Sonidos Telemáticos: Network Remote Performance for Compositional Paradigm Shifting in Peruvian Musical Learning Practice

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Abstract: This paper explores the implementation of network data transmission for real-time remote musical performance as part of a set of strategies for paradigm shifting in Peruvian musical education. It describes the use of the [netsend] / [netreceive] objects in the Pure Data (Pd) visual programming language by the Ensamble de Laptops de la Universidad Nacional de Música – ELUNM, for the composition and execution of musical pieces developed by the creation of programs (patches) design for network distant performance interactivity through a server computer. This practice aims at bridging a technological and conceptual gap, in musical composition and performance, that has accompanied the history of musical education in the country, keeping computational thinking from becoming a tool for the construction of new creative expressions and the extension/reconfiguration of the musical arts.

1 INTRODUCTION

The history of music has been inseparable from technology, and we can comfortably say that most music today is machine-ridden. However self-evident this might seem, the relationship between musical practices and technological development have been, at times, difficult and controversial. From a 'natural fear' of the new and a general technophobic stance, to a lack of opportunities to catch up with rapid technological development, musical technology has, in many cases, been marginalized to a mere mean to produce 'something else' known as music. For instance, the heavy use of digital artifacts in contemporary music does not necessarily reflect a conceptual comprehension of the transformational processes produced by the Third Industrial Revolution. If, from the perspective of a global north, "how fast these technologies are accepted depends on a number of factors as well as an understanding of the appropriate model to adapt or develop" (Evwiekpaefe, A., Chiemeke, S., Haruna, M., 2018), for the Peruvian environment, the conditions were dramatically different from those of the 'international community', and music technology was received by a very specific "almost official nationalist and technophobic context" (López, 2018), that affected radically the development of technologically based musical activities and therefore its participation in Peruvian musical education. The role of particular social discourses in the [under]development of technology-based musical activities in Perú, together with a report on new efforts being made to implement substantial changes on the culture of musical education in the country, has been extensively documented on my Ph.D. dissertation (López, 2020).

This text centers on the implementation of network remote performances by the Ensamble de Laptops de la Universidad Nacional de Música in Perú, not as a mere reflection of contemporary practical oportunities for musical perfomance or a demostration of computer technology advancement, but as a potential paradigm shifting strategy that could help move peruvian musical education away from traditional models of compartmentalization that might see a laptop ensamble or a remote performance,

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for instance, as part of a conflicting conceptual schema that undermines the set of predetermined rules regarding musical education models and performative practices. This is a report on a work in process which results are to be found and interpreted in the following years.

2 THE WORLD OF LAPTOP ENSEMBLES AGAINST THE PERUVIAN EXPERIENCE

Arne Eigenfeldt noted more than a decade ago that: "the laptop ensemble, or orchestra, ha[d] become a new paradigm for electroacoustic music performance in universities in North America and Europe", and that in order to form such an ensemble "you could simply advertise the course, and ask the students to bring their laptops", declaring that the hardware problem had been solved (Eigenfeldt, 2010). This simplicity and viability to implement a laptop orchestra in a university setting, mentioned by Eigenfeldt, can be easily understood as the result of a long history of computer music experimentation, in the global north, and as a demonstration of the social conditions these developments denote. By 2012 the proliferation of laptop ensembles had led to the organization of the 1st Symposium on Laptop Ensembles & Orchestras- SLEO at the Louisiana State University. [1] Close to a decade later, the existence of such ensembles represents no novelty for a world that has embraced technology for both academic and popular music. However, this embracing *world* must be understood as incomplete in the sense that it imagines a not existing unity, of which places like Peru are not a part.

Whether the lack of a long history of computer music or laptop orchestration in Peru reflects a displacement of Peruvian society to the margins of global technological development, showing the byproducts of a postcolonial condition, is, while easy to imagine, an analysis that goes beyond the scope of this work. However, to give us some sense of the situation for education in musical technology in the country, it might suffice to say that there are currently no Computer Music or Electronic Music programs in Peruvian higher education, and that music technology is only seen as a means for the production of *real* music, keeping technology as a subaltern practice mainly associated with the recording studio and the notion of musical production.

In order to diagnose the current situation of technological sound arts in this particular geographical and political setting, and to assess the relevancy of constructing mechanisms for musical performance that challenge the traditional models for musical education in this specific nation-state, one must understand, in basic terms, the conditions of *difference* and *otherness* that affect not only the (1) access to technologically based musical products in Perú, but, moreover, (2) the possibilities of constructing a philosophical comprehension of the value of those musical tools.

It is also important to mention that the hardware problem has not been solved, and access to a laptop computer that could handle heavy DSP processing is not necessarily certain for a music student at a public institution in Perú. For instance: "[i]n 2019, approximately 32.7 percent of all households in Peru owned at least one computer".[2] This problematic had to be taken under consideration for the laptop ensemble we will here discuss, as programing decisions had to be made taking under consideration the specific laptop computers we were to work with.

2.1 What Can You Do Yourself

The nonexistence of the complementary role of education in the historical development of computer music and related sound arts, has affected the progress of national popular music cultures based on technological experimentation, and influenced the existence of a general lack of interest for computers as a musical tool for aesthetic research. This is especially true since the last decade of the twentieth century when "[l]aptop composition – the creation and performance of music primarily using laptop computers – emerged as an important musical activity" (Latartara, 2010). While the world was being, during this period, invaded by laptop performers (both in popular and academic music), Peruvian musicians interested in the new possibilities for sound creation based in electronics and 'machine aesthetics', did not envision the laptop as their main creative tool.

I have previously defined a set of values that informed the Peruvian experimental electronic musician during the transition to the twenty-first century, describing these artists as: (1) informal, (2)

[1] https://ccrma.stanford.edu/~ruviaro/texts/SLEO_2012_Proceedings.pdf. Retrieved on march 22, 2021.

[2] https://www.statista.com/statistics/985602/peru-share-households-access-computer/. Retrieved on march 22, 2021.

recurseros, roughly translated as resourceful, and (3) *cachineros,* trading and sometimes scavenging for second hand goods (López, 2008). Contrary to the position of the avant-garde musician of the global north who takes a decision towards underground, DIY, or Lo-Fi cultures, as an ethical declaration of self-sufficiency, or even as a statement against academic specialization; the Peruvian sound artist engages in these practices as a result of a contextual constrain and in a need to adapt to a continuous state of social insecurity. Most, if not all, of theses artists are self-educated in musical technology, but not necessarily by decision. By the time I presented my research in 2008, homemade analogic synthesizers, old drum machines, guitar pedals, and consumer based second hand cheap electronic keyboards, were the tools of the trade for experimentation.

Figure 1: El Lazo Invisible, IONAXS, Eric Ravina, and Paruro, performing at Paruro Street, 2012.

The absence of opportunities to select a personal computer as the easy solution for musical composition, affects the musical output being produced. The level of complexity and variety of the resulting musical products is determined not by a knowledge or academic professional training but by exposure to popular music products from an international music industry. It is difficult to talk, at this historical stage, of compositional techniques (in the traditional academic sense) for electronic music in Peru, as most of the work done by these underground communities is based on live improvisation. This being said, a morphological analysis of the musical products of these communities is still needed.

While contemporary conditions have changed and the rapid democratization of access to personal computers have reached Peru, the lack of implementation of academic discourses to accompany the machines, prevents both the amateur and the academically trained musician from engaging into an informed musical practice that implements the aesthetics and conceptual possibilities given by the machine frameset and its alternative languages. Many students of music in the country regard the multitrack Digital Audio Workstation (DAW) as the only software worthy of attention, and most papers and undergraduate investigations by the students at the university level, explore the notions of the home studio or the complementary capabilities of technology for the production of music by traditional instrumentation and harmonic models in a traditional studio setting.

Having exposed the general circumstances surrounding the lack of implementation of academic training related to computer music practices, and therefore, laptop musical experimentation, an essential question will always remained unanswered: given the opportunity for educational training in computer music issues, would the Peruvian musical output have dramatically changed? If the country is now capable of reproducing most foreign musical styles and confront all the possibilities given by contemporary musical hardware and software, I believe a lack of connection with the original environments for computer music training and academic exploration has affected dramatically the way these musical styles are perceived and, therefore, the probability for novel or innovative practices in the country. This work explores some of the attempts being made to change this historical course.

2.2 Accepting the Machine

The Technology Acceptance Model - TAM developed by Davis (Davis, 1989) attempted to offer a rationalization of the elements present in computer acceptance, including the main variables of (1) Perceived Usefulness, and (2) Perceived Ease of Use. Venkatesh Unified Theory of Acceptance and Use of Technology (UTAUT), would expand this notion to the presence of performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003). A multitude of alternative models have been presented in the following years, and while most of them approach the problem from a pragmatic perspective not always applicable to artistic endeavours, what has become clear is that a multiplicity of factors can disturb the processes of acceptance (Evwiekpaefe et al., 2018). In the Peruvian case we face here, the external factors associated with a reluctance to approach technology for music composition or interpretation, are not directly related to the aspects presented in these and other models, and composers and interpreters

academically trained are used to complex learning routines and detail work. Social and historical factors have played a direct role in delaying the process of acceptance for machines into musical learning. These factors include: nationalism, ancestralism, ideological conservativism, technophobia, and traditional compartmentalization for the arts, among others. An extensive set of considerations for this can be found in my work (López, 2019, 2020). However complex the set of challenges computer music has encounter along Peruvian contemporary history, what is important to mention here is that the musical arts have been one of the artistic environments that has posed a mayor hesitancy towards he implementation of computers. This being said, this work presents a segment of the dramatic changes taking place at the Universidad Nacional de Música in Lima since 2017, were the willingness and openness of the authorities is turning the wheels toward a natural implementation of experimental musical practices with computers.

3 TELEMATIC MUSIC AT REMOTE PLACES

If the history of laptops orchestras is old, the dream of telematic network music presents a much older history. By 1986 the world already counted with a computer music network ensemble (The Hub), and by 1987 they have already presented the first telematic performance. Later historical references and the challenges and possibilities of network performance have already been extensively mapped (Gresham-Lancaster, 2013, Akkermann, 2016). Students and professors in Peru lack of connection with an international world of network performance and are, for the most part, unaware of its existence and of the pertinent academic discussions taking place. A level of isolation and seclusion becomes evident, and most possible participants lack the means to insert themselves into the academic international network that could support their personal development on these issues or nurture the implementation of network performative models. The difficulties of traveling or paying registration fees at the rate of the economical parameters of the global north excludes them of the game right at the beginning. This has also been true in the opposite direction, and we do not count with foreign professors in computer music in our education system.

In the particular case of our laptop ensemble, the need to develop a system for remote performance was produces by the pandemic situation. Being the ELUNM in its early stages and still in the process of maturing as an ensemble, stopping the learning and practice process was not an option. A need to maintain the visibility of this recently formed ensemble was also an issue to take under consideration. Network performance became a tool to secure the continuity of the ensemble and to allow for a smooth transition from students finishing their composition careers into a world that might not have a designed circuit for computer performance or a social system of support for such practices. This option also allowed me to maintain the possibility of including a new generation of members for the ensemble, as the students finish the related regular courses I teach at the UNM: Taller de Electroacústica 1 and Taller de Electroacústica 2. Telematic performance was not only the result of a craving for innovation, but a survival strategy.

4 NATIONAL PRECEDENTS AND THE INITIAL CHALLENGES

The institution of the first Peruvian laptop ensemble: Ensamble de Laptops de la Universidad Nacional de Música – ELUNM, in 2019, as part of the activities of the Laboratorio de Música Electroacústica y Arte Sonoro (part of the Vicerectorado de Investigación), marked a departure from the conventional understanding of musical practice by the educational institutions in Perú. Its insertion as part of the training for the composition students aimed (1) to broaden the perception of a musical instrument at our school (and the Peruvian context in general) by recognizing that a computer ensemble could share the official performance space with other traditional ensemble models, and (2) to challenge professional boundaries by allowing composition students to become performers and programmers in their own right.

The first year of activities, and my earlier attempts to include a computer into a musical ensemble at an educational institution, together with a discussion regarding its relevancy in Peruvian musical education, have been previously reported (López 2020b), but giving the COVID pandemic will be presented officially during 2021. By the beginning of 2020, as the ensemble was overcoming the initial logistical difficulties for its insertion, but with the complete institutional support of the UNM, a small version of the ELUNM was able to perform for the electroacoustic festival MUSLAB 2020 in Mexico City, being this our first experience outside of the country.

Figure 2: Jorge Quispe, José Ignacio López, and Michael Magán at MUSLAB 2020, Mexico City.

4.1 Basic Original Learning Model

Our first ensemble was part of a strategic plan implemented by the Laboratorio de Música Electroacústica y Arte Sonoro starting on 2017, and in which four angles/areas of learning were taken under consideration for all courses regarding musical technology (López, 2020b):

- Historical/conceptual;
- Technical/practical;
- Creative/performative;
- Investigative/innovative.

Within this learning model the ensemble had a strategic transversal role that involved, among other things: (1) the encouraging of live performance with a computer, (2) the incorporation of visual programming languages for musical organization, (3) the flexibilization of the concept of musical instrument and the incorporation of the concept of interface, and (4) the inclusion of the roles of 'technician' and 'programmer' to the rules of the trade.

Under this integral model, the computer ceases to be considered as a support mechanism for the learning of something detached and perceive as the real musical practice, making the human-computer interaction the center of a creative process in which music parameters and aesthetic outputs are redefined, and learning objectives and mechanisms are constantly modified, in an attempt to produce computer music instead of music produced with the aid of a computer. The idea of confronting an all-in-one machine capable of serving as a composing, sound producing, and instrumental performative tool, forces a traditionally trained musical student to not only enlarge its list of objects of study, but to engage into a new way of confronting musical materials and organizing musical data. This process also undermines the traditional separation between science and the arts, and away from an ICT pedagogical perspective in which computers serve musical learning exclusively for the virtual representation of tonal music and traditional notation.

4.2 Computer as a Physical Instrument

If by the end of the 1980s, seminal texts like "The Computer as a Musical Instrument" (Mathews and Pierce, 1987) emphasised the value of digital electronic equipment in the production and control of new classes of sounds, the addition in 2018 of Electronic Digital Instruments as a principal instrument option by the Berklee College of Music[3] acknowledge the development of computers and computer based musical interfaces into a fully functional musical instrument.

At its initial stage the ELUNM sought to highlight the physical presence of the computer as a multi-functional performative alternative to traditional instruments, and saw on public presentations a promotional approach that could bring musical students unaware of the possibilities of computer music closer by making computer music performance visible in spaces dedicated to other manifestations of the academic musical arts.

4.3 Computers Back to the Virtual Realm

As I have hinted before, the ELUNM, as well as other musical practices of the country, was heavily impacted by the COVID pandemic. With the disappearance of the possibility of a live performance, other measures to maintain the ensemble working had to be implemented. In front of the collapse of the traditional lifestyle of the conventional professional musicians, the Internet arose as a saviour of human relationships in front of the necessary confinement. This was taken by the ensemble as an opportunity to explore ways for remote communication not restricted to webcam and microphone interaction through web conferencing.

[3] https://college.berklee.edu/electronic-production-design/electronic-digital-instrument-principal

The already built perception of musical activities as a virtual enterprise facilitated the migration to the online rehearsal practice.

5 NETSEND / NETRECEIVE: NETWORKING SOLUTIONS FOR PERFORMATIVE ACTIONS

Pure Data, the visual programming language by Miller Puckette, is the main tool for teaching electroacoustic music at the UNM, and also for the composition and performance of musical pieces by the members of the Laboratorio de Música Electroacústica y Arte Sonoro and the ELUNM. Given that, we decided to investigate the options for the transmission of information between computers remotely in order the continue practicing and organizing future remote performances. Multiple options are available in Pure Data for network communication between computers, including the Open Sound Control (OSC), Transmission Control Protocol (TCP), User Datagram Protocol (UDP).

5.1 Sending and Receiving Musical Information

After some deliberation we decided for the [netsend] and [netreceive] objects included in Pure Data for the transmission of TCP stream messages or UDP datagram messages. While sending information was not a problem, receiving information was a more problematic issue and opening the local ports was a more intricate task to resolve. The need to reconfigure the router for the incoming of data at any location used for the main *performing* computer using the [netreceive] object was partially responsible for our next decision. Using an Internet free tunnelling service for port forwarding to open the localhost and allow incoming information into the main computer using the [netreceive] object without having to reconfigure the routers, and, in this case, allowing for TCP transmission. In this way all possible members of the ensemble could receive information regardless of their router configuration, allowing for multiple possible settings of the ensemble. This configuration allowed as to avoid dealing directly with audio from multiple sources and worry only about instructions to be send to a central computer dedicated to audio reproduction. Given the instability of Internet services in Perú he transmission of data instead of audio is the most secure option at the moment.

Figure 3: Forwarding setup on terminal.

5.2 Pure Data Patching for Interaction

For the purposes of exchanging information between computers, a set of server/client patches was developed mainly by the student Jorge Quispe: (1) a server patch to receive information from the different performers and (2) a client patch to be use by each one of the members participating of the ensemble at any given time.

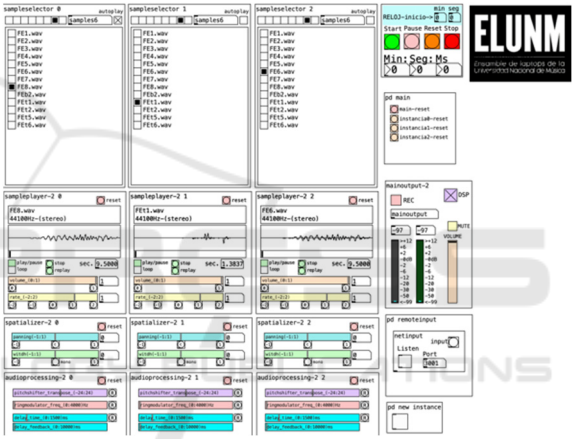

Figure 4: Variation for three performers of Jorge Quispe's server patch.

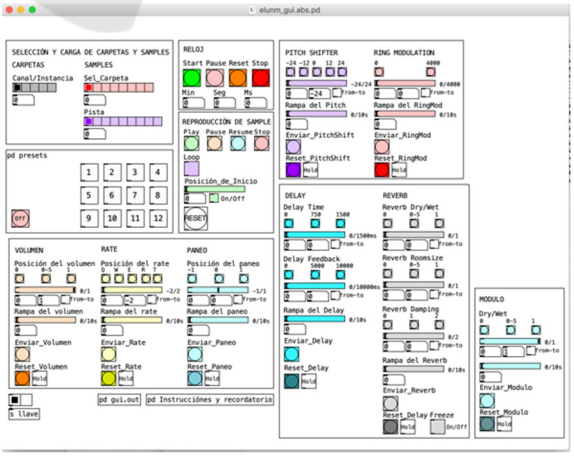

Figure 5: first GUI interface variation of client server by Brian Ki San Yep.

GUI interfaces to simplify performance were later developed for the client patch by the students Bryan Ki San and Saul Medina. Other students also started to develop their own GUI interfaces in Pure Data to control the messages according to their performative needs and, in other cases, according to the compositions they intended for the ensemble.

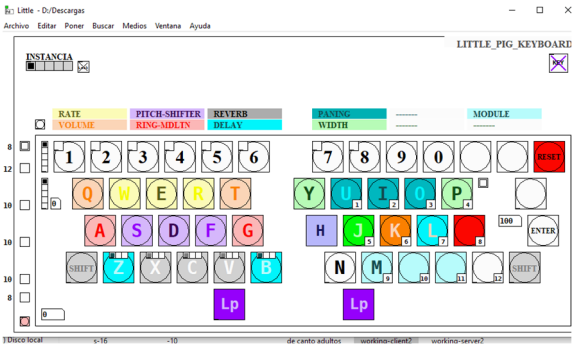

Figure 6: GUI interface variation of client server by Saul Medina.

5.3 Troubleshooting and *Recurseando*

The patch that was ultimately used for our first rehearsals presented a programming problem to resolve. As it allowed for the selection and 'previewing' of different folders by any of the performers participating, but only one visual array per instance/performer to be read at the time of selecting a specific sample from the folder's list visualized, every time a sample was selected, loading the sound into memory from disk caused Pd to have to wait for disk access. In other words, trying to draw a new array in the middle of a performance made Pd stall. Not dealing with the programming aspects of the patch we decided to take a shortcut and build one long sample that included all audios being used for each piece. This permitted us to read only one audio per instance/performer at the beginning and use it for the whole performance. We declare the initial points for each sample included in this long audio, and reproduce them by accessing the specific positions in the sample-player, maintaining, that way, only one graphical array per performer on display. This idea was based on a patch I developed in 2017 for the metacomposition Arpa 1: Descomposiciones y Automatismos used as a compositional tool for the Taller de Electroacústica during that year.

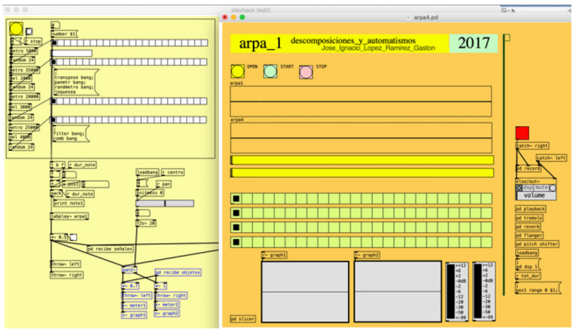

Figure 7: Patch built in 2017 for Arpa 1: Descomposiciones y Automatismos.

5.4 Composing for a Network Remote Performance

After resolving some of the initial technical problems, we commenced the production of musical pieces thought for remote performance. To simplify the process we have started with a smaller than usual version of the ensemble of 3 performers, being 5 the usual. The elaboration of sound materials and the set of instruction for performance implied new challenges and conversations. During this stage we are in the process of testing alternative notation systems and simplified sets of instructions for the repertoire being constructed for the ELUNM.

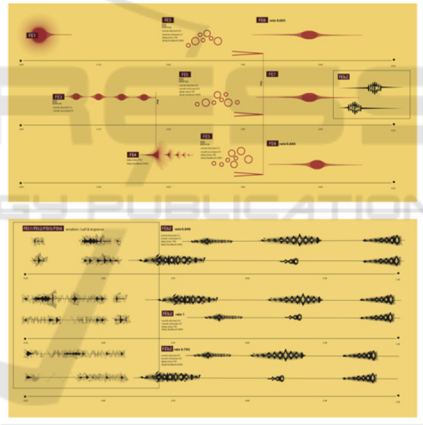

Figure 8: Example of notation for the ensemble. El Filo Errante by José Ignacio López.

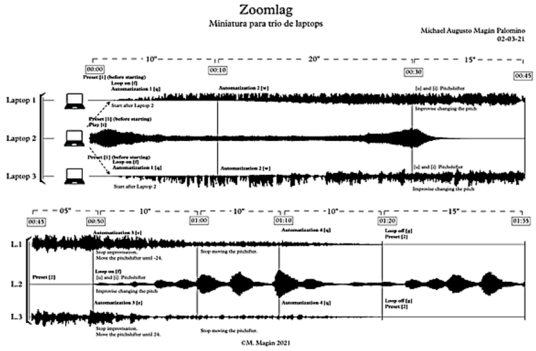

Figure 9: example of notation for the ensemble. Zoomlag by Michael Magán.

6 CONCLUSIONS

Confronting an educational environment requires and acknowledgment of its peculiarities, strengths and weaknesses. The implementation of computer music practices might be seen as a natural addition to any musical training setting, when local and regional subaltern conditions are not taken under consideration. An historical assessment of the presence of technologically oriented musical practices and training in Peru reveals a series of gaps that we hope to be in the process of bridging. The presence of the ELUNM and the intention to develop alternative performative models and remote network presentations sets itself as a teaching/learning process in which the direct connection between musical output and human-technology interaction become evident. The way these practices might serve to produce substantial changes to the central paradigms of Peruvian musical education requires an historical distance not yet obtained.

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