## MARCUS ALESSI BITTENCOURT

# Be<sup>2+</sup> (BERYLLIUM)

FOR TWO ACOUSTIC GUITARS AND SYNTHETIC ELECTRONIC SOUNDS

AND

## HELIODOR

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#### Prefatory Remarks, General Explanations, and Performance Instructions

#### INTRODUCTION

**Be<sup>2+</sup> (Beryllium)** is a work for two acoustic guitars and pre-recorded synthetic electronic sounds. All the electroacoustic operation is performed and controlled by the guitar players themselves by means of a computer program implemented with the free software Pure Data [http://www.puredata.info], a visual programming environment for real-time processing of data, audio, and video, which can be run under the Linux, Windows, or Mac OS X operating systems.

In the sound world of Be<sup>2+</sup> (Beryllium), a central sonority comprised of a harmonic cloud of synthetic sounds coordinates the revolution of two plucked-string entities, which react to it through the uttering of obsessive and sometimes eccentrically imitative musical textures. The work starts dwelling in a certain state of harmonic indefiniteness, and little by little it adventures itself through a harmonic path that includes seventeen stages, each one made out of the amalgam of nine pitch components selected from within the combined frequency spectra of two different notes of definite pitch. The name of the piece refers to the particular situation in which a divalent cation of the chemical element beryllium finds itself, where a solitary duo of electrons orbits a nucleus of nine mass-bearing components, among protons and neutrons.

On occasion, it is also possible to play just the instrumental guitar parts, absolutely without the electronic sounds. In this case, the piece is to be called **Heliodor** (a greenish-yellow variety of beryl, a naturally occurring mineral composed mostly of beryllium aluminium cyclosilicate).

To help and guide the guitar players in the performance of the work, its score includes a graphical representation of the pre-recorded part of synthetic electronic sounds, which depicts the basic structure of the definite-pitch notes of the composition, written in proportional notation in relation to a temporal ruler measured in minutes and seconds. In this notation, each definite-pitch note has its beginning represented by a black stemless notehead, and its duration and approximate amplitude evolution (shown as a plot of time versus energetic amplitude) are indicated by means of a horizontal gray shape which prolongs itself until the respective ending of that note. In this respect, all pitched sound objects in this piece fade in dal niente and fade out al niente, so one will not immediately hear the entrance of a note at the place of its notehead. The differences in amplitude of the sound objects are indicated in the notation by the use of noteheads of different sizes, so that the bigger the notehead is, the louder its respective sound object is. The resultant amplitude summation of all sound objects is also indicated in the form of graphs of time versus energetic amplitude, which are positioned aligned and parallel to the time ruler and underneath their respective staves. The definite pitches of the synthetic electronic sounds - which are microtonal - are indicated in the score approximated to the nearest equal-temperament eighth-tone, considering A4 = 440 Hz. Figure 1 shows the symbols adopted in the score for the microtonal accidentals.

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TONES:	<sup>-3</sup> ⁄4	-5⁄8	<sup>-1</sup> /2	-3/8	<sup>-1</sup> /4	-1⁄8	0	+1/8	<sup>+1</sup> /4	+3/8	+1/2	+ <sup>5</sup> /8	+ <sup>3</sup> /4

Figure 1. Table of symbols for the microtonal accidentals used, in equal-tempered eighth-tones.

To further depict the electronic sounds, the score also makes use of a modified version of the graphic symbols and notation methodology created by Norwegian composer Lasse Thoresen for his 2007 adaptation of Pierre Schaeffer's typomorphology of the sound objects [Thoresen, Lasse, and Hedman, A. "Spectromorphological analysis of sound objects: an adaptation of Pierre Schaeffer's typomorphology." *Organised Sound*, v. 12, issue 02 (August 2007): 129-141]. The non-standard music notation symbols used in the score, including those which were adapted from Thoresen's symbology, are all explained in the table of symbols shown on page III of this preface.

The guitar players are supposed to play their written musical parts simultaneously to the pre-recorded synthetic electronic sounds, which are played continuously and uninterruptedly. The guitar parts are meant to be synchronized to the pre-recorded electronic part as indicated in the score, but there is no need for an obsessive millimetric synchronization of the parts. As such, the guitarists are indeed allowed leeway in the synchronization with the electronic part, provided that the performance choices made do remain within the constraints established by the score. The software used to perform the work also provides help to facilitate the synchronization of the parts, which is done by means of a graphic animation that serves as an automated virtual conductor. This virtual conductor constantly shows to the guitar players the current measure number and it visually counts that measure's internal beats, displaying also a special large bright-yellow rectangle at the exact moments of the initial beats of every new measure.

#### THE SOFTWARE FOR PERFORMING THE WORK

#### **General Description**

The Beryllium Player, which is responsible for the playing of the prerecorded synthetic electronic sounds of the work Be2+ (Beryllium), consists of a single PD (Pure Data) patch containing several sub-patches of diverse complexity levels. The Pure Data version used to program the Beryllium Player was the version pd-0.51.0 vanilla. The Player's patch contains a main graphical interface that hides from the musicians all the complexity of its sub-patches, and it presents in a simple way important information to the guitar players, while providing also all the controls and buttons necessary for the musicians to operate live the work's prerecorded electronic part.

#### The Beryllium Player's Interface

The main patch of the Player serves as interface between the musicians and the audio processing machine. This interface contains elements that turn on and off the execution of the pre-recorded synthetic electronic sounds, and it includes as well VU meters and a fader that controls the dynamic levels of the main audio output. The main interface (seen in figure 2) indicates the temporal position of the pre-recorded electronic sounds in minutes and seconds as well as in measures and their internal beats. In the context of rehearsals, a time slider and buttons for moving forwards and backwards in the measure roster allow the guitar players to control the starting time for the playing of the prerecorded sounds, thus facilitating the quick access to any point in the work in the context of rehearsals.

Some of the Player's commands can be activated by simply pressing the computer's QWERTY keyboard, always without the need for pressing the "enter" key. To activate this feature, there is a switch placed at the top left of the interface screen. The computer keys used for control and quick access are:

- [Insert] to start or interrupt Pure Data's general audio processing (DSP on/off);
- [Spacebar] to start or stop the playing of the pre-recorded electronic sounds;
- [UpArrow] and [DownArrow] to respectively increase or diminish the master volume of the final output audio signal;
- [PageUp] and [PageDown] to respectively move forwards or backwards in the measure roster, for starting mid-piece in the context of rehearsals.

#### ON THE PERFORMANCE OF THE WORK

#### **Gear Positioning and Configuration**

The guitars ideally must be played without amplification. If specially needed, the guitars can nonetheless be miked according to the usual amplification methods used for solo classical guitar recitals. There must always be two loudspeakers (for the required stereophonic effect), and they should be placed on the ground, in the style of stage monitors, positioned immediately behind the musicians and turned towards the audience. The idea here is to have the pre-recorded electronic part sounding like an otherworldly Indian tanpura, played by an imaginary musician sitting right behind the guitar players. The output audio from the computer must be routed to the loudspeakers by means of the usual amplifiers and/or mixing consoles. The PD patch runs in any modern standard personal computer under Linux, Windows or Mac OS X operating systems, preferably a system with at least a 2GHz dual-core processor and 1Gb of RAM, equipped with a proper sound card. The computer must have Pure Data installed in it, in its 0.51.0 vanilla version or newer, which is freely distributed through the internet [http://www.puredata.info]. The computer screen must be visible to the guitar players and its QWERTY keyboard must be placed nearby the music stands or in the vicinity, allowing the easy access of the computer to the guitar players.

#### **Operation of the Patch**

The software components for the work Be2+ (Beryllium) come inside a single folder containing all the software parts necessary for the operation of the PD patch. The folder includes in its first level an executable script which automatically starts PD, loading it with all the needed flags and opening the Beryllium Player patch. Alternatively, one can open directly the patch BerylliumPlayer.pd in PD, making sure to include the folder libs in PD's search path. Once the patch has been started and the audio outputs from the computer have been routed to the onstage speakers, one must: a) start the QWERTY keyboard monitoring (by clicking on the "KeyboardOn" toggle switch in the upper left corner of the main patch); b) turn on PD's general digital signal processing (by clicking on the "DSP\_On" toggle switch in the upper right corner of the main interface, or by pressing the [Insert] key); and c) regulate the master audio output level (either by using the "MASTER" fader or by pressing the [UpArrow] or [DownArrow] keys) according to the particular conditions presented by the performance hall, which the guitarists should investigate and experiment with during the rehearsals. The "and ">" buttons (which can also be accessed by pressing the [PageUp] and [PageDown] keys), and the "POSITION" slider placed right underneath the stopwatch of the main interface can all be used to move forwards or backwards in the measure roster, for starting mid-piece in the context of rehearsals.

#### On the Tuning of the Acoustic Guitars

It is of the utmost importance that the pre-recorded electronic sounds and the live acoustic guitars are in the same tuning level. The Player patch and the score establish a mandatory tuning relative to an A4 = 440 Hz. To facilitate this, the guitar players have at their disposal a *"TUNING HELP"* device at the bottom left corner of the Player's interface, which includes a special volume mini-fader and buttons that play electronic synthetic sounds of timbre and morphology similar to the ones used in the work, for the A2, A3 and A4 notes of pitches 110 Hz, 220 Hz, and 440 Hz, respectively. It is strongly recommended that the guitars be tuned relative to the sounds of this tuning device rather than using external tuning forks.

#### The Performance of the Work

Once all the needed gear is assembled, well-tuned, calibrated in regards to the master volume level, and the QWERTY keyboard and PD's audio processing are switched on, to perform the work one must simply start the execution of the pre-recorded electronic sounds by pressing the [Spacebar] key. The Beryllium Player will indicate through the graphic animation of its virtual-conductor screen the evolution of the measures and their internal beats throughout the score. During the course of a performance, the guitarists should only have to adjust volume levels in order to overcome uneven sound responses from the concert hall or if needed during an emergency, in the case of unforeseen mid-performance mishaps. At the end of the work, it is convenient to turn off the audio processing of the Player (by pressing the [Insert] key) prior to the players leaving their posts.

Length of the work: 11' 36" 11' 25" (Heliodor)



Figure 2. Interface screen for the Beryllium Player.



#### REFERENCES

[Th:] Thoresen, Lasse, and Hedman, Andreas. "Spectromorphological analysis of sound objects: an adaptation of Pierre Schaeffer's typomorphology." Organised Sound, v. 12, issue 02 (August 2007): 129-141.

[GOS: ] Chion, Michel. Guide des objets sonores. Paris: Éditions Buchet-Chastel, 1983.

NOTE: accidentals apply to the measure, just as according to tradition. In spite of this, a great number of courtesy accidentals were placed throughout the score to facilitate reading. Be<sup>2+</sup> (BERYLLIUM) TUNING FOR BOTH GUITARS 6 FOR TWO ACOUSTIC GUITARS A4 = 440 Hz AND SYNTHETIC ELECTRONIC SOUNDS 2016 Α MARCUS ALESSI BITTENCOURT SYNTHETIC ELECTRONIC SOUNDS OF DEFINITE PITCH 6 ~ 20 الحواصة ا ha te fa ELECTRONIC SOUNDS \* L R 0:02 0:09 0:14 0:16 0:00 0:01 0:03 0:04 0:05 0:06 0:07 0:08 0:10 0:11 0:13 0:15 0:20 0:12 0:17 0:18 0:19 A - 3:2 † = 75 1 þé I. 6 pp M тf GUITARS Π mf mp тf н В \$0 ĥ. 20 <u>ب</u> þ. . . . . ELECTRONIC SOUNDS Т R 0:40 0:20 0:21 0:22 0:23 0:24 0:25 0:26 0:27 0:28 0:29 0:30 0:31 0:32 0:33 0:34 0:35 0:36 0:37 0:38 0:39 В 5.4 5.4 2 6 方 h. 20 y I. 100 6 b 120 320 f b m 4. GUITARS \$ \$ pp тp тp 3:2 mf ŧē 2 3:2 П f m mp mf

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ON THE NOTATION FOR THE SYNTHETIC ELECTRONIC SOUNDS:

The noteheads indicate the beginning of each pitched synthetic electronic sound event, and the horizontal gray shapes show their durations and approximate amplitude evolution, all in proportional time notation in relation to the time ruler. The size of a notehead is proportional to its note's average intensity. The amplitude of the resultant sound mass is indicated by the graphic representation of its sound wave, which is a plot of time versus its energetic intensity. All pitched synthetic sounds always fade in *dal* niente and fade out *al* niente. The pitch notations of the electronic sounds are approximated to the nearest equal-tempered eighth-tone, considering A4 = 440 Hz.

MICROTONAL ACCIDENTALS USED IN THE SCORE:

 $\underbrace{0}_{0}$  The normal notehead indicates the open-string to play. The diamond-shaped notehead indicates the antinode point to touch for the harmonic.

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NOTATION USED FOR NATURAL HARMONICS:

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SPECIAL SYMBOLS USED IN THE SCORE:

Snap pizzicato

Fret-buzz pizzicato

Lascia vibrare, until the sound is completely extinct

Play the most sul ponticello possible

Allow electronic part to surface to the foreground



- 2 -



3.





- 5 -







- 8 -



-9-



