A generator/destructive method of sounds and images: microrobotic ballet depicting the Bāyīn-八音system

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Abstract. The method starts linking painting with music, taking Chinese ethnomusical concepts depicted alongside Western solutions, by using $B\bar{a}y\bar{n}$ - Λ principles focused on 8 timbres (tone colors). Building 8 sonorous paintings, neoinstruments subsequent to $B\bar{a}y\bar{n}$ system to be percussed and recorded: the paint weathering. The 4 transdisciplinary formats resulting: a-Exhibition, b-Concert, c-Performance, culminating with d-"Microrobot ballet", where the 8 swarm robotic variations/permutations conduct a new generation of paintings: music newly influenced by the new paintings. A generator device versus an erosive tactic. Music and painting mutual sustainability.

Keywords. Bāyīn, music/painting sustainability, robots depicting, transdisciplinarity.



1 Overture vs. introduction

Chinese sensibility is always alert and ready to the perception of subtle energies and resonances. In fact Chinese is tonal language (forming phonology minimal pairs with the same segmental features where tone is semantic) and sound timbre is the soul of the music; in fact a musical piece becomes another completely different if the timber changes. Any aspect in Chinese culture is not an isolated phenomenon but rather a

contextual part related to diverse aspects of life: emerging special kind of cosmogonist systems.

Any cosmogonist system in China is assembled with intriguing numerical relations. Chinese philosophical speculations is not focused on the quantification, rather dealing with numbers in a passionate way: numerical games are approaching to an emblematic sense because the polyvalence of its manipulations and mutations, rejecting final and unchangeable results. Thus, the number is philosophy, emblem, symbol, game, classification, order and protocol.

The poem $B\bar{a}y\bar{i}n$ "Eight sounds" is part of the literary gem *The Sanzijing*, *The Three-Character Classic* (Southern Song Dynasty, 1127-1279) by Wáng Yīnglín, which embodies the Neoconfucian ideal of uniting education, moral and philosophy. However the precepts and timbre perception date from the 7st century Before the Common Era.



2 Recitative vs. concept

Our method is based on $B\bar{a}y\bar{i}n$ to link music and painting, by building a series of sonorous paintings, a kind of neoinstruments, but involving, performance, dance and robotics in a transdisciplinary way.

Visual and sound experiences as a mixed result by using different Chinese concepts, but depicted alongside Western solutions in symbiosis. The method makes a system just taking those approaches to face music and painting, each other, whereas both of them emerge, develop, demonstrate and perform in unison, in a parallel and mutually binding manner. Linked but following a mutual destruction which summon the energy of an eternal vital circle.

Reading the verses $B\bar{a}y\bar{i}n$ we could understand it is just talking about materials, but Chinese uses them as a symbol to mean the types of the sound timbres and, basically, making a classification for the different types of Chinese instruments. $B\bar{a}y\bar{i}n$ system is completed connecting some others elements in the organization, including material/timber, orientation, season, color, element and Taoism trigram. (Fig. 1).



Fig. 1: $B\bar{a}y\bar{i}n$ system diagram, including the relation between all the components. Fig. 2: Our proposed own route of pairs within $B\bar{a}y\bar{i}n$ system.

3 Aria vs. music/painting

We start making a manipulation on the $B\bar{a}y\bar{i}n$ diagram to plan a route within the elements, alternating primary pairs with secondary ones, to be applied in our own microsystem, which will give us an own visual and meaningful structure to rule the order of the sonorous paintings/instruments in the series and to be used as our trilobed logo, also. (Fig. 2).



Fig. 3. The materials/timbres. Sequence resulting tesserae and direction of the woodgrain for the acoustic boxes, both following our proposed route.

We will use all the materials as surfaces to paint on them, 8 materials for the 8 paintings extracted from both musical instruments and elements for Fine Arts. From Music: skin from the drum gǔ 鼓, gourds from the flute: hú lū sī 葫芦丝, metal from the gong luó 锣 and bamboo from the clapper kuài bǎn 快板.

From Fine Arts: silk from the Chinese paintings bó 帛, white kaolin from the modeling clay nián tǔ 黏土, pear wood from xylography dù lí mù 杜梨木 and stone from the paperweight for the calligraphy zhǐ zhèn 纸镇.



Fig. 4. Plan for the tubes inside the small echo chambers and construction of the wooden parts (bubinga case).

A simple numerical succession makes a kind of mosaic in each painting-instrument, in the order of 1, 4, 9, 16, 25, 36, 49, 81, (Fig. 3) resulting 204 tesserae distributed inside 8 main acoustic boxes with the same perimeter.

Thus each of the tesserae has an own small echo chamber size embedded in the main acoustic box, it depending of the sonorous painting that belong to. Likewise each small echo chamber has a retractable wooden tube inside, being able to tune each of them controlling the length. Both length and distribution of the tubes in the main acoustic box are ruled following 4 different criteria: visual composition, numerical distribution following Sino-Western mathematics concepts, Western music values and Chinese music principles. (Fig. 5-8).



Fig. 5. Tube lengths in cm and notation range. Tuning following a visual composition. Metal/padauk case. Fig. 6. Tuning distribution following a Western music way (piano). Bamboo/bubinga case.



Fig. 7. Tube lengths in inches and notation. Tuning following the 洛書 *luò shū*, numeric Chinese magic square. Gourd/cocobolo case.

Fig. 8. Tube lengths following the 律呂 $l\dot{u}$ $l\dot{u}$, musical Chinese 12 tubes theory, expressed in 尺 chǐ, Chinese unit of length. Clay/purpleheart case.

All those parts and pieces are made with 8 exotic woods used to build Western instruments: African blackwood, wenge, cocobolo, purpleheart, padauk, bubinga, zebrano and pau marfim. Chosen because the own acoustic properties and because a color gradient, also.

Each of the paintings depiction will show the instrument in response to the material/timber, making visual reference in orientation, season, color, element and Taoism trigrams correspondingly. Bāguà 八卦 (literally 8 symbols) is a Taoist trigram system to represent the fundaments of the live by using 8 interlinked concepts. Traced with half and whole lines, representing the Yin and Yang. Being its maximum representation the I Ching (*Yijīng* 易经, The Book of Changes) consisting of 64 pairs of trigrams (hexagram) obtained from the combination of 8 x 8.

4 Interlude I vs. process I

Once painted, we will beat all the tiles one by one to make a recording, whereas the paint is wearing away because of the erosion, it will be significant to the sound emmited.

The raw sounds will be sent to 4 Chinese musicians and 4 Western counterparts to make a sound composition to accompany the paintings following 4 different Artmusic formats. To check the people involved in the project:

http://8sounds.guillermoaymerich.com/

We propose and request a "wear sound" attitude to the musicians. It is about erosive wear (painting and sound). How could we make a sonorous composition linked with visual wear, just using the concept "to wear away" applied to the sound?

5 Orchestration, duet, trio, ballet vs. formats

I- **Soundtrack for an painting exhibition,** it is an exhibition showing the 8 paintings-instruments along with its percussion stick and with the "eroded sound" by the 8 musicians recorded in a loop. Audience could strike the frames, also. (Fig. 9).



Fig. 9. Format exhibition: Paintings and soundtrack. Fig. 10. Format concert. Duet for classical and neoinstruments. Fig. 11. Format performance. Trio dealing with score and improvised music in live.

II- **Duet for bass-clarinet and sonorous-paintings**, it is a music concert requested to the composer Nani García, keeping the "sound erosion" concept. (Fig. 10). III- **Electroacoustic trio**, it is a performance, the same composition performed with bass-clarinet (Xocas Meijide) following the original score; sonorous-paintings played by the author of this project, the Art painter and musical dilettante (Guillermo Aymerich) and the electroacoustic musician and sound technician (Man Ferreiro) receiving the sounds emitted by sonorous-paintings, improvising for processing them in real time and returning them handled in consonance with music in live. After this triangle, the final music (half following the score and half improvised) will reach the public. (Fig. 11).



Fig. 12. Format ballet. Microrobots moving on wet paint to depicting.

IV- Microrobot ballet, it is a dance played by 8 swarm robots designed-programmed to move stimulated by the sound issued by each of the painting-instrument. But each robot will reacts interacting with the rest of specimen's movement, also, due the function ruled by ARDUINO software. The aspect or hardware is made in part with exotic woods according to each of the sonorous-paintings. The in inside of the main acoustic box becomes the stage when the back side is up, being able to see for first time the interior urban landscape formed with the different length of the retractable acoustic tubes and the Chinese landscape carved on each interior main acoustic box side, significant orography for the transmission of the sound. Landscapes based on 8 yàn tái 砚台 as a model. (Fig. 13). Yàn tái is an inkstone used in the Chinese calligraphy as a support to host "seas of ink and water" which destiny is "be moved" or transferred to the paper surface. It is the Chinese equivalent of our palette used by painters but with an added meaning because it is one of the 4 "Treassures of the study": brush, ink, paper and vàn tái. There are stones from the river (highland, middle mountain and low mountain) and there are 4 types of stones depending of the location of origin and characteristics: color, hardness, touch and sound, even.



Fig. 13. Yàn tái: Model example for the landscape carved in the inside acoustic box.

Using a glass to cover this interior stage, to put some areas with wet paint, field where the robots will move on to leave a painted trace as a result of each specimen track: biped, octopod, creeping, wheels, caterpillar belt, coil spring, ball and wings. The general choreography for the ballet offers variants and conditions:

a) Pictorial variations: it depending how, where or how much paint color we apply on the surface.

- b) Musical variations: in function of which "eroded music" composition the musicians will offer us back. The quantity it is 8 themes, as we already know.
- c) Choreography variations: determined by where to put the robotics as a starting point.
- d) Software variations: on purpose of Arduino programming.

We propose 8 variants of each point above. And each one accepts to be taken in consideration as a random (improvised) result or as a ruled (conditioned) consequence. Thus, we offer 8 variants x 4 variations = 32 variations. And 32 variations x 2 modes = 64 results. We will get 64 potential general ways to arrange the choreography, thus we could get 64 new paintings by robotics. From the beginning the choreography task is requested to Brand Nu Dance.

Likewise we are planning to make 8 "weathered video" art pieces (the first one by David Ferrando) insisting in the concept of "wear away" as in light conditions as in the conception of the filming as in the edition.

6 Interlude II vs. process II

We would like to explain the route for the general work in process: The origin of the paintings is the music// Sound reverberations will be conditioned by the painted tesserae to percuss, but also by the hidden carved landscape in relief in the interior acoustic box (hidden during any music process, but just visible when the robotic ballet)// Consequence of the sound tones tis he painting erosion and final disappearance// Robotics are moving following the music// Each robotic variation-permutation gives new paintings.

From this moment we are able to paint on the eroded sonorous-painting surfaces, again, to depict a replica of the robot's paintings (model). It would start a new circle-generation with the meaning of a reedited facsimile, whereas a palimpsest evolution. Our method it self-restarts while it self-destroys... Music-painting sustainability!



Fig. 14. Notebook sketches. Sequence for the tubes. Fig. 15. Notebook sketches. Building small echo chambers.



Fig. 16. Notebook sketches. Tuning test. Stone/pau marfim case.

7 Coda vs. conclusion

If the origin of this method was simply pictorial, soon it was related, connected and interacted with some other medias. Conforming a transdisciplinary¹ attitude where the interaction proposed keeps all the characteristics of each of the disciplines without forming a total new discipline. Surpassing the addition of knowledge it is a kind of holistic collaboration under a common organized thinking, but within an integrated intention.

Usually a music creation is a result after a painting, or synesthetic paintings in regard to the music: a discipline following the other, and vice versa (We should remind here the swarm robots). But we are rejecting those dependence and treating both disciplines in a transversal way, proposing a music/painting immanence, equality emerging and developing in unison, a mutually binding manner, where both disciplines are generating each other but mutually self destroying, via a relation of structural affinity, an organized convergence.

Because we understand the Art creation as a complete system and a sensitive unit of knowledge the main purpose of our researching is to build a microsystem considering a group of diverse concepts to find a method with a double intention:

First, an artistic extension linking several Art form manifestations, following that aesthetic system proposed by Wagner based on the Greek Tragedy and the opera of the end of the 18th century, where his ideal of unifying all works of Art achieve the *Gesamtkunstwerk*, the Total work of Art, artistic synthesis which successfully presumes his idea about the artwork of the future.

Second, a way to get an extended device able to deal (and get a dialog) with the curiosity of an intrusive artist as a thinking being, connected with the multiple reality but considering the level of permanence of the Art beyond the physical conditions, by using a generator of sounds and images where the artist is a willing part of the process of creation, but just a simply conductor on those regenerator maneuvers. By meaning of a perpetual sustainability Art form.

¹ Term created by Piaget in the International Conference "Interdisciplinarity –Teaching and Research Problems in Universities" healed at University of Nice in 1970. "Finally, we hope to see succeeding to the stage of interdisciplinary relations a superior stage, which should be 'transdisciplinary', i.e. which will not be limited to recognize the interactions and or reciprocities between the specialized researches, but which will locate these links inside a total system without stable boundaries between the disciplines". (NICOLESCU, 2006).

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