MNT2: A Longitudinal Evaluation of an Open-Source Mapping Software

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Abstract. *El mapa no es el territorio (MNT onwards) is an open-source application developed to control synthesizers and audiovisual materials through gestures. It offers interconnectable modules providing strategies based on two-dimensional maps, which can be configured manually or using dimensionality reduction techniques. This article briefly introduces MNT2 and focuses on its evaluation process. It reviews literature on the evaluation of new musical interfaces, discussing both longitudinal and practice-based approaches. These approaches were used to design a study in which five experienced musicians and sound artists used MNT2 over several weeks, integrating it into their workflows and creative practices. Finally, the article shares the results of this evaluation.*

1. Introduction

MNT[1] is an open-source application developed by the author. It allows the user to control synthesizers through physical movements by creating mapping schemes based on two-dimensional maps. One of the main interests behind MNT is the collective design of audiovisual materials in projects involving digital instruments or interactive audiovisual environments.

Figure 1: Mapping

MNT was initially developed to share mapping strategies with musicians or video artists who neither have a strong interest in programming nor on more technical aspects of such projects. To this end, MNT compiles techniques that do not require long training or calibration processes, prioritizing a creative approach based on play and exploration. It can be applied to the control of synthesizers, DAWs, VJ software or any general purpose tool developed by third parties. The project has received funding from UNQ and UCLA REMAP, and was awarded first prize in the art and technology competition Fusión 2020. It was presented as one of the main outputs in the author's PhD thesis at UNA.

The first version of MNT2 was developed in 2018 in cheLA, for the interactive audiovisual system used in the dance and circus piece Recorte de Jorge Cárdenas Cayendo. This practice-based approach became a guiding principle for the project. Tools were only added when required for specific artistic outputs. MNT2 was driven by the need to solve problems related to creative projects and exhibitions, with modules like Concatenate evolving from various performances and installations between 2017 and 2022. This approach provided frequent validation opportunities through public presentations and academic discussions, while ensuring that artworks weren't treated as mere testing grounds for pre-conceived tools.

1 https://mnt.com.ar/

Although it was designed to control audiovisual materials in interactive environments, MNT2 has produced emerging uses over the years. In particular, it has been used extensively to produce sound materials in studio settings and without the intervention of sensors. An evaluation process was designed to validate the potential of these emerging uses.

This article focuses on this evaluation process. It will review problems and particularities of evaluating tools aimed at designing digital musical instruments. It will then briefly present the characteristics of MNT2[2]. Finally, it will describe the evaluation process and discuss its results.

2. Related work - Longitudinal Evaluation of Digital Musical Instruments.

Practices related to the evaluation of digital instruments and interactive systems for music production have been extensively examined, particularly in recent years [2][3][4]. The strategies applied in communities dedicated to new instrument design often differ in methods, objectives, and even in the interpretation of the word "evaluation" [2]. Conceptual frameworks have been proposed to unify criteria and offer systematic approaches to this task [5]. Some of these frameworks incorporate approaches from UX and other disciplines [6]. However, there are still no clearly defined guidelines for methodological design.

A recurring factor cited to explain the dispersion of criteria is the idiosyncratic nature of the interfaces and instruments to be evaluated. Designers often avoid developing controllers or interfaces that resemble existing instruments [7]. Some devices, moreover, arise to solve some specific need of a composer or performer, or even for use in a particular piece. This poses a problem when choosing parameters for an evaluation process, particularly as it makes it necessary to consider the contexts and users for whom the devices were developed [8]. These interfaces can also be

2 A full description of the project and details on implementation can be found at [1].

conceptualized in many ways, presenting themselves as instruments, input devices, parameter mapping schemes, output devices and other similar configurations.

On the other hand, these technologies reconfigure traditional relationships in music, creating intersections and overlaps in the perspectives from which evaluation is performed. Some recurring roles in the literature are audience, performer, designer and maker [9][10]. Each of these roles implies a different approach to evaluation. For instance, in a review of papers published in the NIME conference proceedings, Barbosa et al. [2] classified evaluation processes according to three perspectives: audience (20%), performer or user (52%), and designer (28%). These approaches influence methodology, as quantitative methods often dominate evaluations focused on the designer's, commonly focused on technical aspects. When the user experience predominates, on the other hand, qualitative methods such as interviews or questionnaires are usually used.

In terms of methodology, interactive systems for music production challenge traditional techniques used to evaluate human-machine interaction. As they involve creative and affective aspects, musical interactions cannot be described in terms of tasks for which one can account, for example, for a completion rate. The attention required for their use and the need for temporal precision render certain traditional techniques, such as protocols based on speaking aloud while performing a task, intrusive. Other methods, such as participant reaction observation, face challenges due to the lack of a clear success criteria and the varying degrees of bodily involvement in performance. Studies are usually conducted with a limited number of subjects, due to the specific skills required. This makes the use of psychometric scales difficult [4].

Another important aspect to take into consideration is the duration and context of these studies. According to [2], most evaluation processes presented at the NIME conference (66%) took place in a single session or experiment. This characteristic appears to stem from the skills needed to use these devices effectively. However, there are numerous frameworks that suggest observing both the use of the devices in practices performed outside a laboratory and the learning process required to use them [6][11][12].

While there are few studies conducted from the user's perspective, over long periods of time and outside workshops or laboratories, the framework proposed by Gelineck and Serafin [11] serves as a prominent example. This article highlights two reasons for choosing a longitudinal approach in the evaluation of interactive systems. On one hand, this strategy is useful to account for changes in usage over time. On the other hand, it makes it possible to explore how a device integrates into a user's habitual practices, and how it articulates with other tools. Conducting evaluation processes outside the laboratory helps avoid interference with practices often tied to specific spaces and schedules, as is common in computer music production.

Gelineck and Serafin [11] evaluated as a case study the PHOXES interface, a modular set of musical instruments based on physical modeling developed specifically to test the proposed methodology. The evaluation lasted four weeks, divided into three phases. In the initial two-week phase, users were offered a free exploration of the interface. In the second phase, lasting one week, specific compositional tasks were proposed, with the aim of encouraging the exploration of features neglected by the subjects in the first phase. Finally, an additional week was dedicated to a new free exploration process. After each phase, semi-structured interviews were conducted. During these interviews participants were asked to demonstrate how they used the interface. The analysis of the results was carried out following the guidelines proposed by Kvale and Brinkmann [13] and Johnston [14].

3. MNT2

3.1. Graphical interface

MNT2's main visualization is a diagram-based graphical interface, called "connection view" (figure 2). MNT2's connection view makes it possible to configure "sets": combinations of modules, inputs, outputs and connections. By double-clicking on the rectangles that represent the modules, the user can access the "edit view" (figures 3, 4, 5, 7 and 8). This view displays specific configurations for each module. The "tiled view" (figure 10) shows every module included in a set at once.

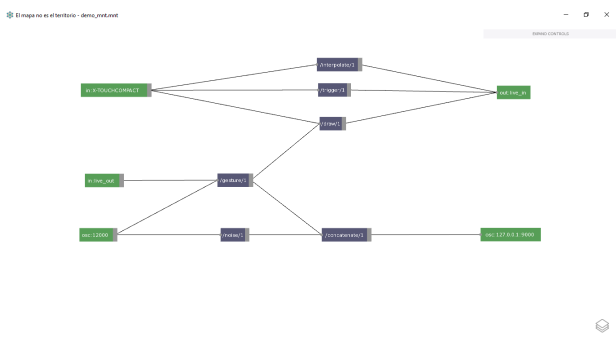

Figure 2: Connection view

3.2. Modules

MNT2 includes six modules. They can be connected to each other or to inputs and outputs. Each of these modules is structured around a two-dimensional interface or map. In the Interpolate, Trigger and Draw modules, the maps contain combinations of parameters or presets. In Concatenate, points represent audio files or fragments of audio files. Finally, the graphics included in Noise and Gesture represent a position or a series of positions for a cursor. All modules send and receive messages either via MIDI or OSC.

3.2.1 Interpolate

Interpolate (figure 3) was inspired by Metasurface [15].

It uses natural neighbor interpolation [16], a method based on Voronoi tessellation, to generate gradual transitions between presets assigned to polygons distributed in the map. Navigating the interpolation space adds a new polygon at the cursor. The weight of each preset for the final set of values is calculated as the area that this new polygon takes from the first ones.

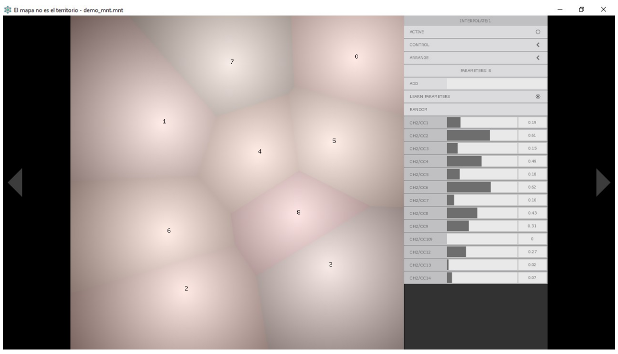

Figure 3: Interpolate

3.2.2 Concatenate

Concatenate was designed to control corpus based synthesis [17]. It analyzes audio files, obtaining 19 Mel Frequency Cepstral Coefficients and a set of audio descriptors. It allows the user to generate a map by applying dimensional reduction techniques like PCA or t-SNE [18] to the MFCC data, or by mapping audio descriptors to each axis. This map (figure 4), displays points ("units") that represent a position in an audio file. When navigated by a cursor, the module sends the file names and time positions of the selected units through OSC.

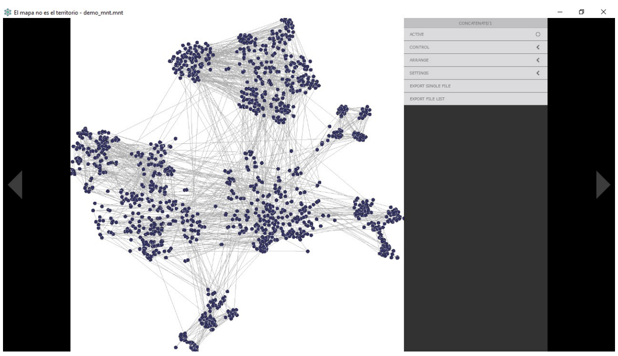

Figure 4: Concatenate

3.2.3 Trigger

Trigger represents combinations of parameters through a series of objects distributed in a two-dimensional map. These "triggers" contain two concentric circles with a configurable radius (figure 5). When the cursor enters the smaller circle, the trigger is activated, sending the values it stores to the module output. For a trigger to be deactivated, the cursor must be positioned outside the larger circle. This prevents the preset associated with each of the points from being triggered repeatedly if the module is controlled by a noisy signal.

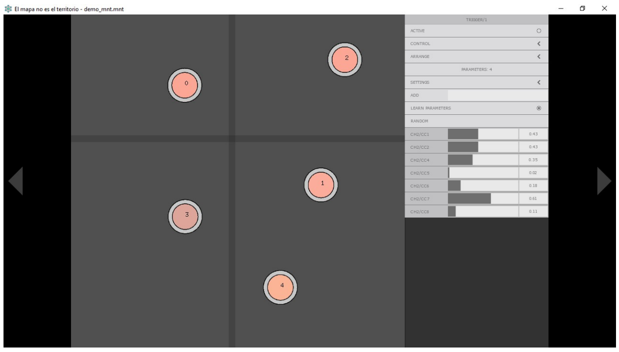

Figure 5: Trigger

3.2.4 Draw

Draw aims to generate gradual transitions between parameter combinations through arbitrary graphics. It allows the user to work with grayscale images (figure 6).

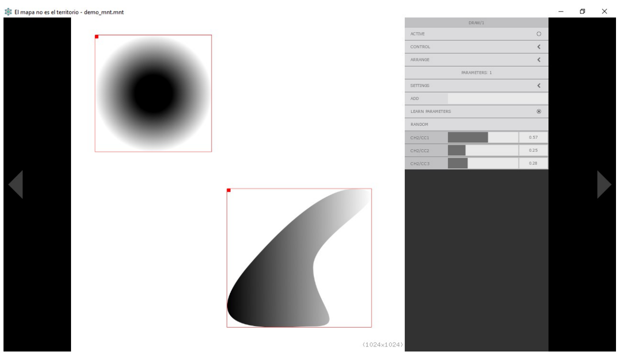

Figure 6: Draw

The cursor obtains a single color at its position by applying a Gaussian kernel. This value is used to scale the ones stored in the presets for each parameter. Moving the cursor to the center of the circle in figure 8 could result, for example, in a fade in.

3.2.5 Gesture and Noise

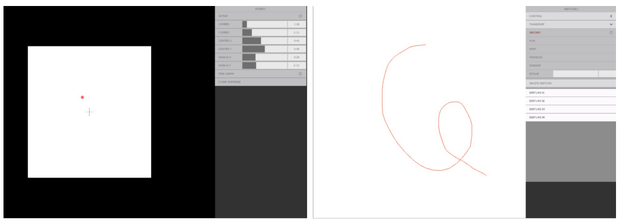

Figure 7: Noise (left) and Gesture (right)

Although they can be connected to outputs, Gesture and Noise were developed to control the rest of the modules. Gesture (figure 7, right) captures and plays paths recorded by the user. Noise (Figure 7, left) generates random paths using Perlin Noise.

3.3 Data entry and analysis tools

Once a map contains enough information, MNT2 allows the user to generate new points at random positions. Parameter values at these points result from the interpolation of the values stored in the rest of the map. The user can also obtain random values for the parameters and redistribute the maps by generating random trajectories for each point. Finally, the maps can be rearranged through descriptors and dimensional reduction techniques .

As in Concatenate, MNT2 uses t-SNE and PCA to generate new distributions for any map. These dimensional reduction techniques allow mapping multidimensional data - such as presets - to lower dimensionality spaces - such as the map - preserving, as much as possible, the original structure of the data. The general idea behind the application of these techniques in MNT2 is that elements that are close together in a multidimensional space will remain close together in lower dimensional spaces. In the simplest case, the user can automatically arrange the maps such that similar presets will be close together, achieving representations that result in smooth transitions.

The user can also choose to sort the points according to one of the stored parameters. This allows, for example, the cutoff frequency of a filter -associated to a control change message in a DAW and stored in a preset in MNT2- to increase from left to right in a map.

4. Evaluation

MNT2 was first designed to control audiovisual materials in interactive environments. However, during its development process it was used extensively to create sound materials in studio settings and to control live performances. This practice resulted in the inclusion of new modules and in updates to the graphical interface and connection schemes. The evaluation process focused on analyzing these emerging uses.

One of the main interests behind the evaluation was to investigate user experiences, in order to assess whether MNT2 was received as an intuitive system that could be adopted by composers and performers of computer music. The utility of the available connection formats, the stability of the system and the applicability of the technologies implemented in the sound design were evaluated as a secondary objective. The modules contained in MNT2 are based on previous developments and were incorporated as a reflection on concrete practices. In this sense they were extensively tested in performances and installations.

4.1 Methodology

The evaluation of MNT2 was modeled on the framework described by Gelineck and Serafin [11]. A study was set up in which five people used MNT2 in their usual work contexts. Participants were selected based on their experience. Priority was given to individuals who frequently develop unconventional mapping schemes for composing computer music or who work in designing interactive or generative sound environments. The evaluation process was divided into three stages, for which minimum tasks and durations were assigned (figure 8). To accommodate the evaluators' usual schedules and spaces, they were able to pause and resume tasks at their convenience.

At the beginning of the evaluation, participants were provided with the application, a manual and video tutorials. During the first stage, lasting at least one week, they were asked to study these materials.

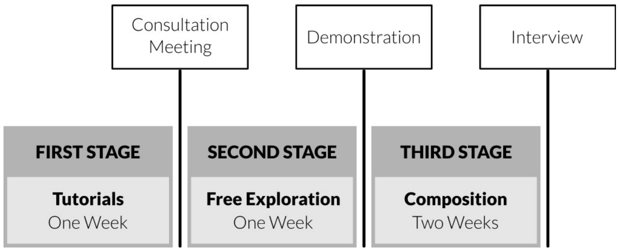

Figure 8: Evaluation of MNT2

At the end of this week, a consultation meeting was held to address any questions about the application's mechanics. In the second stage, participants were asked to freely explore MNT2 in sessions lasting at least one hour, focusing on familiarizing themselves with its features. Following this stage, participants attended a meeting to demonstrate how they used MNT2 and to explain the initial control schemes they had designed. The third stage spanned at least two weeks, during which evaluators completed at least two one-hour sessions to compose a small piece or study. At the conclusion of this last stage, participants attended a final meeting to present their designed schemes and the outcomes of the assigned tasks, followed by a semi-structured interview.

4.2 Evaluators

4.2.1 Evaluator 1

Evaluator 1 (E1) was born in Buenos Aires in 1981, where they currently reside. They hold a degree in Composition with Electroacoustic Media and a PhD in Social Sciences. They teach at various universities. They work primarily on sound pieces and video. Although they were familiar with the theory behind some of the techniques implemented in MNT2, they had never applied them in practice.

4.2.2 Evaluator 2

Evaluator 2 (E2) was born in Buenos Aires in 1994 and lives in Temperley, Lomas de Zamora. They are a musician with classical training in clarinet and have a degree in Music and Technology. They are a PhD candidate in Science and Technology. Their main area of work is ludomusicology. They teach audio for video games and are a sound designer. While they use digital technologies professionally to produce music, they had neither used tools similar to MNT2 nor had in-depth knowledge of its underlying technologies before the evaluation.

4.2.3 Evaluator 3

Evaluator 3 (E3) was born in Salta in 1988, where they currently reside. They hold a degree in Music and Technology and are currently pursuing a PhD in Science and Technology. Their main lines of study are the acoustics of spaces and the soundscapes of Argentina. They have not used applications for parameter mapping and sound control like MNT2. They were unfamiliar with the techniques implemented in MNT2 at the start of the evaluation.

4.2.4 Evaluator 4

Evaluator 4 (E4) was born in 1994 in Buenos Aires, where they currently reside. They are a composer and saxophonist, they hold a Bachelor's Degree in Composition with Electroacoustic Media and have graduated as a saxophone teacher. As part of this practice, they used tools similar to MNT2 and are familiar with some of its technologies.

4.2.5 Evaluator 5

Evaluator 5 (E5) was born in the city of Buenos Aires in 1985, where they live and work independently as an electronic musician, music producer and private teacher. They also work as a producer in audiovisual and sound art related projects. At the beginning of the evaluation they had used parameter mapping tools and corpus-based concatenative synthesizers.

4.3 Results

4.3.1 Input and output devices

The evaluators used a range of input devices and synthesis engines. Parameter input for modules that work with preset combinations was performed through the text fields and sliders available in the graphical interface or via MIDI controllers.

E2 and E3 used MIDI messages, using the Pocket MIDI app on a cell phone and the NanoKontrol hardware controller, respectively. E4 used the MNT2 graphical interface for parameter input and E5 made use of the MIDI output from an Elektron Digitakt, the same synthesizer they used for sound generation. Finally, E1 did not include preset management modules in their project.

The synthesis engines also varied across evaluators. E2, E3, and E4 controlled virtual instruments within Ableton Live. While this is one of the most widely used digital audio workstations in recent decades, this decision may have been influenced by the tutorials, which featured examples developed through this DAW. Both E2 and E3 focused sound generation on the Max For Live device MNT::CONCATENATE, while E4 used Ableton Live's native devices. E1 developed a patch in Pure Data, centered around the_grainer~ granular synthesis external. E5 controlled parameters on a Elektron Digitakt hardware synthesizer:

> The sampler I use is an Elektron, which also functions as a MIDI controller, so I was working with MIDI from there (...) The sampler has eight channels, and all its parameters respond to control change messages. So, I selected a bank of parameters that includes the start and end points of the samples, the filter cutoff frequency, and effect sends like reverbs. These are the ones displayed in Interpolate. Then, using the analysis tools, I experimented with different configurations to explore various map organizations. With the Gesture module, I tried controlling Interpolate by creating drawings.

For cursor navigation, E2 used the two-dimensional control included in Pocket MIDI ("XY PAD"). The other evaluators preferred to navigate representations by dragging the mouse cursor over the MNT2 interface. E3, in addition to navigating Concatenate through gestures, controlled two instances of Interpolate using a NanoKONTROL. They organized presets in a six-rows by two-column grid (figure 10).

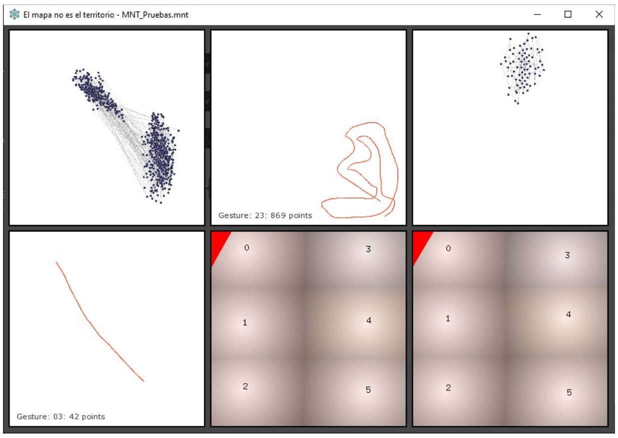

Figure 10: Tile view of E3's set

They used a button on a controller to select columns and a slider to control vertical axis positions. Finally, E1 stored trajectories created with a mouse in Gesture, and controlled their playback using OSC messages sent from a Pure Data patch.

4.3.2 General characteristics of the sets

The evaluators designed sets that included between 2 and 6 modules. In all cases, they included one of the modules dedicated to generating or storing trajectories. However, no set included an instance of Draw. All projects centered on audio file manipulation rather than sound synthesis.

E1, E2 and E3 used Concatenate for this purpose. As noted in the previous section, E1 controlled a Pure Data patch implementing granular synthesis. E2 and E3 used the Max For Live MNT::CONCATENATE device. The other two evaluators relied on different samplers. E4 used native Ableton Live instruments. E5 used samples stored in a Elektron Digitakt sampler and drum machine. The output obtained through these instruments was modified using additional audio processes, either integrated within these devices or as effects organized in return channels. Notably, no other synthesis techniques were employed in the projects.

During the interviews, the evaluators noted that they had relied on one main module to drive their pieces. E1, E2 and E3 centered their work on Concatenate, using other modules to control parameters of MNT::CONCATENATE or of audio processes. E3, in particular, described MNT as a "complex granular synthesizer":

> I thought of MNT2 as a sound material creation system; in a way, I saw it as a sophisticated granular synthesizer, like a box where I put a bunch of information I had and then resynthesized it based on spectral data.

E4 and E5, on the other hand, relied on external synthesizers. Both evaluators used a single module to determine the occurrence of events, with E4 focusing on Trigger and E5 on Interpolate. In E4's case, additional modules were used to control supplementary processes. Interestingly, while E1, E2 and E3 predominantly work on digital environments, the two evaluators who preferred preset management modules (E4 and E5) favor hardware synthesizers. For instance, although E4 ultimately constructed their project using native Ableton Live samplers, their initial inclination was to work with a Volca Sampler:

> My initial approach was to intuitively organize the sounds and load them into a Volca Sampler so I could control them with MNT2. I couldn't achieve an appealing setup, so I decided to work with a DAW instead.

4.3.3 Use of modules

a) Concatenate

E1, E2 and E3 included at least one instance of Concatenate in their sets. Both E1 and E3 performed a manual classification of their audio files before the analysis, including instances of Concatenate for sample groups. E1 distributed audio files in three instances of Concatenate. They edited the samples before analyzing them, selecting fragments they found interesting and removing redundant information:

> I devised a concatenative synthesis trio. The synthesis units are divided into three materials: rain, birds, and running water. I used the tools to distribute the maps and came up with three configurations that I liked. Each of these maps controlled a granular synthesis engine.

E3 used two instances of Concatenate. They pruned the maps by removing units, obtaining relatively small collections of points:

> Down here [in Concatenate], I have sounds of soundscapes: birds, crickets, etc. Up here, there's an erquencho, deeper, raspier. I navigate this using gestures. When I move the cursor in Interpolate, it changes the period and grain size. This way, I can achieve more percussive, more 'granular' sounds, and, in other cases, more continuous ones.

E2, on the other hand, analyzed a folder where they routinely store samples, without considering its contents. Instead, they relied on Concatenate's analysis tools to cluster units.

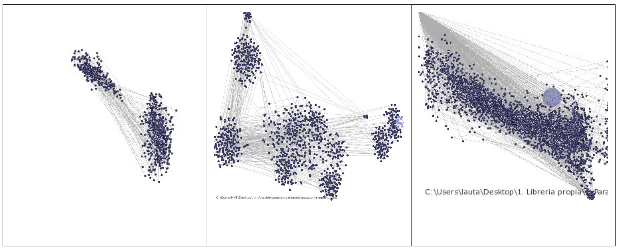

Figure 11: Use of Concatenate. E3 (left). E1 (center). E2 (right).

b) Trigger and Interpolate

With the exception of E1, all evaluators included at least one instance of Trigger or Interpolate in their projects. As discussed previously, the importance of these modules varied across the sets. These differences can be observed in the number of presets distributed across the maps, and the number of parameters assigned to each preset.

E4 and E5, who placed particular emphasis on Trigger and Interpolate, used a large number of zones. While E4 distributed these zones across different modules, E5 centralized parameter control in a single instance of Interpolate. E5 also designed complex parameter combinations for each point on the map, involving a large number of parameters.

E2 and E3 focused their projects on the Concatenate module, relegating Trigger and Interpolate to secondary roles. These modules were mainly used to modulate granular synthesizer parameters or apply audio processing to Concatenate's output. Compared to E4 and E5, E2 and E3 used fewer zones.

Both E2 and E5 used Interpolate's tools to organize their maps. E2 noted that they didn't necessarily need to understand the dimensionality reduction techniques to use them:

> The most important thing was that I understood the sonic result. I mean, sometimes I'd come across things I didn't know I could achieve with the app, but once I heard it and tested it, I could replicate it and understand why it produced that result.

E3 arranged zones in a layout tailored to the characteristics of their controller, rendering the use of these tools impractical for their setup. Lastly, E4 did not find it useful to include Interpolate's organization tools in their project, as the presets contained a relatively small number of parameters.

c) Gesture and Noise

All the sets designed by the evaluators included at least one instance of Gesture or Noise. These tools served different roles in shaping the temporal development of their pieces. E2 and E3 used MNT2 to generate materials, which they then assembled in another environment. E1, E4 and E5, on the other hand, controlled the evolution of the materials entirely through

MNT2. This distinction may explain the shorter duration of gestures stored in Gesture by E2 and E3, compared to the longer gestures that E1 and E5 created (Figure 12).

Both E1 and E5 stored complex paths in Gesture. While E1 used OSC messages to navigate the gestures, E5 simply played back the trajectories as they were recorded. E1's workflow involved generating a set of maps with Concatenate, then executing and recording trajectories based on sound results:

> From the start, I was already thinking about the gesture: 'I'm going to start here and end there. I want it to begin rougher and transition into something more defined. I want to go through the lows, move away, and then come back.' While the map and the gesture are technically separate, conceptually they are very intertwined. In a way, the gesture was a consequence of how the material ended up being organized.

In contrast, E5 used Gesture to freely draw shapes without initially considering the maps they would control. They later designed an Interpolate map and organized it to align with the stored trajectories:

> In the last two sessions, I've been working with the module that allows drawing, which led me to spend a lot of time focusing on a single drawing. It was something that caught me by surprise—I didn't imagine I'd be doing that (...) I have a team I work with, and we try to approach artistic content generation from a transdisciplinary perspective. This got me thinking about how I could take some of these tools not just into performance but also into visual design. I'm working with Philip Glass's Metamorphosis No. 1, so I created a series of insect-inspired drawings to keep everything within a kind of ecosystem. It's quite fun to do and to listen to because the paths traced through the drawings also reflect the speeds of the strokes, which ends up generating shifts in the piece's sonic movement.

E4 did not use any instance of Gesture, relying instead on Noise to randomly generate trajectories.

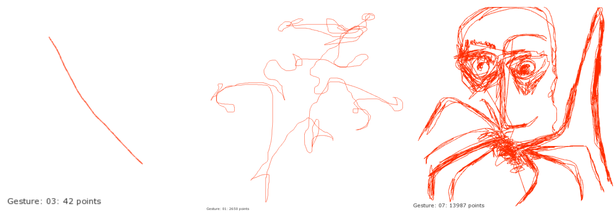

Figure 12: Use of Gesture. E3 (left). E1 (center). E5 (right).

4.3.4 User experience

With the exception of E1, all evaluators achieved a functional configuration in their first working session. This discrepancy may be attributed to E1's decision to develop a custom synthesizer in Pure Data specifically for the evaluation process. This task required harmonizing Concatenate's output with the input requirements of the_grainer~ object. The other evaluators, however, largely adhered to the configuration models presented in the manual and tutorials, occasionally adapting them to their needs. They also frequently utilized devices included in MNT2, such as MNT::CONCATENATE, or technologies previously tested in conjunction with MNT2, such as Ableton Live and the LoopMIDI virtual port.

All evaluators found MNT2 engaging and noted that it provided an effective medium for creative expression. E2, for instance, found in MNT2 a quick way to express complex ideas:

> I found quick ways to do things that initially seemed very complex in a very short time (…) At first, I explored Concatenate and then Interpolate—those are the two I used the most. To start, I felt like I was able to easily create certain textures or things that would normally have taken me a lot of lines of code or the integration of multiple tools.

Regardless of whether they began the evaluation process with a pre-established plan, they often remarked that the map design and connection possibilities influenced their decisions, prompting them to explore new workflows. E1 commented that MNT2 shaped the way they designed their piece:

> MNT2 sparked an idea and helped me bring it to life. I started with one goal, and along the way, another one emerged, which was a consequence of the software and interacting with its possibilities.

Similarly, all evaluators commented on MNT2's user-friendly and intuitive interface. They found working with the maps allowed a playful approach. E3 found this to be one MNT2's most prominent features:

> It allows me to express myself. There's a very rational stage at the beginning, but then it becomes quite visceral, and it lets you play around a bit. (...) It's very playful. It didn't take me long to get a result.

Finally, all evaluators expressed an interest in using MNT2 again and agreed that it could serve as a valuable tool for live control of synthesis parameters. E1, E2, and E5 found the application reliable. E3, however, suggested the addition of features like an undo function and automatic backups to enhance reliability and safeguard their work.

5. Conclusions

MNT2 was developed as a toolkit for designing interactive audiovisual environments. However, it also demonstrated utility as a platform for sound design tasks in studio settings. To investigate these potential applications, an evaluation process was conducted in which five musicians and sound artists used MNT2 to compose a piece. A longitudinal approach was adopted to observe how the application use changed over time and to explore its integration into each artist's typical workflows, accommodating their preferred spaces and schedules for computer-based music production. The evaluation concluded with semi-structured interviews, during which the evaluators showcased their work and answered questions about their experience.

All evaluators successfully completed the proposed task, producing a piece. Notably, one of these, Territorio by Damián Anache, was published in the compilation *Microtopies 2023: 79 miniatures de música i geografia54*[3]. Although some evaluators had access to sensors similar to those used in the projects that inspired MNT2's development, none chose to use them during the evaluation. Instead, they employed a wide range of input methods, such as randomly generated data, envelopes controlled on other applications, MIDI controllers, general-purpose peripherals like a mouse, and touch-based devices such as cell phones. The projects also demonstrated diversity in synthesis engines, including DAWs, Pure Data patches, and hardware synthesizers. This variety extended to the configuration of MNT2 sets, which featured different modules and innovative uses of the same module. For instance, the Gesture module was used to create short gestures of about two seconds, long gestures lasting approximately one minute, and intricate trajectories running up to six minutes. These examples highlight MNT2's flexibility and adaptability to different production styles and contexts.

All evaluators commented that MNT2 enabled them to express their creative ideas and found the application intuitive, at least in certain aspects. Most also described it as comfortable to use. Interestingly, several evaluators characterized their experience with MNT2 as "playful" and noted that they discovered their module configurations and map designs through iterative trial-and-error processes. The application's features often influenced and reshaped their initial work plans. Furthermore, the evaluators incorporated dimensional reduction techniques and available audio and MIDI descriptors into their projects, even though these elements were not deeply covered in the documentation. This exploration, too, emerged from trial-and-error workflows driven by the visual and auditory feedback provided by MNT2. These findings align with the objectives outlined at the start of MNT2's development: to create an environment that fosters the playful exploration of mapping strategies and promotes workflows where material representations shape potential solutions to creative challenges.

6. Bibliography

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