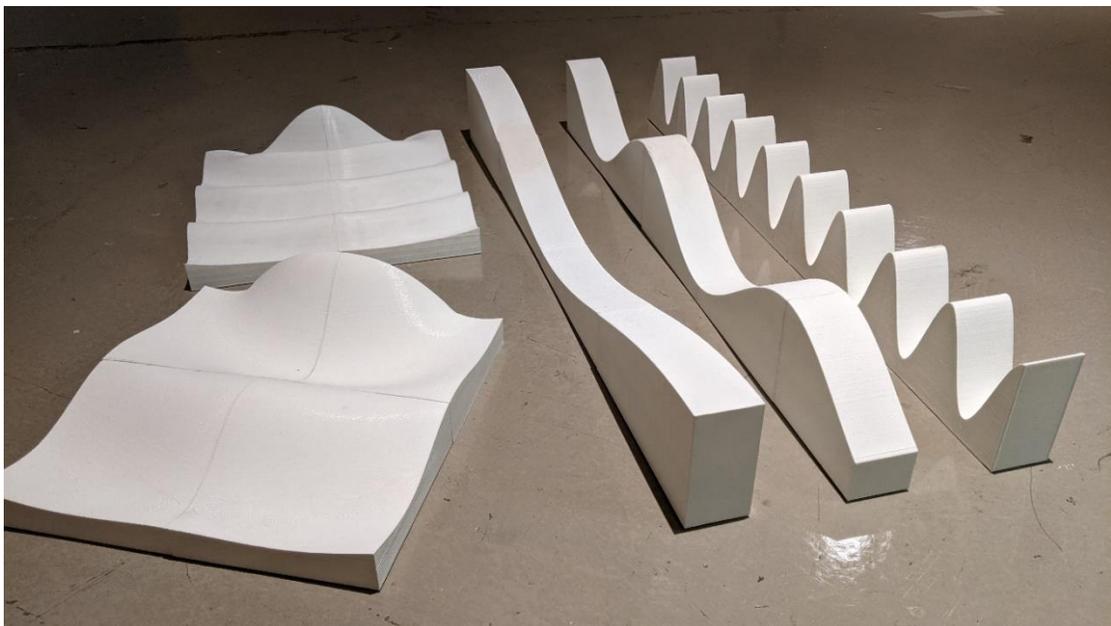


Figure 2: From left to right – Sound directivity of the trombone at 2000 and 4000 Hz, acoustic wavelength at 400 Hz, 1000 Hz and 4000 Hz.



Figure 3: Screen capture of the teaser made for introducing the series of four videos.