Old Musical Instruments and Melotherapy

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***Abstract*— This paper initiates the study of old instruments (especially Stave (Portative) Organ) and how these can be integrated into research done inside the - Master of Melotherapy - from "TRANSILVANIA" University of Brasov. In the first stage of the research, it was seen one possible link between the 415 Hz Stave (Portative) Organ tuning and Passive Melotherapy. We have noticed etymological, constructive and sound aspects to integrate Portative Organ into practical applications.**

Keywords—Melotherapy, Lab VIEW, pipe organ tuning.

I. INTRODUCTION

Classified in the keyboard musical instruments class, the classical organ exploits the sound of the air column produced in a cylindrical tube. The pipe organ is a musical instrument that produces sound by driving pressurized air (called wind) through the organ pipes selected via a keyboard. Because each pipe produces a single pitch, the pipes are provided in sets called ranks, each of which has a common timbre and volume throughout the keyboard compass. Most organs have multiple ranks of pipes of differing timbre, pitch, and volume that the player can employ singly or in combination through the use of controls called stops.

A. Historical view

Since the Fifth century, the term *Stave* is found in literary references, to only give the example of „The Romance of the ROSE", a novel, introduced by a French poet, Jean de Meung. Portable organs (the portative and the positive organ) were invented in the Middle Ages. Towards the middle of the 13th century, the portatives represented in the miniatures of illuminated manuscripts appear to have real keyboards with balanced keys, as in the Cantigas de Santa Maria.

Its portability made the portative useful for the accompaniment of both sacred and secular music in a variety of settings. In the 11th century, the monk Theophilus described in his treatise, known as *Schedula diversarum artium* ("List of various arts"), all of the steps required for the construction of a church organ. The instrument described by Theophilus was operated by a system of knobs and drones. Air pressure was maintained by stepping on air-filled hoses positioned at the player's feet.

For the purpose of documentation about the instrument, in addition to literary references and archive records, iconography gives us the most important visual sources: paintings attributed to King David, Saint Cecilia, sculptures, frescoes, but also allegorical figures representing the "music" of the sixth Liberal Art. The literary references of the XII century seem to refer to the use of the portals in assemblies: for example, Heinrich von Veldeke in the Mainz Imperial festival used the organ together with violin and whistles. In addition to describing the musical notation system, the term *Stave* refers to a small organ (keyboard tool) that was worn in the arms of the interpreter being attached to his neck or shoulder through a belt. He used his right hand to play on the keyboard, and with his left hand he pushed the lower part for air supply; the wind is synonymous with air supply.

B. Etymological view

Etymologically, the portative organ is based on the Latin term *Portare*, which is translated by *To carry the*m. Term *Stave* is synonymous with the terms *Organetto* And *the Organino*, which in Italian provides descriptions of the small organ: a tool that possesses a keyboard with a larger ambitus that can interpret parts with both hands by one person while another person acts the bellow for air supply [1].

C. Pipe organ tuning

Tuning is a sound perception property that allows organizing on a frequency associated scale. Tuning a tool is determined only by sounds that have a clear and stable frequency to distinguish from noise.

The term tuning refers to a reference point describing that characteristic of a sound, expressed by combining the music note name with a frequency value (for example, for note a' = 440 Hz) to secure its position on the music ladder. This practice allows musicians at any time or place to ensure sound uniformity with each other [4].

The need for standard tuning accepted by performers existed from the emergence and development of musical instruments that were used for the first time together with the human voice (a problem discussed earlier in the work: *Il Desiderio Vero di concerti di vari strumenti musicali*, Ercole Bottrigari, 1594-1599). These problems arose because of the different means by which the instruments of wood, strings and wind instruments were granted. Before the second half

of the 16th century, the organ was the only instrument used in the church. When it was used at the same time as voices, the pipe organ was only in an alternate way, the voices remained a cappella [1].
On the music, scale note la above the level at C (central Do) is usually granted at 440 Hz, although they are often used as variants and other frequencies such as 442 Hz or 435 Hz. Another standard tuning variant for the A (a) note, also called Baroque tuning, was established in the twentieth century with the frequency of 415 Hz - with about a lower halftone than a 440 Hz [4].
Today, the absolute height of a' tone is 440 Hz; with increasing trends.
In the past, we have to take into account a few large deviations from the absolute height: from a small ascending second interval to a high downward big third range. We can not expect in the same epoch or in the same country at a unitary level of sound; Kammerton was tuned for all strings, and the Chorton (with a whole tone above) gave trumpets, trombones and pipe organs.
For historical instruments in the Baroque era, a practical reasons with a unitary tone, lower than today's, with exactly half a ton, has been earthed. This sound height a' = 415.3 Hz is an average of the room tone (Kammertone) probably used towards the end of the 17th century and the 18th century.

Until the 19th-century different Kammertone and types of attunement (unequal donation) were preserved. In France a' was awarded at 415 Hz, in Vienna, the orchestras had different room tones (Kammertone) but all over 450 Hz.
These different types of sound tuning required different construction tools: the more Kammerton's downward tuning, the instruments needed to be larger. In the same idea, the sound tubes for a pipe organ needed the appropriate size.
If during summer the tuning of the sound tubes in an organ grows and the winter decreases, this is a natural consequence of changing the air temperature [5].
For many years, there was no pitch standard across Europe. The frequency of a′ (the standard notation for tuning musical instruments), for example, could range from a′=392 Hz in parts of France to a′=465 Hz (Cornet-ton pitch) in parts of Germany. Pipe organs were often tuned differently than ensembles, even within the same region or town. The modern tuning standard of a′=440 Hz (c′=262 Hz) was proposed in 1939, and accepted by the International Organization for Standardization (as ISO 16) in 1955 and again in 1975. The first task of a pipe organ tuner is to select a temperament. Generally speaking, the temperament of a pipe organ is part of its design and is not lightly changed during its lifetime. Equal temperament is very common, but by no means universal. Along with the temperament goes the overall concert pitch of the instrument, often A=440 Hz in modern instruments, but this also is far from universal. The pitch of an organ cannot be significantly changed without major work, as pipes need to be shortened or lengthened.
Another important preparation step is to stabilize the temperature of the building in which the organ resides. Ideally, the temperature should be the same as that at which the organ will be typically used, and the temperature should have been stable for many hours before beginning the tuning. The reason for this is that the pitch of organ pipes vary significantly with temperature, and not all pipes vary at the same rate relative to temperature.
The actual tuning process begins with the tuning of the "tuning stop", the stop to which most or all other stops will be tuned in turn. The tuning stop is usually the 4′ Octave or Principal (Diapason) in each division. The middle octave is usually tuned first, either by ear, or using some sort of electronic tuning device. The rest of the tuning stop is tuned to itself, in octaves. That is, tenor C is tuned to middle C, tenor D to middle D, and so forth. Once the tuning stop is fully in tune with itself, the rest of the stops are tuned. Most stops are tuned to the tuning stop, though some stops are more easily tuned to stops other than a 4′ Principal [6].

II. SILBERMAN PIPE ORGANS

The organs that Silbermann and his brother Andreas Silbermann built show a clear and distinctive style, both in architecture and in their musical qualities. Silbermann never deviated from this style. Silbermann's ability to earn money with organ construction was remarkable, leading him to uncommon wealth. His economic operation and slow consolidation of his position eventually created a near monopoly. His apprentices had to pledge never to work in Central Germany. Silbermann's non-negotiable style was not welcome everywhere, an important example of an opponent being Johann Sebastian Bach, who, unlike Silbermann who tuned in meantone temperament, preferred a more flexible tuning. Silbermann designed and built approximately 50 organs, 29 of which are still in existence in Saxony, including the organ in the Hofkirche in Dresden. The Hofkirche organ and that of Freiberg Cathedral are considered his greatest works. The organ in Freiberg Cathedral has three manuals and 41 stops divided between Oberwerk, Hauptwerk, Brustwerk, and Pedal. Silbermann's organs are characterized by the use of strong reeds, a broad range of stops, and pipes with a high tin content, which adds a distinctive brightness to the tone [8].
The German organ builder Gottfried Silbermann (born 1683; died 1753) built three organs for churches in Dresden. The only one to have been preserved during World War II was that of the Catholic Court Church (Katholische Hofkirche), finished in 1755 and is the greatest work ever built by Silbermann and his pupils: three manuals and pedal with 47 stops, about 3,500 pipes.
During the centuries the organ suffered some modifications. One of the main changes was the raising of pitch: in 1755 A4 was at 415 Hz and finally arrived at a frequency of 440 Hz – a little more than a halftone higher than Silbermann’s original tuning. To achieve this tuning all pipes were shortened. By doing so not only scaling of the pipes was totally changed, but also the sound of the whole organ. The shortened pipes of this Silbermann organ had a diameter that was – relatively speaking – much wider than the original pipes.
The musical instruments during the Baroque era were tuned in tempered pitch, but there were other composers who kept their own tunes. Different sources mention the use of the 415 Hz tuning pitch during the Baroque period, having about one semitone height less than the 440 Hz tuning [2]. In the same idea, we note the work of restoration and sound reconstruction for Orga Silbermann of the Catholic Church in Dresden, Germany [3].
Supporting the architectural acoustic profile of the church through the construction of the Silbermann pipe organ provides a bridge to our discussion based on the theme of

415 Hz tuning and passive melotherapy.

III. MEASUREMENT AND SOFTWARE

A. Selecting the instrument

The first tests were carried out using the Organ Portative (presented in Fig. 1) made in the workshops: Harman - Romania's Construction of Organs and Carpentry SRL (C.O.T. SRL). Established in 2003 Company Construction of Organs and Carpentry SRL (C.O.T. SRL), in this company from the first day of work has imposed the Swiss standards of quality and requirements. Thus, in a short time, the C.O.T. reached the market leader in the field of organ building, achieving the most complex restoration and construction work of new instruments in Romania in recent years. The quality of the company's work is recognized both internally and internationally, with works both in and outside Romania.

C.O.T. SRL opened the first workshop in Romania that specializes in the field of organ and carpentry construction. This was possible with the support of Mr. Ferdinand Stemmer and Mrs. Barbara Dutli, whose vast experience in the field allowed the specialization of other young people.

Best ad for SC C.O.T. SRL are the products executed. Therefore, it has been considered and is still considered that the outcome of the work speaks for itself. The built organ obviously displays its sound, but also the visual and artistic values in its way to fit the specificity of the space in which it is mounted.

Initiating research into the construction of old musical instruments brings with it a unique value that supports and defines identity.

Fig.1 PORTATIV ORGAN

In the image, this musical instrument was built on the proposal of a student after having graduated from this organ builder skill and artisanal carpentry.

Is constructed simply in order to make it as portable as possible. The pipes are arranged on a small rectangular windchest and supplied with wind by one or two bellows placed at the back, or under the instrument. The row of pipes is supported by posts at either end or an oblique bar.

B. Development of LabVIEW Applications

To make first tests we designed one simple LabVIEW application, which controls my DAQ (From National Instruments) data acquisition system and acquires sound waves with one external microphone. We developed this application using Express Icons, an idea to be easily understood and developed by the students from I and II years from Master of Melotherapy. Panel and Diagram of the application, the data acquisition based on myDAQ with external microphone are presented in Fig. 2.

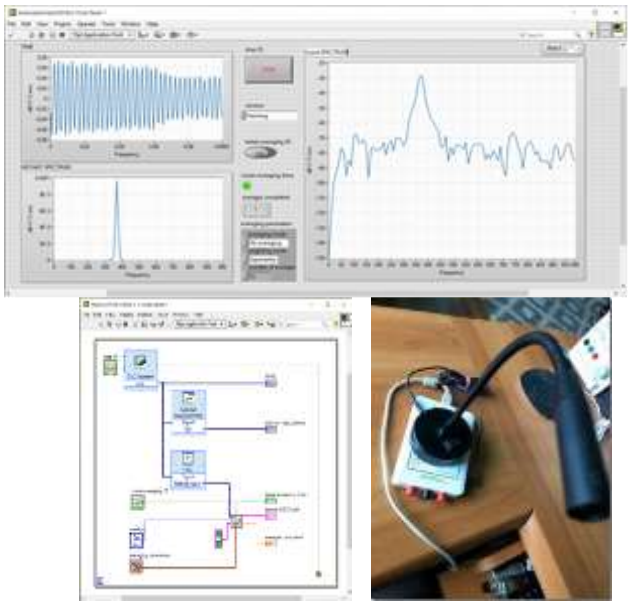
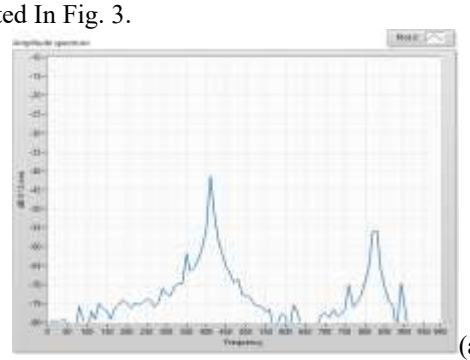
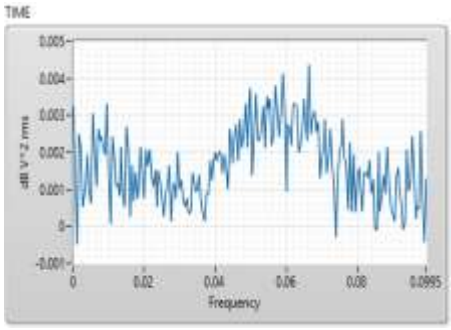


Fig. 2 LabVIEW Application to control myDAQ

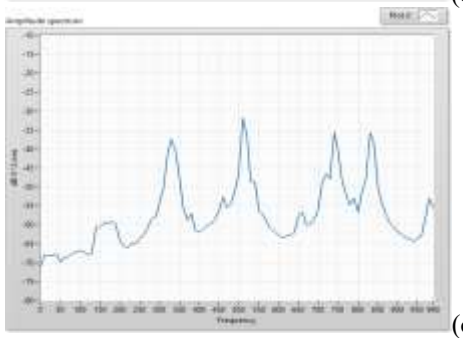
In the first step we have checked the tuning of Portable organ on 415 Hz frequency, the analysis made by us is presented In Fig. 3.



(a)



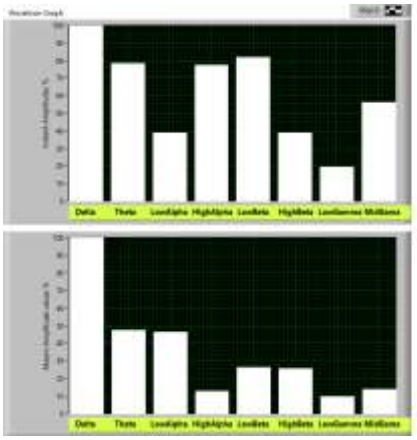
(b)



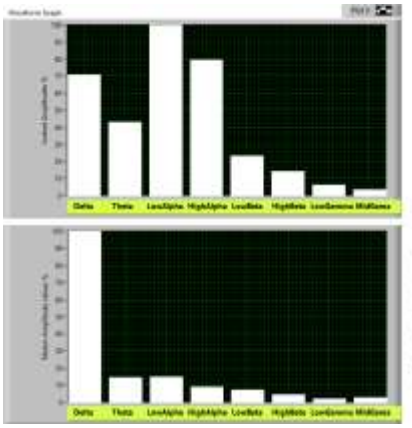
(c)

Fig. 3 Organ Stave: (a) Tuning on 415 Hz, (b) Music signal in Time, (c) Signal Frequency analyze

After was checked the tuning on a frequency of 415 Hz, one old song was interpreted on the organ and we pass to do the brain wave analyses using MindWave 2.0 system and a new LabVIEW application was build. This application makes instant analyses, mediated and maximum for brain waves and for those two indicators of Attention and Concentration in accordance with application BrainWave Visualizer.
In Fig. 4 we present the analysis of brain waves made as "Reference" before of making the tests in the presence of old song interpreted on the organ chosen in these experiments. In the report with the reference presented in (Fig. 4a), we do a present a new recording (Fig. 4b) made after students listening old song interpreted on the organ used in passive melotherapy.
How can see it we recorded clear changes easy interpretable (from the point of view of the passive melotherapy) measurable with the proposed system in this paper. This song was interpreted on this old musical instrument tuned on the frequency of 415 Hz.
In the next preliminary stage, we do tests on two Organs tuned on two frequencies: current tuning at 440 Hz and ancient tuning studied in this paper on 415 Hz.



(a)



(b)

Fig. 4 MindWave Signals: (a) reference and (b) after listening to music

IV. PASSIVE MELOTHERAPY

There are two fundamental types of music therapy: receptive music therapy, and passive music therapy, which is sometimes called expressive music therapy. Passive music therapy engages clients or patients in the act of making vocal or instrumental music. Receptive music therapy guides patients or clients in listening to live or recorded music.
In our passive melotherapy exercises we used for recording two musical fragments:

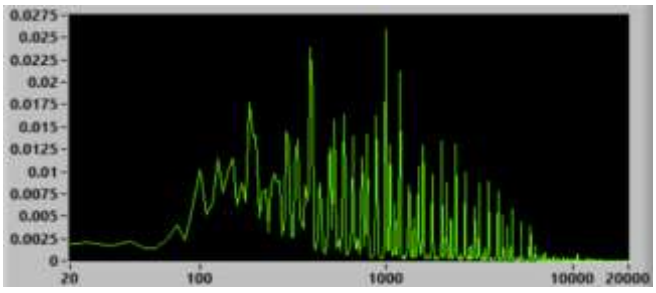
- "Thy is the Glory", a choral from Haendel Juda Maccabeus oratory.
- ”Hear, Smith of Heaven” melody by Þorkell Sigurbjörnsson.

Fig. 5 *Thy is the Glory*

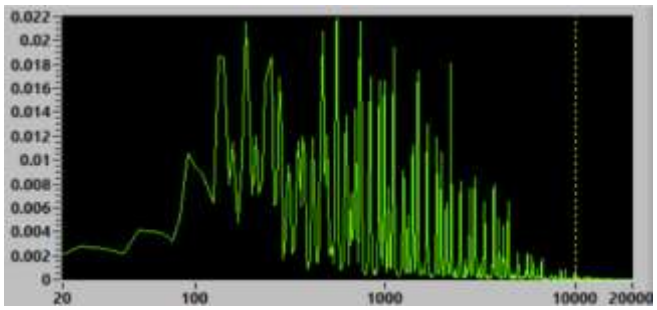
Fig. 6 *Hear, Smith of Heaven*

Now we do one analysis with a pick-hold frequency analyzer for the same organ [3] of the Dresden church playing the same song: first recording (LISTEN TO DEMONSTRATION #5) have the pitch 440 Hz and the second recording (LISTEN TO DEMONSTRATION #17) have the pitch of 415 Hz (Fig. 7a). As we can see the second one (Fig. 7b) present deeper spectral structure and one more accentuated low-frequency components in the spectrum.

Now we must investigate the effect of these two pitches on the brain waves, on attentiveness and concentration.



(a)



(b)

Fig.7 Same song with (a) pitch 440 Hz and (b) pitch 415 Hz

CONCLUSION

The initiated research regarding the use of old instruments (especially Stave (Portative) Organ) and how these can be integrated into passive melotherapy reveals one new way to explain why along with time we assist at different tuning frequencies.

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