PERFORMING WITH SOUND SAMPLE-CONTROLLED GLOVES AND LIGHT-CONTROLLED ARMS

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ABSTRACT

Interacting with media: The TransTeamProject (T3P) works on developing interactive gloves techniques - and other materials, with sound and/or visual samples. *Piamenca* continues the work developed in *Transpiano*[1] with a specific emphasis on visual content such as transforming sound into lights, in this case together with a strong vernacular inspiration (Flamenco). The T3P creative project is involved with art music - as opposed to commercial music - together with technical perspectives. After contextualizing the state of the art in the specific field of "body gesture technology", this paper will explain how *Piamenca* relates to computers in a practical sense – methods and processes to produce media transformations (both audio and visual) - and will comment on their integration in terms of sound, music and audio-visual performance. It will finally demonstrate some ideas such as trans-music orientations with regard to enhancement theories in relation with the transhumanism movement [1].

INTRODUCTION

Although the so-called "interactive glove technology" has already a long history, as such in the interactive design research, whether or not related to music at first[2] (even though initially experimented with sound[3]) but more generally concerned with designing performance protocol for controlling trans-media data [2] [3], T3P develops normative procedures within the public domain by its own, making use of available cost-efficient hardware (Arduino board, Flex-Sensor) and software (Arduino-Uno, Max-MSP, Ableton Live). Once different technologies were originally mentioned as earlier as 1986 [4], but more recently redesigned such as for making music controlled by hand gestures, "Musical glove"[4], Mi.MU glove technology[5], Leap motion technology[6], such experimentations were so far never thought of as for making art music but rather and more or less for pop sound productions. Within new technological processes, T3P team is developing typical formal ideas such as enhancing music performance gestures to extend traditional piano fingering techniques.

CONCEPTS FOR DESIGNING SOUND

Piamenca is conceived with fragments of Andalousian culture – Buleria and Tarento dances. Music patterns are arranged as identifiable elements looped in sessions of specific content, chords, melodies, rhythms to convey "audible design" [5]. Time structures depends upon (re)cycling modes of repetition using or not available transformations - inversion, reverse, transposition … *Piamenca* uses diverse technics to filter sound spectrum, either from Max-MSP software or Ableton effect module in realtime.

Besides a quest for renewing acoustical sources - operating on traditional instrument while performing samples, such experiment concerns enhancing traditional gestures in order to recover empathy and produce emotional feedback in acting the sound with the help of visual representation.

INSTRUMENTAL CONTEXT

Piamenca, such as *Transpiano*, makes use of the piano as it concretizes in the written classical heritage the "king of the instrument" for accompaniment. Not to mention its leadership over the Romantic composers which even made piano music sound dictatorial, piano remains the perfect visual, plastic tool to conceptualize all types of music. Nonetheless, it is not the original musical instrument of the flamenco technique. But today each instrument may easily be replaced by any other instrument through digital sampling technics [6]. While a totally autonomous piano does not really connect with the acting body - although it does in blind MIDI performance since we can see the key performing activity[7], and while the glove techniques might still limit any emotional response, sampling techniques can really apply to music production with specific theatrical embodiment when prerecorded by the performer himself as a re-appropriation of the initial feeling at a second stage.

[1] Premiered last year at Limassol, Cyprus - XV SMC Conference (2018)

[2] Power Glove from Nintendo for Video Controls (2005)

[3] MODO Music Technology

[4] https://interactiondesign.sva.edu/projects/musical-glove

[5] https://mimugloves.com/

[6] https://www.leapmotion.com/

[7] We would mention here the expressive os Trond Reinholdsten piano concerto (2016) named « The theory of the subject.»

WHY *PIAMENCA* IS ANOTHER TRANS-PIECE ?

While *transpiano* was the initiated version of such a starter "chain" of more works to come, as a first experimented fragment for designing different performing technics in art music, including videos, *Piamenca* uses extended conceptual technics with lights. Two basic ideas are proposed in the piece: first to develop sample patterns that structure listening; second, to produce a related visual matter - light, beams and video in relationship with the patterns. The overall form depends upon mixed media with a strong vernacular flamenco identity for the sake of this specific event.

TECHNOLOGICAL CONTEXT : SOUND CONTROL

It logically happens that the basic idea behind the technological part of the T3P project is roughly the same as that of a MIDI keyboard. The performer has ten sensors (one on each finger). The sensors send raw data to the Arduino [7]. Then the Arduino sends the data via Bluetooth to the computer, more precisely to the Max-MSP. Max-MSP recognizes and separates this data from the Arduino (which have a range of 0-1023) and converts them directly to MIDI (range 0-127). A general setting of the performance is shown on fig. 1.

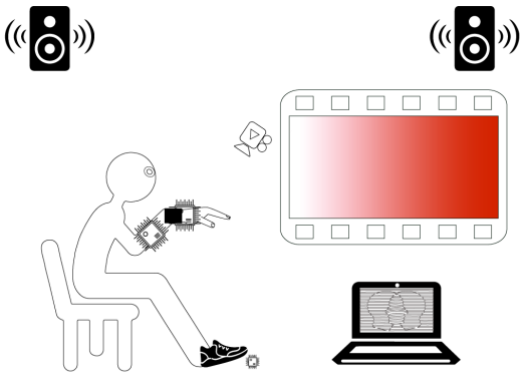


Figure 1. Elements for the setting

FORMALIZING ELECTRONIC SOUND DATA

With such an interactive situation one may first resolve the fact that the performer has only ten fingers but might use more parameters to control (over 150 parameters). The following list mentions some of the technical issues to be resolved in such a project, from a sound point of view:

- Trigger the correct samples;
- Control the score;
- Enable/disable different effects;
- Control the correct parameters of all effects (some lists more than 50 parameters), etc.

MAPPING: MAXMSP TO ABLETON LIVE

On a real piano, the performer controls pitches by pressing keys with fingers. In this project pitches (or sounds in extended technics) are sampled[8]. In this environment, fingers do not produce pitches but rather trigger samples and control different effects that would apply to them. Moreover, the performing activity is as follows: first, the performer selects a preset number with a foot controller - each preset already matches one or more samples; second, he triggers them with his thumbs to activate the sound(s) - at the same time, the other eight fingers are associated with the correct effect parameters already designed; third, he performs music with his fingers - instead of controlling pitches, the performer controls and transforms samples according to preconceived order impacting their own structural composition. A detailed score provides information for changes, starting over by selecting a new preset number and so on (Fig. 2).

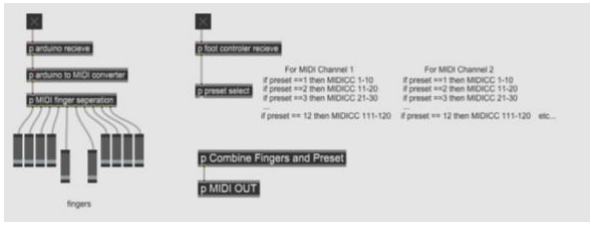
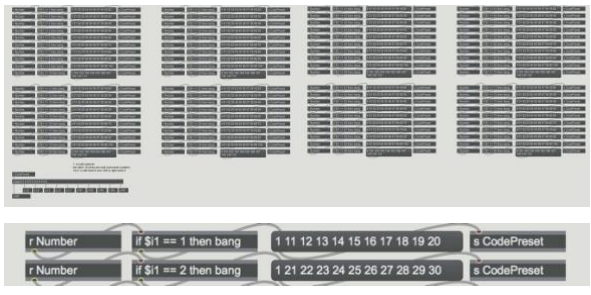


Figure 2. Diagram of the Preset subpatch

PRESETS SOLUTION

In order to divide the piece into sessions in Ableton Live we used the "master session" command in Ableton with subsequent sessions to be triggered linearly. Each master session would correspond to a unique line in the program, a unique sample, a unique effect and in some cases, pages in the score. So, this particular display allowed to create one preset (or more if needed) for each session. The performer would select the correct preset with a foot controller. Each preset has ten MIDI CC, one for each finger. The MIDI protocol has 16 channels and each channel has 127 MIDI CC, so one may use up to 2032 MIDI CC or 2032 controllable parameters! (Fig. 3).



[8] A sample refers here to recorded precomposed sounds to be modified during the performance, never mind they be pitch sequences or "sonorities".

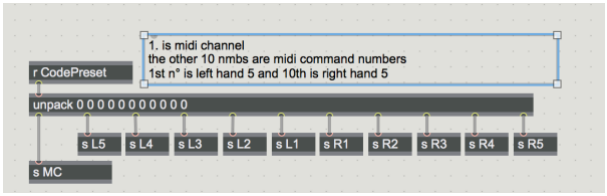


Figure 3. Preset structure

LIMITATION OF MIDI CC

Although Ableton is perhaps the software with the easiest MIDI mapping system - we would have however some recommendations for improvement -, it is impossible to have two different MIDI CC connected to the same parameter. In other words, it was impossible to connect the same effect, let's say a basic Reverb, with two or even more different samples because each sample has a distinct preset – MIDI CC. This obstacle was resolved somehow in an unorthodox way. Instead of having one effect for all the samples, the same effect was used as many times as needed for the samples. For example, in the case of using three samples with a reverb, the same reverb was used three times. With such a setting it is therefore possible to assign one MIDI CC for each sample and each effect.

IDENTIFYING EFFECT PARAMETERS

Beyond the number of effect parameters, the performer challenge is also to master their efficiency [8]. To this extent, one needs to change and provide a unique name for each effect, which is also combined with the dedicated score to easily identify sound properties as well as fingering functional settings. Instead of naming the followings "reverb1", "reverb2", "reverb3", better use such codes T2E4S7, T3E1S8, T3E1S9 where T stands for Track, E for Effect and S for Session (Fig. 4)

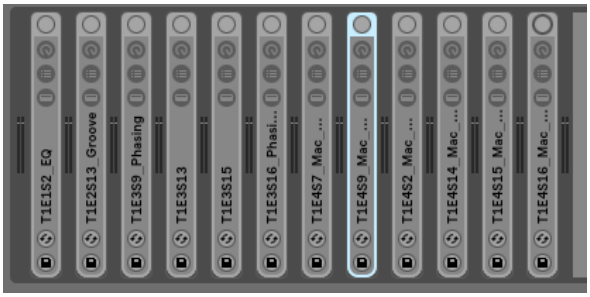


Figure 4. Ableton Live Effects accessible from a single track (T1)

In the above example, the effect T1E1S2 means Track 1, Effect 1 and Session 2. With such a technique the performer knows exactly which effect was related to which sample. At the same time, the same preset enables only the correct effect(s) and selects them so that whenever the performer triggers a sample, he only sees the related effects in Ableton's window.

To resume this section, such a project raised technical obstacles related to the interface design but not with the glove and its shelf, neither with the Arduino board and the connecting system. Composing with such environment brings to the fore weaknesses in the design of predefined software (Ableton's GUI), due to its original conception, in this case processing samples in realtime. Technically, it might be unorthodox to have an exact same effect multiple times (calling for more RAM memory, resulting in lower compiler performance), with all 150 parameters, but it was the only solution available to be able to identify and control them with ten lively fingers!

LIGHT CONTROL USING ARM SENSORS

In order to make a full mediation between different types of media, *Piamenca* also explores the relationship between sound and light, emphasizing performance strategies for the musician, such as mixing light properties with regard to acoustic correspondence controlled by specific body movements[9]. Using light intensities, color spectrum, shadows and interaction between glowing features and objects are part of demonstrating sound matter in this interactive process[10].

As colors may change the way one perceives sound [9], we face this issue in three different perspectives:

- Sound analysis
- Musician interaction.
- Music composition.

As sound and light are waves stimulating our senses in distinctive frequency spectra, *Piamenca* explores this relationship using some previous studies on the subject. Amidst several stimulating data found and longtime analyzed is the impressive concordance that "synesthetic people" have in relationship with colors and musical notes [10].

In order to translate sound spectrum into light spectrum we are considering the sound produced by the musician to have the frequencies that compose the sound. By using the Fourier transform we analyze the sound spectrum in real time and use that information as input to the software which controls the lighting system.

While the performance is taking place, the musician is "touching" the music with his fingers - or according to arm gestures - by sending information to the system with absolute position. This project also allows fingers and arm positions to control the way light is projected and how the sound spectrum is transformed into lights and colors. As every performance would depend upon specific objectives due to artistic motivation, there are numerous ways for sound to be converted into light. Each composition requires its own choices. For the *Piamenca* project, we chose a light spectrum close to

[9] To this regard, let's mention the PIGS (Percussive Image Gestural System) prototype from Amy Alexander.
[10] Reference to be made here to the seminal work of Waisvisz M from STEIM. http://www.crackle.org/TheHands.htm

the red tonality in order to represent the distinctive red dress of the flamenco dancers.

TECHNICAL VISUAL INSTALLATION

The light system used for this performance requires one led strip of five meters and four led light spots. The whole system is controlled by an Arduino card which receives the information coming from the software by the USB port. As the led strip shape can be modified, we use it to interact with the space to generate shadows and light movements. The four directional led lights are placed behind the musician in order to play with the space perceived by the audience.

PERFORMANCE MEDIA CONTROLLED BY BODY GESTURES

At the root of digital composition, and in our peculiar context, sampling techniques for performance means expressing the self with "automated content". The performer has some cues, since he is working on prerecorded sequences that he performed himself. However, questions on performing arise such as automated transforming samples and/or how looping patterns may influence decision making? While automation describes musical material depending upon audio data streaming, processes develop sound material and generate self-determination choices besides a more confined frame. In effect one cannot say it is pure improvisation while data lies on a score [11]. However, within a time frame process launched by gestures, it covers a wide range of body interaction that links to connected control. A set of constraints allows this type of musical processing [12].

CONCLUSIONS

Although the T3P team's philosophy isn't limited to traditional musical instruments but would extend to other types including non-musical "objects" and media, *Piamenca* uses a piano sound without a physical body. The digital move of this century opens the way to further technological involvements with efficient materials such as sensors, microcontrollers, software, controlling systems, all easily affordable (and usable) outside institutions, freeing somehow creation from normative cultural appreciations. Not only such an opportunity saves the instrument, it also modifies the sound perception - processing, listening and visualizing, by creating a virtual gap between performing and producing sound in relation to other media, innerving space with lights and finally interacting all together. As transhumanism is also, amongst other theories, a way to consider technics in relationship to human, the so-called "anthropological technicity", in art culture - where music is thought of as a voice to express ideas, it is also a matter of "trans" actions related to different contexts - socio-economic, ethical & political, neuro-bio-GIA-scientific, esthetic & artistic -. From these different angles performing art allows different positions, fundamentally based on mediating strategies for multimodal awareness.

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