Towards a free, open source and cross-platform software suite for approaching music and sound design

R. Penha

INET-MD / DeCA, Universidade de Aveiro, Portugal

In this paper, the author describes three applications developed for the promotion of computer music exploration and education: Políssonos (a midi sequencer based on polygons), Narrativas Sonoras (an audio sequencer based on granular synthesis), both awarded a «Mention for the whole of the pedagogical work» in the Lomus 2008 – International Music Software Contest, and the more recent Digital Jam (for networked improvisation). The concept behind their interfaces and the accessibility of music software, along with the promotion of free and open source software are the text's focal points.

Keywords software; music; sound design; open source; music education

1. Introduction

While fostering Digitópia – Platform for the Development of Digital Music Communities –, a project at Casa da Música in collaboration with INESC Porto, ESMAE and UCP, there was a major hunt for free, and preferably also open source, software for computer music making. Intended for mostly unattended use by beginners and musicians alike, the software's easiness of use and its ability to provide a rich environment for musical exploration were amongst the most important characteristics that were searched for. The results fell a little short of expectations: in the beginning of 2007, the "instant gratification" factor, e.g. attainable when using loop-based music software like Apple's GarageBand, was somewhat absent from the open source world. At the same time, some of the easy to use, free software available wasn't really capable of successfully tempting the user to explore musical languages beyond their most common experience. This led to the creation of a free, open source and cross-platform software suite for approaching music and sound design.

Recent advances, such as multi-touch displays [4] and the Reactable [3], along with the flourishing of projects based on new interfaces for musical expression, such as the monome [2], all heavily spread throughout the Internet, show how much importance is nowadays given to the mediums through which humans and computers can interact, namely in the computer music world. There has also been a great emphasis on the interaction with mediums – i.e. the musical instruments – as a major focus in our traditional western music education. Yet many of the interfaces we learned to depend on while creating music with computers were originally conceived for other, often older, realms, thus reflecting its original purpose's strengths and, more importantly, drawbacks. The ubiquitous "piano roll" interface is perhaps on of the most striking examples of this idea. While professional musicians can capitalize their acquired vocabulary and musicianship when approaching computer music by using interfaces based on piano keyboards, scores or mixing boards, beginners can face a double challenge imposed by them: not only do they have to find ways to explore the possibilities of the software, they will also have to overcome the potential difficulties of approaching an analogy to an interface they don't fully control. As an example, one can think of the piano keyboard, which is probably the most common kind of physical controller for computer music and almost omnipresent as an interface on computer music software. Should it be natural to expect everyone to relate immediately to an interface that not only makes microtonal exploration hard, for example, but also presents some equivalent intervals in a different and unnatural (i.e. with no discernable acoustical relation) way?

2. Goals and Guidelines

One of the main goals of this software suite was therefore to rethink some of the interfaces we use for computer music making, in order to provide its users with easy to grasp, expressive and rewarding means of exploring music and sound, while making use of processes often reserved for professional use. Each application should thus be easily explained in a just a few minutes, yet potentially gratifying enough to tempt real exploration and to allow an assortment of results. The main guidelines for designing the interfaces were: the whole application screen should be as uncluttered as possible, with all the interface objects visible at a glance; the use of bright colours should be reserved for music making or sound varying interactive objects, with each colour tied to a different voice; the main idea for the bind between interface and sound or music creation process offered in each application should be handy and immediately usable, without any previous configuration; a space on the bottom

of the application window should be reserved for written instructions, both in Portuguese and English, catering for most, if not all, tutoring needed to use the application.

The programming environments used to develop the software suite should ideally be also free and open source, while being able to provide an easy to use standalone for the three main platforms: MacOS X, Windows and Linux. These requirements, together with its extensive use in the digital arts realm (thus augmenting the potential demand for the source code), made Processing [6] surface as an ideal choice.

3. Applications

Three applications have been developed so far: Políssonos, a midi sequencer based on polygons, Narrativas Sonoras (Sound Narratives), an audio sequencer based on granular synthesis, and Digital Jam, for networked improvisation. Each one of these applications, developed in 2007, will be briefly described below, along with the specific goals aimed by each of their concepts. They are available for download, both as standalone applications and as source code, at [9]. Políssonos and Narrativas Sonoras received a «Mention for the whole of the pedagogical work» in the Lomus 2008 – International Music Software Contest.

Fig. 1. The interface of Políssonos, Narrativas Sonoras and Digital Jam, from left to right.

3.1 Políssonos

Políssonos is a loop-based midi sequencer that elicits the relation between the rhythmical division of time and the shapes of polygons. It is the youngest application of the suite, but it is perhaps the one that more closely abides by the guidelines outlined for this project, as it provides tools for “instant gratification” while creating loop-based music, at the same time allowing some further experiments. A simple midi sequencer at its core, Políssonos is mainly a proposal for a visual orientated alternative to the traditional “piano roll” interface.

The main items in Políssonos’ graphical user interface are six similar rectangular interfaces for the six available midi tracks. Each of these interfaces uses an unique, identifying colour, besides the common grey backgrounds and divisions, and is dominated by a circumference that represents a loopable bar (figure 2). This circumference is marked with several equally spaced potential vertices of the enclosed polygon, which represent the subdivision of the bar. When the user selects a vertex, its pitch can be defined by the stepped interface on the right of the circumference, which provides the option to select one note within a two-octave range of the active scale. In a similar way, but on the left side of the circumference and without a stepped scale, one can select the volume, i.e. midi velocity, of the note. This control can be used to create rests, by selecting a volume of zero, as the duration of each note is always defined by the interval between itself and the following note. Detached on one side of this interface is a numbered series of small squares that represent nine available “slots” for assigning patterns. On the other side, one finds two buttons: a play button on top, independent for each track, and a menu button at the bottom.

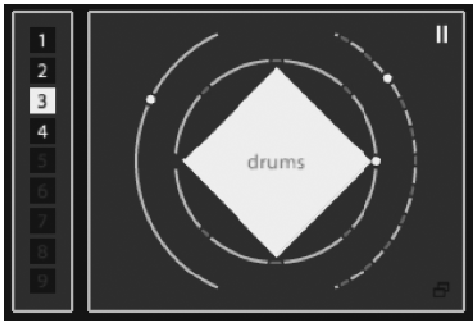

Fig. 2. The interface for each of the six tracks.

This menu (figure 3) allows the configuration of five different parameters for each track: the instrument, from a list of midi instruments; the key note, which translates as the lowest, middle and highest notes selectable; the scale, from a selection of pentatonic, dorian, mixolydian, major and octatonic (unavailable for percussion tracks); the number of beats in each bar; the subdivision of each beat in the bar. These two last parameters are not labelled in the traditional way (like 4/4 for four quarter notes in a measure, with e.g. 16 representing four subdivisions each), but instead indexed to the main sequencer's beats per minute (bpm), thus being represented as e.g. "bpm x 5" for a bar with five beats and "bpm ÷ 3" for a subdivision of three notes per beat. All these parameters are independent for each track, so the user can, for example, select different kinds of simultaneous subdivisions of the beat or experiment with dephasing cycles of different duration. With the ability to play and stop each track separately, albeit synchronized, and changing all the parameters whilst playing, Políssonos can be used as a real-time, loop-based midi performance tool.

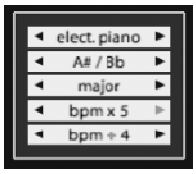

Fig. 3. The menu for each track. When selected, it replaces the rotating sphere.

While focusing on the visual translation of rhythm, the interface for each track doesn't offer an easy way to grasp the melodic progression. To address this constrain, a constantly spinning 3D model of the currently selected pattern is presented in the bottom center of Políssonos' interface, with longitudes representing rhythm and latitudes representing pitch (see figure 1). When a note is played, the lines of its coordinates flash. Above the sphere there is a main sequencer, where one can lay out sequences of patterns to play or to export as a midi file, a play button for the sequences and a fader for changing the bpm of the playback. Additionally one can find buttons to open and save files, both in the native '.psn' format and the general midi file format (save only).

3.2 Narrativas Sonoras

Narrativas Sonoras is a very simple audio sequencer that uses granular synthesis as its sound engine. The oldest application from the suite, its original design dates back to end of 2006. The first implementation of the software employed a Processing user interface controlling a hidden Max/MSP sound engine. The current generation, however, was developed entirely on Max/MSP, thus infringing the aim of using only open source development environments and, at lest at the time of this writing, excluding its availability for Linux. Max/MSP, nevertheless, has far greater audio capabilities than Java, has the ability to compile standalone applications for MacOS X and Windows and has a large established user base capable of using the source code.

The user interface of Narrativas Sonoras was originally based on an example one can find in the Processing's Examples folder - Examples:Basics:Input:StoringInput. This interface, which consists basically on a simple XY controller, leaves a fading tail of progressively smaller circles behind the moving mouse cursor, in this case resembling the several grains of sound outputted by Narrativas Sonoras' sound engine.

After selecting a sound file, either one of the ten built-in sounds or an external one, its waveform is presented below a clickable rectangle (figure 4). When clicking anywhere on this rectangle, one is choosing the location of the file to be used by the granular synthesis engine on the horizontal axis and the pitch of playback on the vertical axis, covering two octaves. A line in the middle of the rectangle marks the original playback pitch. It is also possible to show guides for the chromatic scale, to accommodate for the potential need of some controlled transpositions. The user can play the sound files while accelerating, transposing or freezing the sound at will.

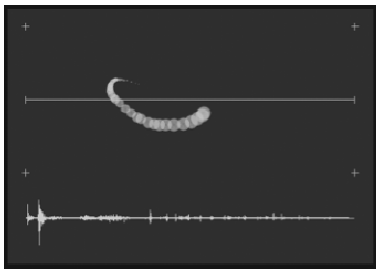

Fig. 4. The interface for controlling the pitch (vertical) and position on the file (horizontal) of the granular synthesis.

On the left side of the screen (see figure 1), one can find a basic audio sequencer were fragments of sounds can be recorded, sequenced and edited using the simple available tools: pan, initial volume and final volume (other volume envelopes can be made by dividing the sound in several smaller bits). When a specific sound fragment is selected, one can replay it and modify parts of it by grabbing the cursor, in a kind of touch-sensitive, read/write automation. This was made possible by the fact that, unlike its own original implementation, the Narrativas Sonoras' sequencer is not a real audio sequencer, but a sequencer of automation events with an independent granular synthesis engine, built with the Granular Toolkit for Max/MSP [8], for each of the eight tracks.

Using the same interface as the one previously used to "record" the sound, it is also possible to apply filters to the granular synthesis. While replaying the selected sound, one can click anywhere on the rectangle to apply a filter, with the vertical axis controlling the frequency of the filter and the horizontal axis morphing between, from left to right, a low-pass filter, a band-pass filter and a high-pass filter.

3.3 Digital Jam

Digital Jam is an application for collective improvisation using networked computers. Unlike the original implementation, that used soundless Java interfaces on each computer connected to a Max/MSP sound engine running on the server, thus limiting its use to supervised workshops, the current generation has an interface, a sequencer and a sound engine included in a single application. When the application is started, it sends a request to the network looking for other active users. If none is found, the standalone mode is activated and the sequencer automatically starts. If another user on the same network starts Digital Jam, both users won't have any option other than improvising together. This choice was made specifically for the promotion of group improvisation within Digitópia [5]. All the users can hear the sounds controlled by all the others, to cater for the use of headphones or large, displaced networks. If any one of the users quits, all the applications will adapt themselves and one will automatically take over the sequencer if deemed necessary. All the connections are made through OSC, using oscP5 [7].

Digital Jam's interface is probably the most simple of the three applications' interfaces, as it is intended for real time music making. There are two flowers on each side, surrounding a circle intended for soloist use.
Each one of the flowers is an instrument, with three configurable parameters: the instrument sound, from a bank of gamelan orchestra samples, and the bpm's multiplication and division, as described above for Políssonos. The number of beats in each cycle is now represented by the number of petals in each flower, which have seven buttons each, representing seven notes of the currently select scale, from a choice of four (sléndro, pélog, pentatonic and Digital Jam, a scale specially conceived for the application). The button in the center of the flower triggers the lowest note of the scale on the selected instrument.

The soloist circle is available to one user at a time and consists of particle that is controlled by a series of springs and user definable anchors that control the particle's movement using the traer.physics [1] engine.

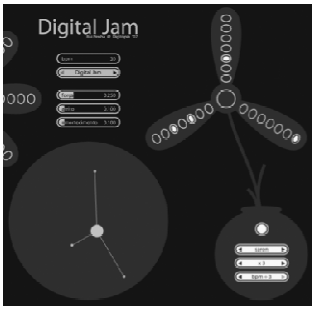

Fig. 5. The two main items of Digital Jam's interface: the soloist's circle and a flower.

4. Results

The presented applications have been put to use in Digitópia [5], both in supervised workshops and in unattended use by general public. In workshops alone, several hundreds of people from all ages and backgrounds have used them (Políssonos alone was responsible for circa 600 workshop participants between October and December 2007). This experience has shown that their interfaces are fairly intelligible by anyone with little to no personal tutoring. There has also been a considerable number of remarks that they provide an enjoyable experience, while inviting users to experiment outside the most common language. Narrativas Sonoras, for example, had in, its first version, a fixed set of ten sounds. Still, with its simple tools, it supported countless diverse approaches and different sounding results, during several months of daily use.

Diogo Moreda, a graduate student at the Portuguese Catholic University, recently developed a new application - Phonobooth - while doing an internship at Digitópia. Developed entirely using Max/MSP, Phonobooth consists on a collection of audio effects than can be manipulated and applied in real-time to a live sound source. This system uses some of the guidelines outlined for the presented software suite and can be regarded as closely related work. At this point, Phonobooth is installed inside an old arcade machine at Digitópia.

Acknowledgements The support by Fundação para a Ciência e a Tecnologia is gratefully acknowledged.

References

[1] Bernstein, J. T. “traer.physics - a particle system physics engine for processing”, http://www.cs.princeton.edu/~traer/physics/
[2] Crabtree, B. and Cain, K. “monome”, http://monome.org/
[3] Kaltenbrunner, M., Jordà, S., Geiger, G. and Alonso, M. “The reactable: A Collaborative Musical Instrument”, *Proceedings of the 15th International IEEE Workshops on Enabling Technologies*, Manchester, U.M., 2006.
[4] Han, J. Y. “Low-Cost Multi-Touch Sensing through Frustrated Total Internal Reflection”, *Proceedings of the 18th Annual ACM Symposium on User Interface Software and Technology*, Seattle, USA, 2005.
[5] Penha, R., Rodrigues, P. M., Gouyon, F., Martins, L. G., Guedes, C. and Barbosa, A. “Studio Report: Digitópia at Casa da Música”, Proceedings of the Digital Resources for the Humanities and Arts Conference 2008, Cambridge.
[6] Reas, C. and Fry, Ben *Processing - A Programming Handbook for Visual Designers and Artists*. The MIT Press, Cambrige, Massachusetts, 2007.
[7] Schlegel, A. “oscP5. an osc implementation for processing”, http://www.sojamo.de/libraries/oscP5/
[8] Wolek, N. “A Granular Toolkit for Cycling’74’s Max/MSP”, *Proceedings of SEAMUS 2002 National Conference*, Iowa City, USA, 2002.
[9] http://www.ruipenha.pt