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Rendering embodied experience into multimodal data: concepts, tools and applications for Xenakis' piano performance

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Abstract

Following-up from the four axes presented in our paper proposal, we propose a supplementary workshop for a small group of active participants and an ad libitum (within reason) larger group of passive participants. The ideal duration of the workshop would be about 4-6 hours (half-day workshop), but we will do it in the 1h45m available. We will be presenting the complete range of materials (hardware, software, data libraries and data analyses) and applications for both active and passive participants.

The main core of the workshop will be the presentation of the system *GesTCom1* (acronym for Gesture Cutting Through Textual Complexity), which has been developed since 2014 in collaboration with IRCAM (*interaction-son-musique-mouvement* team).

GesTCom is a sensor-based environment for the visualization, analysis and following of the pianist's gestures in relation to the notation. It comprises four modules, implemented in the form of Max/MSP2 patches featuring the MuBu3 toolbox and connected to INScore4 scripts:

- a) a module for the synchronized recording of multimodal data of a performance;
- b) a module for the reproduction and analysis of the data;

¹ <https://medias.ircam.fr/x2253e1>

² <https://cycling74.com/>

³ <https://forum.ircam.fr/projects/detail/mubu/>

⁴ <http://inscore.sourceforge.net/>

- c) a module for the processing of the notation on the basis of the data;
- d) a module for real-time gestural interaction with the notation.

The end goal is a system of mutual reinforcement learning between human and machine. Such a system optimizes the piano performer's learning experience through longitudinal multimodal performance documentation, real-time activity monitoring with augmented feedback and guidance, and real-time adaptation of the complexity of the music notation, according to the user's developing skills.

The second point of focus will be the presentation of interactive tools for augmenting Xenakis' *Evryali* ("the extended sea") for solo piano. We present this work as an interactive scenography composed of a virtual space that hybridizes the musical score with the physical space in real time on stage.

The workshop will attempt to address all four axes presented in the 'Call for Papers':

1) *Presentation of tools and methodologies for capturing the Xenakian body in performance:*

The systems in question include:

Hardware: inertial sensors (BITalino R-IoT sensors⁵, Perception Neuron⁶ full-body motion capture), systems of capacitive sensing on the keys of the piano (TouchKeys⁷), EMG equipment⁸, Kinect, MIDI and sound recordings.

Software: Max/MSP patches and INScore scripts for the recording, playback, analysis, following and multimodal augmentation of data and of music notation.

Active participants will be invited to experience the affordances and constraints of these systems, trying out Xenakis' works for piano on the basis of existent recordings;

2) *Analysing the corporeal subtext of Xenakis' notation:*

This axis of the workshop will present analytical work on Iannis Xenakis' *Mists* and *Evryali* and methods to explore the relationships between musical score and multimodal data.

3) *Creating interactive systems for enabling learning through multimodal data:*

In this part of the workshop, selected participants will have the chance to explore the motion following possibilities of the *GesTCom* system and try out alternative notations for Xenakis' piano works, which might facilitate the first stages of the learning process.

4) *Augmenting Xenakis performance:*

Presentation of the system and active participation in the interactive control of the digital staging using the realtime 3D software Unity.

List of required in situ

Grand piano and/or keyboard with MIDI capabilities and sensitive touch

5 <https://forum.ircam.fr/projects/detail/edit-in-administration-bitalino-r-iot/>

6 <https://neuronmocap.com/>

7 <https://touchkeys.co.uk/>

8 <https://developerblog.myo.com/>

Audio equipment (speakers)

1 projection screen (3 meters x 2 meters minimum) or white walls

2 short lens projectors full HD 3000 lumen minimum HDMI

2 HDMI cables 10 meters

4 Power Strips 3-Outlet minimum

4 Extension Cord 10 meters minimum

3 Tables

4 Chairs

3 Black tablecloth

1 Black Gaffer 50 meters minimum

1 Touch Screen min 15 inches HDMI

The rest of the equipment will be provided by us (the workshop organizers).

Short CV (100 words)

Pavlos Antoniadis (PhD in musicology, University of Strasbourg-IRCAM; MA in piano performance, University of California, San Diego; MA in musicology, University of Athens) is a pianist, musicologist and technologist from Korydallos, Athens, Greece, currently based in France and Germany. He performs complex contemporary and experimental music, studies embodied cognition and develops tools for technology-enhanced learning and performance. He is a Humboldt Stiftung scholar at the Berlin Institute of Technology (TU-Audiokommunikation).

<https://pavlosantoniadis.wordpress.com/about/>

<http://ismm.ircam.fr/pavlos-antoniadis/>

<https://eur-artec.fr/projets/habiter-avec-xenakis/>

Jean-François Jégo, PhD, is an associate professor, digital artist and researcher at the INREV Virtual Reality Laboratory in the Faculty of Arts of the Université Paris 8, France. His research topics question human perception and the aesthetics of interaction, exploring embodied cognition and interaction, focusing on the expressivity of human and virtual gestures in digital art. He creates immersive and interactive experiences, art installations and digital performances hybridizing Virtual and Augmented Reality which has been exhibited internationally in many venues in Austria, Canada, France, Germany, Taiwan, Russia and the USA. He is a cofounder of the international Think-Tank GAIIA and of the artistic collective VRAC. Website: www.jfcad.com

Aurélien Duval is a real-time 3d expert and digital artist. In his path of life, he oscillated between professional work and studies. From a real-time 3d modeling centered skillset to learning to code alongside the discovery of Unity, he now has a hybrid profile. He made his experience in the industry : simulators, virtual house catalogs for real estate companies, training AR applications for telecom technicians. It allowed him to grow a global vision of interactive

software development. In 2019, he decided to take the Arts et Technologies de l'Image Master's degree in Paris 8 University in order to shift his skills to artistic fields. Website : aurelduval.xyz

Frédéric Bevilacqua is the head of the Sound Music Movement Interaction team at IRCAM in Paris (part of the joint research lab Science & Technology for Music and Sound – IRCAM – CNRS – Sorbonne Université). His research concerns the modeling and the design of interaction between movement and sound, and the development of gesture-based interactive systems. Website: <https://www.stms-lab.fr/team/interaction-son-musique-mouvement/>

Stella Paschalidou holds a BSc in Physics (Aristotle University), an MSc in Music Technology (University of York) and a PhD in computational ethnomusicology (Durham University). She is currently working as a lecturer at the Department of Music Technology and Acoustics of the Hellenic Mediterranean University. Her research interests include embodied music cognition, audio interaction, and ethnomusicology (Hindustani), with a special interest in the concept of effort in music performance. <https://mta.hmu.gr/en/>