VOX AETERNA – THE COVID VARIATIONS

Rafael Bresciani

Scuola di Nuove Tecnologie dell'Arte
Accademia di Belle Arti di Carrara
Carrara, Italy
bresciani@rafaelbresciani.com

ABSTRACT

VOX AETERNA - THE COVID VARIATIONS is a series of audio visual pieces created after the sonification of COVID-19 mortality data at some chosen countries, during 2020. The work is formatted as a sonification concert or installation, with possibility for public interaction, and as a collection of audio visual pieces. The musical composition results in a choir of voices, tuned and summed over the development of data in a given territory, while the visual is based in the sonogram of the sonic result, altered by an audio-reactive algorithm which follows the dynamic of the sound in real time. By using auditory and visual senses to imbibe the drastic consequences of the Sars-CoV-2 infection in each chosen territory, I expect not only to deliver another experience about the first year of its impact in the planet, but also to allow comparison, opening space for questioning each strategy and response to the pandemic.

1. INTRODUCTION

The year of 2020 was a historical one for humanity. Because of the COVID-19 pandemic and its consequences, nearly two million people died and every single society in the planet felt the impact of such happening in its daily basis. The unexpected outcome was so big that the Time magazine elected 2020 as 'The Worst Year Ever' [1].

It is a year to forget, in one way, but also a year to remember, in the other. To define the track of the next years in mostly every aspect of the human activity on Earth we must (at least try to) understand the best way possible all that happened, its causes and consequences. But even with an ongoing worldwide deadly disease, whole countries under long lockdown period, poor economic growth, health systems collapsing, mass unemployment and bankruptcies, we still struggle to accept the need of basic control measures as wearing a mask, staying at home and accepting the vaccines. "We're not just fighting an epidemic; we're fighting an infodemic", said the Director-General of the World Health Organization (WHO), Tedros Adhanom Ghebreyesus in February 2020, in Munich [2]. This gap in the communication process – between the real and the perceived dimension of the challenge we are facing as society – is the core of the problem of poor understanding the macro-reality that embraces us all.

This project aims to help filling this gap through an audio visual experience. The pandemic is yet far from over, but as 2020 was the first year of this global condition, this work focus in this time frame, at least for this first edition. In this project, sound and image will reinterpret data to emphasize the impact of the disease on the lives of real people and to increase awareness about the real tragedy behind numbers.

By using techniques of data sonification, sound visualization and generative audio-reactive algorithms, we created a series of audiovisual compositions where the data of mortality provoked by the Sars-CoV-2 infection in a given territory is the main source of information and, therefore, the reality to be represented. The daily mortality data in each country is interpreted by a sonification algorithm which composes the music to be, then, reinterpreted in a visual manner and altered, in real time, following the dynamic of the sound. In that way, using the exact same parameters and choices, the system produces a different result for each country depending exclusively on the data differences during 2020.

As one of the goals of this work is to give the possibility of an experienced comparison between territories, the total number of daily deceases was gathered divided in age groups to give another distinguishable character and comparison element. So we will able to hear and see the difference between the impact of the disease identifying which age group was more affected in each given moment of 2020. This first version was made with a limited number of countries, but that methodology can be expanded and replicated in any group of territories we wish to compare.

The work will reach the public in two different ways. The first, by creating a collection of audiovisual variations about the COVID-19 pandemic, to be accessed through the internet. But the real impact will come to those who will have the opportunity to experience it live, in the installation format. In a dark room, with five audio channels and a wall size projection, VOX AETERNA will not only provide us with other layers of understanding the deadly progression of the virus in different territories, but will use the sonic, visual and immersive principles to communicate with our inner selves and help us to feel deeper in an emotional level the consequences of our loss as a community. "Sonic representations can also be effective aids in interpreting complex data, especially when sonification is used in conjunction with visualization" [3].

One of the most important source of inspiration for this approach were the works of Emeka Ogboh – *The Song of the Germans* [4] and *The Way Earthly Things are Going* [5] – and Daniele Puppi – The *Fatica* series [6] and *What Goes Around Comes Around* [7] – two artists that master the relationship between sound, visual and public experience. There were also some relevant sonification works which were evaluated to create this project, as the *Egypt Building Collapses,* by the Tactical Technology Collective, together with the Shadow Ministry of Housing and the Egyptian Initiative for Personal Rights; *The Oklahoma Shakes,* by The Center for Investigative Reporting; *the sonic memorial to the victims at Orlando's Pulse nightclub,* by Jim Briggs; *Distance from home* and *Two Trains,* by Brian Foo [8]; and

Outros Registros, by Nico Espinoza, Rafucko, Samuel Van Ransbeeck and Tori Holmes [9].

At last, works using COVID-19 data in 2020 were also part of the research – like *Sonifying The Coronavirus Pandemic*, by Rayam Soeiro, Paul Koenig, Simon Sandvik, Donho Kwak [10]; Sonification Framework for Ireland's Covid-19 Outbreak, by Stephen Roddy [11]; *Every UK Covid 19 Death by Day*, by Jamie Perera [12]; and *COVID-19 Data Sonification*, by Chelidon Frame [13] – but they all differ from the proposed work in some ways. First, either they don't respect a predetermined timeframe by just collecting live data, or they have smaller time frames than the whole year of 2020. Second, they usually don't use exclusively the mortality rate, but also the contagion rates mixed with recovery and other data. Another relevant work, based on mortality, found in the research was published at the BBC UK website [14] and it is a good example of the differences between these works and VOX AETERNA. It does a really good job on allowing a comparison of the sonic results between every country included in the Johns Hopkins Coronavirus Resource Center's data, but it relates it with the total number of cases, it doesn't include the age group information and it ends in December the 6th. The result is interesting, but not very effective on translating the data to another level of perception. In the end, the progression of the numbers related to image and sound is not clear.

And that is probably the biggest difference between VOX AETERNA and the other data sonification works from the COVID-19 dataset: the experiential level. It is different to hear an algorithmic composition with synthetic sound in your computer or cell phone and be immersed into a sound and visual context based in human voice. The public will be in contact with an immersive experience, receiving audio visual information about that subject, focused only on the most tragic outcome of the pandemic, and with aesthetic choices that communicates with our emotions and culture. In this way, I believe that we are closer to meet the goal of fostering the perceived impact of the reality behind the numbers of those who left us in 2020.

2.　METHODOLOGY

This project consists in a series of audio visual works based in the daily mortality rate of different countries/territories, divided by age group, that shall put the public in contact with another method, another experience of understanding the data. This chapter describes the steps, concepts and choices that lead us to the definitive format of this work. The last subheading, will be dedicate to the exhibition/distribution aspects which this work is prepared for.

2.1. Data

This project needs as ideal dataset a daily report of deaths caused by the Sars-CoV-2 infection in each chosen country, divided in five age groups of 20 years – 0 to 19, 20 to 39, 40 to 59, 60 to 79 and 80+. All the data used is free and accessible. Although, it was not an easy job to gather data in this specific cut/format in some of the territories explored so far. We can easily fetch the daily death rate by territory from different sources as the Johns Hopkins Corona Virus Resource Centre or the WHO Covid Dashboard or even from each country's official source. In these sources it is also possible to slice it down the total mortality to any given date,

divided by age groups. That means the data holders have track of how old were the people who died each day during 2020, but it is not reachable to ordinary people in most of the countries' sources.

So far, we could find this data ready to go in the UK online sources only. In the official sources from Spain it is possible to reach the almost daily reports which describes the progression of the disease with this cut, so, we made contact with them asking for help and they have provided us with the data in the way we need. The same happened with Brazil, Chile, Argentina, Peru, Australia and New Zealand, that didn't have the data available online and helped us to find our way through.

At this very moment we are still digging for data of other countries and have made direct contact with Canada, USA, Italy and South Africa. But in order to don't depend exclusively of this ideal dataset we have developed an average adaptation to translate, in a very approximate way, the total daily mortality with the total proportion by age group. Of course, with that mathematic solution the precision of data representation is lost but, as the final outcome is an art work with the goal of stimulating a sensory perception of the evolution and differences between territories, the approximated result is acceptable.

The alternative would be to let go the age group element, but providing this level of comparison is essential for us to understand better how the disease developed in each territory. By using a different sound output from each age group we will be able to instantly understand how deep into these groups the disease was more lethal and raise the question of why in one territory we had more fatality in between the elder, while, in that other, we had a considerable amount of young adults' mortality, to give a generic example.

2.1.1. Averaged data

To be able to use data from sources that does not publicize the ideal dataset needed for this project we had to create a simple data average translation sheet, which works well but could still be perfected. From the total number of deaths in 2020, of those whose age group is known, we have extracted the proportional representation for each one of the five groups. Then, the total daily deaths get multiplied by each average and an approximate number is found.

To illustrate, let's say that a thousand people died in the territory X during 2020 of which 400 were 80+, 300 were 60 to 79, 200 were 40 to 59, 90 were 20 to 39 and 10 from 0 to 19. Let's say that the total daily deaths during the 20ᵗʰ of April were 100 people, but we don't know for sure how old were they. So the average approximation technique will give me that we had 40 deaths in the 80+ group, 30 in the 60 to 79, 20 in the 40 to 59, 9 in the 20 to 39 and 1 in the 0 to 19 group.

As said, it is not at all the exact picture of the reality, but a trend representation of the progression of the disease's mortality over time. Since the musical result will follow a 50 deaths step progression (to be explained bellow), the impact of such imprecision can be relieved.

2.1.2. Preparing the file

To be ready to feed the sonification algorithm, the data must be set in a specific way and extension. Most of the sources have the option to download the data in .csv format/extension which is organized as a lines over columns

sheet. In that environment, the days must be represented in the lines, while the columns are left for each age group. Another pre-setup I had to do to most country's data is to add lines from January first to the date of the first death (or confirmed infection), when the dataset had begun to be produced and, therefore, is where it usually starts.

Once the sheet file is ready it must be saved in the .csv format divided by commas and then have the extension changed to .txt. The result will be a text file where in each line the data will appear as: "date", "0 to 19 group", "20 to 39 group", "40 to 59 group", "60 to 79 group", "80+ group". Now it is ready to be read by the patch made in Max MSP Jitter that will stablish each parameter that will compose the music following the development of the numbers of each age group in each day during 2020.

2.2. Algorithim

All the generative sonification algorithm is made inside Max MSP Jitter environment. The system is modular and consists in four modules: time and data reader, sound module, control module and visual module. The first module is responsible for reading the .txt file according to a time speed and outputting the data in the format every sound module will receive. So, it is programed to read one line for second and that means that every second of the composition will represent the results of one day in 2020. The algorithm then reads the line and outputs a list with the separate integers of each age group and the date as symbol. Then, these parameters are outputted into the control module where the list is separated and each number is sent to two parameter variables of the sound layer. The first is the input of five different music modules, one for each age group, and the second is the pitch control, right outside the music modules' outputs and before the main audio out.

Inside the music modules, the progression of numbers controls two parameters: volume and harmony. The volume variates from a -20dB to a -6dB value, related to a 0 to 500 absolute number (of deaths). The harmony develops from a consonant sound to a dissonant one, adding one midi note at each 50 deaths. For instance, from 0 to 50 deaths it will play one midi note, from 51 to 100 it will play two, and from 201 to 250 it will play five. Those midi notes are then sent to a virtual instrument programed with classical choir's samples which output the result to the volume gain circuit.

Once outputted, the sound information is then pitched accordingly to the incoming data, variating from a 0 to 100 per cent from the original pitch. Each music module is set to work inside one octave – except the last two modules which share an octave (to be explained further) –, so the harmony starts in a consonant ensemble and grows in complexity exploring the dissonances inside the same octave for each age group. In that format, the elder will be in the lowest octave, while the children in the highest octave – from octave one to four.

Once all the music modules output the generated sounds, the control module pack tem in two ways: a stereo output with panoramic information and as a 5.0 multichannel output. The outputs are, then, recorded directly from the control module in each of the chosen formats, or else, either as a stereo file or as five mono files. After this process, some sound refinement procedures (like equalization, limiting, compression and adding a light reverb) were also done in a sound processing software in order to reach the desired result

and have a balanced audio file to be played in any condition and hardware setup.

2.3. Music

As explained in the sub chapter before, the music layer is created inside the music modules respecting a four octaves progression that evolves according to the incoming data of each one of the five age groups. In short, as the numbers raises over a certain threshold – which is at every 50 deaths – new voices from the classical choir's samples are summed inside the corresponding octave in dissonant intervals, creating composition of human voices that vary between tuned and detuned constantly. Also the volume increases in order to change the timbre and loudness of each age group, redirected to a specific output in the five channel format or to the stereo panoramic mixing.

2.3.1. Harmony

The first detail to dig into is the harmonic progression. In order to have a harmony that goes from a consonant ensemble to a dissonant one smoothly I chose to use the 50 deaths threshold technique. It could be one hundred deaths or one thousand deaths. The number from which each midi note will be added must follow the total number of cases, once we can add only twelve notes in each octave. The other alternative was to use a progressive detuning to follow the deaths progression but, in that case, the dissonance would follow a progressive glide and we would lose the control of the resulted harmony. With the midi note step progression it is able to create a progressive composition, playing with consonance and dissonance, balance and unbalance, while the numbers go up and down. Also, it allows us to create a more chaotic dissonance only when reaching a higher number of deaths.

For the first sound module, in the octave one, and corresponding to the 80+ years old age group, the first note to play is the F, followed by the G, which gives us a 2ⁿᵈ major interval, a very dissonant one to begin with. The idea here was to give soon a slightly idea of unbalance, even if the numbers aren't over one hundred cases yet. The third note is a C and that brings the harmonic field to gravitate under the C major scale, in a consonant perception, even if there is still the 2ⁿᵈ major dissonance from the beginning. Then, we sum the F again, one octave above the first, to give the sensation of a higher number and reinforce the dissonance. That is the highest note in every sound module (it will go from F to F, or from C to C, as we will see below). The fifth note is a D, that is consonant with the F but have a great dissonant aspect with the C besides it. The sixth note is the A, and the same relationship applies. The seventh and eight notes are consequentially the E and the B, to finish with all the white keys of the keyboard. At this point we are already in almost 400 daily deaths in a single age group, so the dissonant sound must be loud. Also, from now on it will only give us the perception of a bigger loudness, since it is already dissonant enough. Therefore, the progression will follow in that order: F#, D#, G# + A# and finally C#.

The second sound module follows the same interval progression but starting from the C#. The reason for that is because the sampled human choir have the basest note in the F one so I could not start from the C one. Consequentially, if we would start the second module with the C two, which is

the third note of the progression of the first module, it would not be noticed to the ears. So, starting from the C# gave me room to create dissonances also in low numbers without masking two age groups between them.

For the third and fourth music modules, the interval progression follows the same pattern, but starting from the natural C (three and four, respectively), once there are no overlapping of notes. But for the last sound module, related to the age group from 0 to 19 years, another choice was mandatory since the human voice does not reach the fifth octave. So we chose to overlap the fourth and fifth music modules in the same octave but divided in half. If the fourth module follows the same progression from the C four to the C five, the fifth modules starts from the seventh note of the fourth module progression, so from the C#.

That corresponds with more than 350 deaths in one day in the 19 to 40 age group, a rare scenario in 2020. Also, the number of daily deaths of the youngest age group (0 to 19) during 2020 rarely overcame the 50 threshold, so this harmonic arrangement worked for this work at this very moment. If this project will work with 2021 data in the future, which is something taken in consideration, adjust the 50 deaths threshold and think about another harmonic solution to deal with the younger age groups data will be essential.

2.3.2. Aesthetics

An extremely important issue to discuss about the music composition is the chosen aesthetic. And there is not much complexity in those choices. The first thing wanted was to don't sound synthetic. One of the reasons relates to my background and research interests, stressing digital environments to seem analog or even real ones. It is not that I don't like the "digital feel", but it is a way for me to explore the boundaries and relate to whatever there was before the binary world in which we live in now.

But the main reason for choosing of working with human voices was the coherence around the goal of this work. If the motivation was to foster another level of perception, we had to play this game. As we know that the voice-selective regions of our brains "showed greater neuronal activity when subjects listened passively to vocal sounds, whether speech or non-speech, than to non-vocal environmental sounds" it was a not very difficult choice [15] [16].

Another relevant aspect of the choices made is related to the music perception. Studies shows that music is directly connected with a particular 'kind' of emotions – aesthetic emotions – and influences also our cardiovascular and immunity systems, with different results depending on the emotion provoked (sadness, fear or happiness) [17] [18] [19].

We have also looked for references on the contemporary classical music universe to choose the best way to represent the Sars-CoV-2 infection mortality. György Ligeti's work is a huge source of inspiration, with special mention to *Requiem* and *Lux Aeterna*. Ligeti's fractal composition structures and synesthetic approach were fundamental elements to reach the result of this work [20] [21]. At last, the reference to the theme and variations' format in music. A very accurate (and also opportunistic) way to express the differences between each chosen territory to be represented in this work [22].

2.4. Visuals

Once the music composition is done, the result is processed in four levels of visual composition to reach the final result. First, it generates a scrolling sonogram of the frequency's pitch and dynamic which is created and captured by another Max MSP Jitter system. That video is, then, mirrored – like a mirror of our society, of ourselves – and trimmed to perfection. Then, it goes back to another generative system in Max MSP Jitter, but, this time, an audio-reactive one that extrudes video highlights in accordance with the real time amplitude of the music. Four different setups are set in this environment and exported to four different versions of visuals. Then, all the four are combined in the video editing software to be blended in the way to reach the final result. The last step is to synchronize the final visual with the audio track in order to have the video file ready to be exposed.

This process is part of my research in audio reactive video representations, shaders and creative coding and the main idea behind the choices was to represent a beautiful but recognizable version of a standard sonogram. In that track I have chosen to add the audio reactive effects to represent the development of the sound in real time, in order to catch the public attention while the music develops itself. With that idea I was able to represent the COVID-19 development during time in two different dimensions: the remained track in time and the real time stimuli. The scrolling sonogram give us a continuous track of the progress of the mortality in 2020 in each day, making it easy to see the ups and downs of numbers and the age group representations. In the other hand, the audio reactive generated spikes give us a constant attention in the sound we are listening to and therefore, about the day which is being represented in that second, literally. The proportion of the projected visuals is 32:9.

2.5. Exhibition

Before leaving the chapter about the methodology chosen to create this work, we would like to dedicate some words to describe the decisions related to the exhibition version of VOX AETERNA – THE COVID VARIATIONS. The space and light work are really important in the immersive process so the installation needs a dark room with a wall with at least six meters long. The only light inside the room is the projector light and maybe a spotlight above the tablet, positioned in the center of the room in order to allow the public interaction (if wanted). If needed by security (or other) reasons, soft indirect lights pointed to the side walls can be placed as far away from the projection area as possible.

The ambient shall be as outside noise isolated as possible and with at least a three meters' height celling. The reverberation must not be cancelled. It is better to maybe avoid 90° walls to don't cause unwanted reverbs – and panels can be used to achieve this result –, but a controlled reverb is wanted. The ideal spatial environment would be inside a church, for instance, not only because of the aesthetic impact, but also because of reverberation.

In case of allowing public interaction, a tablet will communicate directly with the main computer by OSC protocol and will give the user the possibility to choose which territory data to experience. The central computer will be connected to five speakers through a multi-channel output sound card that will be positioned in front of the audience in a SBTA choir formation setup – where S represents the age groups from 0 to 39, B the group 80+, T the group 60 to 79

and A the group 40 to 59 – to keep a spectral stability with the bass voices in the center and with at least 50 cm between the speakers [23]. Each speaker will output the resulted sound of a specific age group data, forming an immersive choir of voices of those who left us in 2020. The video can be projected on the wall behind the speakers or on a tissue hanged in the room. The only prohibition is to cover the speakers. Here, less is more and we must create the environment to foster a better auditory perception.

3.   IMPACT

This work has the goal of addressing the problem of misinformation in the context of the coronavirus pandemic and, therefore, provide a way to deep feel the outcomes of the crisis. Therefore, is centered in the experience of the audience. Being immersed in an audiovisual experience can stimulate people to reflect upon their understanding and behavior. Also, this is an experiential approach, which can be adapted to different scenarios, territories and data.

The first foreseen outcome is providing another layer of perception to the mortality rate in each chosen territory. But there are other reflections we can make upon the discussion we are raising. A person can have an intellectual awareness of the situation but that doesn't mean being able to feel it in an emotional level. And whatever information one feels deep inside, the perception and reaction is different [24].

Another issue which helped to motivate this project, is to raise the flag into how ineffective is the mass communication industry strategies and methods. This project offers another level of exchanging information, through art, and, clearly, a mass media company cannot create art to communicate with the public. It must find a solution within its own reality. But maybe acknowledging that there are other levels of understanding or perceiving information can help the mass media industry to reinvent itself in the direction of a more effective method. Since the popularization of the internet, people developed a different layer of communication and perception and it is clear how much effort the mass media industry is making to compete with non-traditional channels and not being able to catch them. [25]

So the goal of this project is to become inspiring, to bring reflection, to propose another way of experiencing that data/information. Any outcome will always be dependent of the relationship it bridges, it fosters, between the work and the public [26]. That is the relevance of this project, to help giving another layer, another opportunity of experiencing the consequences of the pandemic in a deeper, intimate level and, therefore, change our perception and inspire our behavior as individuals and society.

4.   MEDIA CONTENT

Readers can see the UK and Brazil compositions in the link bellow. This file was made only with two of the chosen countries to fit into the ICAD 2021 duration requirements. That was also the reason that motivated me to trim the videos a bit after the compositions starts. In the full compositions, since the first death was registered around March 2020, the first minute of the pieces is dark and silent. One more page with the spatial diagrams in different perspectives is attached to the end of this file. They shall not be read as a demand, but a reference.

https://vimeo.com/562321404/2864a525c9
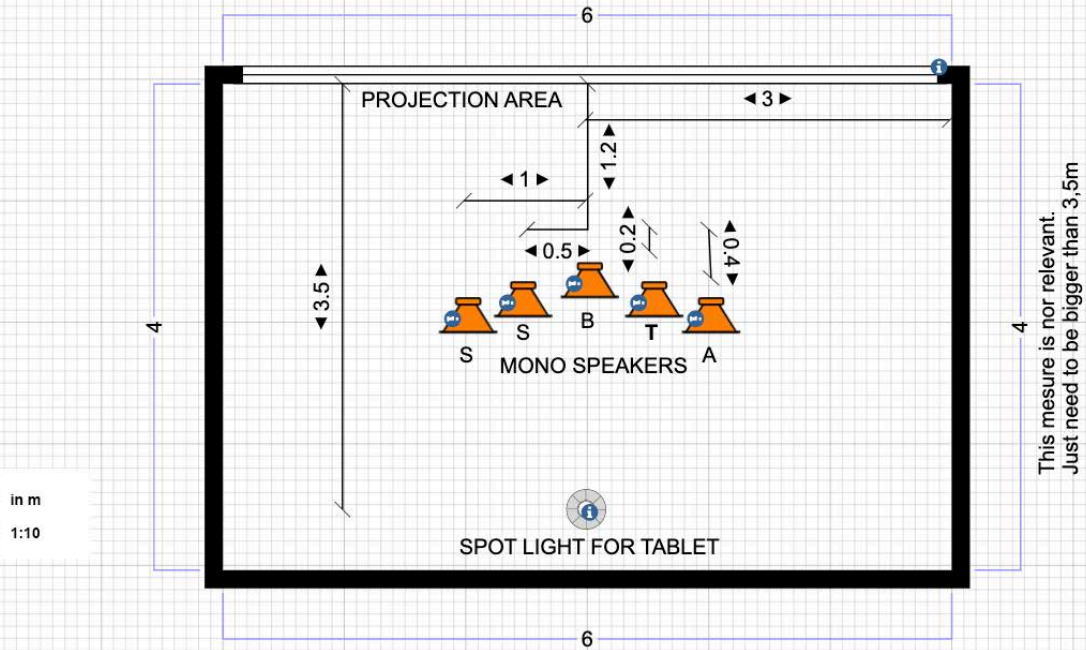
5.   ACKNOWLEDGMENT

6.   REFERENCES

[1]   S. Zacharek, J. Zorthian, "The Worst Year Ever," Time Magazine, December 2020.

[2]   https://www.un.org/en/un-coronavirus-communications-team/un-tackling'infodemic'-misinformation-and-cybercrime-covid-19

[3]   C. Scaletti, A. B. Craig, "Using sound to extract meaning from complex data," in *Proc. SPIE 1459, Extracting Meaning from Complex Data: Processing, Display, Interaction II*, San Jose, United States, 1991.

[4]   https://contemporaryand.com/fr/exhibition/emeka-ogboh-the-song-of-the-germans/

[5]   https://www.e-flux.com/announcements/318298/emeka-ogbohthe-way-earthly-things-are-going/

[6]   https://www.danielepuppi.com/fatica-n23-2010/

[7]   https://www.danielepuppi.com/what-goes-around-comes-around-2011/

[8]   S. Lenzi, P. Ciuccarelli. Intentionality and design in the data sonification of social issues. *Big Data & Society*, July 2020.

[9]   https://outrosregistros.wordpress.com/

[10]   https://mct-master.github.io/sonification/2020/03/09/Sonifying-Corona.html

[11]   https://stephenroddy.github.io/data-scape/

[12]   https://soundcloud.com/jamieperera/sonification-every-uk-covid-19-death-by-day

[13]   https://covid19-data-sonification.space/

[14]   https://www.bbc.co.uk/news/resources/idt-7464500a-6368-4029-aa41-ab94e0ee09fb

[15]   P. Belin, R. Zatorre, P. Lafaille, *et al.* "Voice-selective areas in human auditory córtex", *Nature*, vol. 403, pp. 309–312, 2000.

[16]   M. Latinus, P. Belin, "Human voice perception", *Current Biology*, vol. 21, no. 4, pp. R143-R145, 2011.

[17]   H-A. Arjmand, J. Hohagen, B. Paton and N. S. Rickard, "Emotional Responses to Music: Shifts in Frontal Brain Asymmetry Mark Periods of Musical Change", *Front. Psychol*, vol. 8, pp. 2044, 2017.

[18]   R. McCraty, M. Atkinson , G. Rein and A. D. Watkins, "Music Enhances The Effect of Positive Emotional States on Salivary IgA", *Stress Medicine*, vol. 12, pp.167-175, 1996.

[19]   C. L. Krumhansl, "An exploratory study of musical emotions and psychophysiology", *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*, vol. 51(4), pp. 336–353, 1997.

[20]   P. M. P. Monteiro, *Ordem, caos e percepção : modelo teórico e analítico para Lux aeterna de György Ligeti*, Porto, PT, Universidade Catolica Portuguesa, 2013.

[21]   P. Krieger, "György Ligeti (1923-2006). Creatividad rebelled", *Anales Del Instituto De Investigaciones Estéticas*, vol. 29(90), pp. 251-26, 2012.

[22] A. Ridley, *The Philosophy of Music: Theme and Variations*. Edinburgh, UK: Edinburgh University Press, 2004.

[23] J. F. Daugherty, "Choir Spacing and Formation: Choral Sound Preferences in Random, Synergistic, and Gender-Specific Chamber Choir Placements", *International Journal of Research in Choral Singing*, vol. 1 (1), pp. 48 – 59, 2003.

[24] N. H. Frijda, A. S. R. Manstead and S. Bern, *Emotions and Beliefs – How Feelings Influences Thoughts*, Cambridge, UK: Cambridge University Press, 2000.

[25] M. Guerini and J. Staiano, "Deep Feelings: A Massive Cross-Lingual Study on the Relation between Emotions and Virality", in *Proc. of the 24th International Conference on World Wide Web (WWW '15 Companion), Association for Computing Machinery*, New York, USA, 2015, pp. 299–305.

[26] N. Bourriaud, *Estetica Relazionale*, Milano, Italy: Postmedia Books, 2010.

7. SPATIAL DIAGRAMS

VOX AETERNA - THE COVID VARIATIONS
PRESENTATION ROOM - SPATIAL DIAGRAM   by Rafael Bresciani

PROJECTION AREA

MONO SPEAKERS

SPOT LIGHT FOR TABLET

This mesure is nor relevant.
Just need to be bigger than 3,5m

in m
1:10

VOX AETERNA - THE COVID VARIATIONS
PRESENTATION ROOM - ELEVATION PLAN   by Rafael Bresciani

SPOT LIGHT FOR TABLET

PROJECTION VISIBLE AREA

MONO SPEAKERS

in cm
1:5