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A study of perception of flute timbre and digital sound processing

Research report – CIRMMT Inter-Centre Research Exchange Funding

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This Inter-Centre Research Exchange Funding has been used for the second part of a research stay at the Centre for Systematic Musicology at the Karl-Franzens-Universität (Austria), that took place between May 15th and July 31st, 2018. In Graz, I had the opportunity to work under the supervision of Richard Parncutt, a leading researcher in the field of music cognition and perception.

During the previous part of my research stay in Graz (November 1st, 2017 to February 2nd, 2018), several experiments were conducted as part of my doctoral research on a set of flute sounds characterized by different timbre signatures and playing techniques, in order to identify their principal acoustic features. The aim of this project was to extend this investigation to flute sounds with digital audio processing, such as in the context of music performance with live electronics, then to compare processed and natural flute sounds after the extraction and the analysis of acoustic descriptors. Another objective was to identify their perceptual correlates and relate them to the vocabulary used by flutists to describe instrumental sounds.

Starting from samples recorded for previous experiments, a set of sounds was constituted, resulting from various processings such as reverberation, filtering, frequency shift, and distorsion. With the TimbreToolbox (Peeters et al. 2011), temporal, spectral, and harmonic descriptors were extracted and interpreted according to the results of a principal component analysis and to the main dimensions related to timbre spaces found in the literature (attack time, spectral centroid, spectral flux, and so on).

The second part of this research was supposed to be conducted with expert flutists, originally German speakers from Graz and Vienna. Although I already met the research ethics requirements in Austria to work with participants, I was informed that I had to get a research ethics certificate from Université de Montréal as well. So I submitted an application at the beginning of May, before my departure to Graz. However, in mid-August, I am still waiting for the official authorization to proceed with the experiment.

Therefore, the research protocol has been modified so that the experiment can be conducted later this fall in Montréal with French (native or fluent) speakers. The group of expert flutists will evaluate the dissimilarity between pairs of sounds from the same set and provide a verbal description of the samples, using their own vocabulary. The participants will be graduate students or professional musicians, recruited in Montréal.

This research will provide results from a study of sound perception among instrumentalists who are able to give subtle and detailed descriptions of instrumental timbre. We are taking account of the musician's point of view, for a better understanding of perceptual aspects of digital audio processing in the context of music performance and composition. In this regard, the results of this research will lead towards the acquisition of a common knowledge useful to both scientists and musicians. Furthermore, the methodology used here will be adaptable to the study of other musical instruments, for a better global understanding of orchestration with digital sound processing.

Beside this research project, I had the opportunity to attend and help with the organization of the ICMPC/ESCOM 2018 conference, taking place simultaneously in Graz, Montréal, Sydney and La Plata, since the Centre for Systematic Musicology took charge of the activities in the Graz hub.

I am very grateful to CIRMMT for making this exchange possible, and for supporting my research in a significant way. I would also like to thank Richard Parncutt and Caroline Traube for their insightful supervision.