

Sounds of the Anthropocene

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Sounds of the Anthropocene

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“The poetry of Earth is ceasing never”

John Keats.

1. INTRODUCTION

Sounds of the Anthropocene is a project that involves a group of artists and scientists with the aim to raise awareness of humankind’s unprecedented footprint on the Earth and, more fundamentally, to flesh out this singular moment in human history from the perspective not of words, images or acts, but sounds. Specifically, it aims at translating data from stratigraphic markers of the Anthropocene¹ into sound, expressing the state of our planet in the shape of music stemming from the Earth’s changing condition.

The outcome must be concrete, tangible and soundly anchored in scientific facts but yet aesthetically enjoyable and, above all, genuine as music truly arising from the Earth. It epitomizes the simple idea that beauty relies on the search for truth, a simple truth where science and art are bound together. The outcome will be a set of materials whereby sounds and music are generated and stored. Music with a shape. Music containing life and death in the form of sound and silence. A message. A piece of art one can touch, experience, sense and learn from. Music that speaks immediately to our senses and tells – without appealing to reason or argument - what we have done to our Earth. Musical material of its own singular kind, expressing the singularity that we call the Anthropocene.

Geolocation will be used to locate the stratigraphic markers of the Anthropocene, constituting a readable score, and the Earth itself will turn into an

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instrument, a sounding piece, a musical experience. The tempo of the piece will be the Earth's own rotation, and sunrise will play the sounds of the Anthropocene when its light touches the areas where our footprint (captured by stratigraphic markers) has shaped our unprecedented era.

The project comprises three main stages: (1) identification of the most suitable stratigraphic markers for the Anthropocene, (2) development of musical instruments and/or sounding devices – digital and/or analogic – based and inspired on the scientific data identified in the first stage, and (3) the composition of a piece of music and a sound installation for devices that can be played worldwide by means of an application that uses cross data from geolocation and stratigraphic markers.

2. SEEING THE WORLD THROUGH SOUND

“Recent anthropogenic deposits contain new minerals and rock types, reflecting rapid global dissemination of novel materials including elemental aluminium, concrete and plastics that form abundant, rapidly evolving ‘technofossils’ ” ⁱⁱ

As materials emerging from our techno-scientific civilisation slowly accumulated as anthropogenic deposits, a new form of music was silently being born, and it is no coincidence that the birth of electronic music coincides with the point in geological times where scientists are establishing the beginning of the Anthropoceneⁱⁱⁱ. The wide variety of resources that enabled the emergence of electronic music have been the result of new materials and technological developments that made those resources possible, and that technological progress left a footprint.

Prompted by a request from the United States Secretary of War, Benedict Crowell – Assistant Secretary of War, Director of Munitions – prepared a report on the historical development of munitions production. The first page of this report, now freely available in a public archive as a part of the Gutenberg project, is a picture of a celluloid film where the sound of the end of the First World War is recorded. The image in the picture is the product of sound ranging, a system used to find out the position of enemy weapons based on the sound of the guns captured by several microphones. (a detailed description of this device can be found in the report).

On 11 September 1918, at exactly 11:00 AM, soundwaves that, a second before, were whirling in the celluloid, abruptly vanished. The picture is more than eloquent, and it carries the following heading:

*FRONTISPIECE. "THE END OF THE WAR." A GRAPHIC RECORD.
Nov. 11, 1918. 11 A. M.
One minute before the hour. All guns firing. One minute after the hour.
All guns silent.*

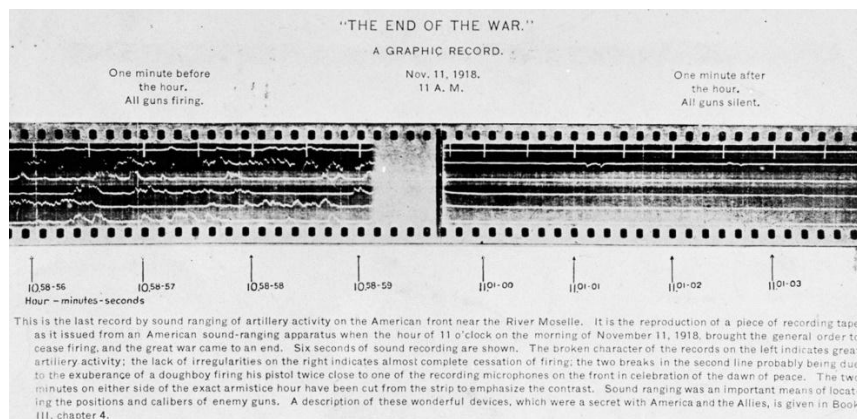


Figure 1: Images from the celluloid of the sound ranging system used to find the position of enemy weapons.

No other image can so powerfully capture a landmark moment in human history. Looking at this simple image, one can see the moment guns – and war – stopped. “All guns silent”. One is “looking” at the end of the war fleshed out in the shape of soundwaves. If one could hear the sound of the guns ceasing fire, silence would then take over and one would eventually be immersed in it, getting used to it, and losing sight of its meaning. But in the picture, the moments characterised by “All guns firing” and “All guns silent” are captured forever, and whenever one looks at it, it is possible to see and feel something singular ending. In that sense, the image represents time in a linear way, but also escapes from the effects of the linear perception of time, representing a static picture containing war and peace – two different moments of time – in a single, inseparable and unalterable frame.

The power of the image depicting the silence of the guns after the armistice relies on the evocative force of the concepts of sound and silence as a state of things,

by means of perceiving something as existing or having ceased to exist, or perceiving something as alive or dead.

In 1962, Rachel Carson used this power to convey her deep ecological message in her book *Silent Spring*,^{iv} which put the topic of ecology in the sphere of public opinion. It is not a minor fact that a book that so profoundly influenced the environmental movement used the word “silent” in its title. That is a statement. It is the image of something ceasing to exist, as if non-existence was represented by silence and life by sound, and therefore movement. The source of certain sounds is somehow gone, and silence remains as a footprint of what once was. So the sound of one time can be defined not only by the new elements added to its soundscape, but also by the elements that have vanished away from it.

The meaning of sound as well as the power of those who have permission to make sound – in wars, concert halls, public speeches, industry, media and nature – can be traced back to prehistoric times. Iégor Reznikoff^v concludes in an illuminating study that primitive paintings were located in the most reverberant spots of the caves. This suggests that the places humans chose to express themselves visually were also the places best suited to express themselves acoustically. We can follow the footprint of a brief history of echo in spaces destined to meditation, contemplation, liturgy and artistic expression, and it will take us back to the search for meaning and answers about who we are. Ramón Andrés, in one of his many lucid studies about music, makes a clear point about it: “it is remarkable that this correlation between the symbolic and acoustic phenomena, which can be traced to one hundred thousand years back in time, took place in the deepest darkness, demonstrating the importance of hearing as a key to the transcendent world.”^{vi}

Humankind, sound and the environment have always conformed an “ecosystem”, and the relationship between them is closely intertwined with human biology, social structures, and beliefs. In order to get a sense of the sound of the Anthropocene, we must first find a map capable of charting that ecosystem, by looking at the relationship between humans and the environment in the shape of sound actions and reactions. We will thus think of humans as ‘sound entities’ and of the environment as a ‘soundscape’^{vii}. Humans are agents capable of reacting to sounds stemming from the environment – soundscape – and an agent of sound production. Drawing a map to chart the lines of interaction between humans as sound entities and the environment as soundscape will provide us with a novel view of how humankind and Earth history are connected through sound.

Looking at humans as sound entities means focusing on their relationship with sound and the latter’s bounds to power, belief, social structures, art and even human’s own biology. Considering the environment as a soundscape will help us

recognize those bounds in the shape of links between humans and their surroundings, taking note on how one agent – whether humans or the environment – affects and modifies the other. In that context, we will take a close look at the definition and implications of the Anthropocene to recognize where it has shaped the map of our thus defined ‘ecosystem’.

However, as we proceed, we must dissipate an apparent logical inconsistency. It is not the Anthropocene that has modified ecosystems by itself. If the Anthropocene is the geological time in which we live, and all the markers that define it are a consequence of human action, then, have not we – as humans – affected ourselves? There is no doubt that we are – by its very definition – responsible for what we call the Anthropocene, but once the changes are made, the geological era in which we live continues to affect us irrespective of what we do. Those effects shape also the way we perceive the world and the relationship we have with sound and the environment. Hence, at a certain point, our project amounts to focusing on the consequences of Anthropocene.

If there is a voice for the Anthropocene, which is certainly our creation, how do we react to it? Where does it lead in an ensemble that encompasses nature, humans and sound? How does the poetry of Earth shift our paradigms? We seek a new way of expression, capable of digging into scientific facts and extracting a voice out of them, a voice out of a new age for which humankind is responsible. We should arrive to a place where certain answers come to us in the form of sound and music. “The poetry of Earth is ceasing never”, wrote John Keats, and we must listen to its sound.

3. SOUND ENTITIES IN SOUNDSCAPES

“All of us ... begin as eavesdroppers in darkness, hearing muffled sounds from an external world into which we have yet to be born.”

David Toop.^{viii}

Sound is our first connection to the world. In the uterus we perceive the sounds from that unknown world, still to be revealed to us. We know that it is there but we neither have the resources to access it nor to see it. We remain in the dark, listening to what could be the shadows of reality, or even our first notion of reality. Ghosts of the things to come. A future and wider home. Echoes from a chaos that we will try to organize while we grow out there. Sounds produced by already born

men and women who are constantly changing the soundscape we live in, modelling our deepest consciousness.^{ix}

Once we are born, light provides extra information that makes us associate certain sounds with their sources, so we start mapping the world in both visual and acoustic ways, and visuals eventually prevail. That, until language helps us to conceptualise not only objects and their properties, but also our feelings about them. And we build a world out of signs – a social and cultural world – where sound remains as an echo of a deep past that still has the power to change us, mainly because we are most of the time unaware of it, because we have forgotten the mysterious quality of that dark space where the world was only sounds without presence.

Sound has always shaped the way mankind understands and relates to the world. From the power of almighty gods in mythology to the power of media, across all the in-betweens of sound and silence, in every culture and religion (acoustics of churches, echoes of liturgical chants, soundscapes), in every political system and historical moment (a leader's speech, the sound of a gun, the sounds of a revolution, the sounds of war), and, of course, in art (from all primitive forms of music to the most refined and intellectual music systems of the XXI century, recording the movements of sound in literature and poetry, and the music of painting), sound acts as a feedback loop between the sound of the world as a state of things and humankind's way of perceiving it.

As noted earlier, Iégor Reznikoff^x has shown that primitive parietal paintings were located in the most reverberant spots of the caves. Humans have turned sound into allegory, giving meaning and power to the acoustic phenomenon. From the echoes of the Palaeolithic humans in caves to a rock concert today, sound shapes the way we think about ourselves, and it builds hierarchies in our social world and cultural context. But this is no unidirectional bound. Humans modify sound not only by manipulating it – with edition, amplification, silencing and processing – but also by adding new sounds and materials to the environment that reflect the sounds we produce. Industry and architecture modifies sound and soundscapes, music technology and the music industry modify sound production and sound expectations. We modify sound and thereby we also change what we think of it, how we think of it, and how we express ourselves through it. Even music has extended its own sonic material. In he's 1913 manifesto, Luigi Russolo questioned the bounds between music and life, arguing that the sonorous material of music was self-referential and could not represent the sounds of life itself; and since then paradigms continued to shift in music as in sonic arts.

Humans started listening in the dark to the sounds of an unknown, mysterious and defying world. We are still coming out of the darkness trying to grasp a glimpse of light by understanding how the universe works. We observe, but mostly we listen. We have created an extended network of eyes and ears much more powerful than our own. We have spotted the radiation remaining from the Big Bang, we have captured gravitational waves and we rely on the light of distant stars and galaxies to continue to understand. As part of the same attempt at dissipating the darkness, can we cast light on our path by studying our sound footprint as a civilisation and what that sound tells us about ourselves?

Many fields of study cover large parts of that question. The study of soundscapes is one of them. We can trace back the sound of our environment even to the time before recording devices existed, thanks to the written testimonies from the past. But that, of course, are the contemporary human impressions of the soundscape they lived in. Murray Schafer's work on soundscape history is one of the most complete and insightful studies on that matter.^{xi} Knowledge on acoustics provides us with the necessary tools for analysis and simulation of soundscapes and acoustical environments. Convolution reverb, for instance, is a clear example of the new techniques used for acoustic simulation. It takes samples of the acoustic reactions of one specific room or place and uses them to shape the way the device reacts to the sound signal that stimulates it.

The story of soundscapes also embodies the story of acoustic environments as a map of sound and echo, of action and reaction, a story of how we listen to ourselves. Our voice does not sound the same in a XXI century flat as in Palaeolithic caverns. The feedback has changed because the resonance in the environment has changed. The way we listen to our own voice has shifted the paradigms of politics, culture and religion. When we enter a church or another comparable liturgic place we tend to silence our voices down. We know that the reverberation power of that space is not meant for us, and we leave it for someone else – the priest – who speaks for God. The man in the caves was also in a quest for power; he was looking for a mystical bound to the Earth, looking for himself while he looked upon the skies. Things have changed, and so the game of power through sound has shifted along with our conception of the world, with the places we inhabit and with the materials we use to build them. Echoes have also changed. It is the Anthropocene now and its sound is our own echo.

4. DEVICES FOR SENSING THE ANTHROPOCENE

In his essay, *What is an apparatus?*, Giorgio Agamben^{xii} reflects on the idea of device, tracing back in time the concept of *dispositive* used by Foucault, as a network of elements -abstractions, technologies and polices-. The components of such a network, following Agamben's path of thoughts, plays a fundamental role in shaping individuals -as living beings- system of beliefs and feelings. As a bottom line to the essay Agamben concludes: "(...) I shall call an apparatus literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions, or discourses of living beings."^{xiii}

The device we call *Sounds of the Anthropocene* comprises not only an apparatus -a physical installation- but a network of ideas and actions intended both to build an experience and a body of knowledge to raise consciousness about the specific moment in geological time that we call Anthropocene, it's causes and consequences. The project aims to add a sensitive dimension to scientific facts emergent from the state of our planet, anchoring them into the perceptual universe of the broad public and creating an impact that renders the subject of climate change both tangible and ineluctable, hence raising consciousness about it by means of multi-dimensional device -a network of element's working in different levels-. Consequently, this different levels of experience carry out different developments stages for the project.

Broadly, we can think on two main stages of production, namely the software programming and the analogic interface; the first one being the development of the software running behind the experience and the second all the devices involved in the experience -meaning all the things the public can hear, see, sense and interact with. Those stages carry with them the concurrence of different temporalities for the same project, a topic that we'll address later.

4.1. Nature as a driving force

Addressing the topic of Anthropocene oblige us to attend the binomial nature-culture, focusing in how mankind rendered nature into technology that later reshaped nature. Sound, and more specifically music, has a very significant role in the history of that binomial, since it accounts for a clear quantification of natural phenomena. Western civilization cosmogony is built upon a model that discards incongruences for the sake of order -the Pythagorean coma has been suppressed to obtain a tempered tonal system, leaving out not only perfect tuning but also a lot of

grades out of our chromatic scale-. The suppressed Pythagorean comma in favour of an organized form of musical narration, multiplied itself through time as a suppression of the unnecessary^{xiv} -culturally, physically, sonically-. We can think of any compression or any compression algorithm for digital audio -such as MP3-, as a mean for suppressing apparently unnecessary frequencies, transients and dynamics out of the sounding material in order to free memory space in our devices, and getting us acquainted to a lower quality sound -or to an artificial way of listening to the sounds from the world-. We create not only private environments for listening -bringing us apart from the environment in which we live- but also artificial ones, sound realities that replaces the natural shape of sound for a representation of it that fits into the grid of digital devices sample rating and compression algorithms.

The picture, however, will be incomplete if we elude the fact that all digital techniques for recording and reproducing sound has shaped new aesthetics and provided musicians and sound artists with a set of new tools for expressing their ideas and feelings. As the binomial nature-culture goes, by reshaping nature man has reshaped himself, and that's what's Anthropocene is all about: reshaping, rendering nature into techno-nature, trans-nature, rendering bio into bio-mechanical and bio-digital, mixing the organic with the synthesized in ways that we can't tell where one ends and the other begins. We quantify, and the Anthropocene is a man-shaped quantified state of our planet.

Sounds of the Anthropocene intends to give nature a place in the production of culture, but not as a element shaped by mankind to produce aesthetic results, but as a force driving them. We want nature to recover its voice or, at least, its temporality -one we accelerated and shifted-. Anthropocene is a geological epoch in which the driving force is mankind. *Sounds of the Anthropocene* is a cultural device in which the driving force is nature.

For years, we have depicted nature trying to capture its "voice". *Sounds of the Anthropocene* is all about nature depicting us, turning mankind trace into an instrument played by nature's compass -one yet unaltered compass: Earth's own rotation.

Our planet rotation is the main engine running behind the installation, and sunlight will trigger sounds as it touches the indicators for the Anthropocene distributed in a world map. The software reads data from the geolocation markers previously uploaded to a database and turn them into triggers for sonic actions. Each marker is a multidimensional variable containing information for the following data: (1) geographic location -latitude and longitude-, (2) type of indicator for the Anthropocene -specific functional or stratigraphic indicator- (3) dating of the

indicator and (4) sun's altitude in that geographic point in real time -updated every second-.

4.2. Time and the Anthropocene

*"The temporal dimension of the human Umwelt (...) is tuned into a limited set of rhythms and durations. Therefore, many of the temporalities that are relevant for developing a politics of time in the Anthropocene (...) may not be directly available to the human sensorium."*²⁸⁷

Undertaking the task to make different temporalities -geological time's slow shift from one epoch to another, Earth's rotation, timelines for the Anthropocene and running times for the live experience of the sound installation- available to human sensorium is a challenge we must take without scaling down nature's temporalities nor coarse-grain systems. By doing such things we will be defeating the purpose of giving nature the control over mankind voice and also we will fail in providing a sense of nature's own time.

The fact that Earth's rotation is the temporal compass running the installation define that shifts in the sounding and visual material are produced as

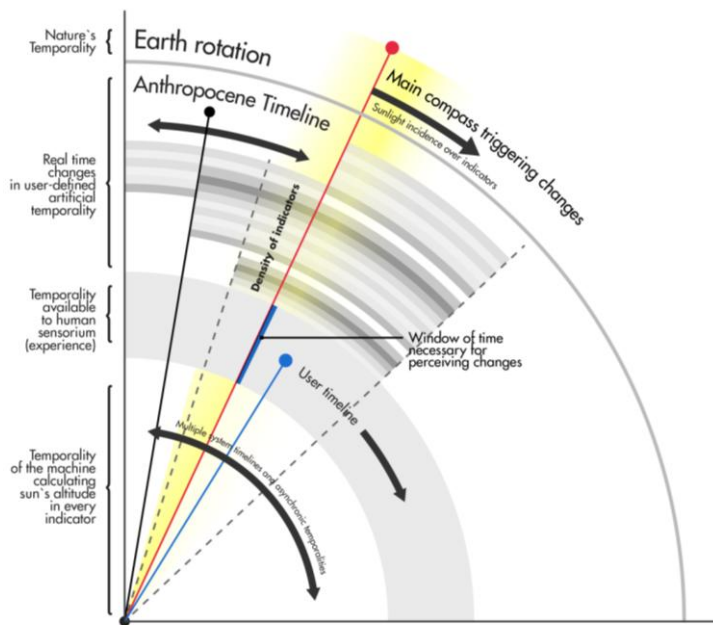


Figure 2: Temporalities for Sounds of the Anthropocene. Different time-frames operate within the installation.

slowly as the altitude of the sun changes in every point marked as an indicator for the Anthropocene. Slow fluctuations compel us to change our perceptual time frame to notice those subtle shifts on volume, pitch and voices that are rendered in real time as our planet rotates around its axis.

Anthropocene is a present time that requires us to observe our actions, be conscious and

attentive. Working with the rotational movement of the Earth in real time is an invitation to inhabit a state of awareness.

However, Anthropocene as an epoch has its own timeline that comprises another temporality that must be embodied in the experience. It is at this point when the variable of dating for each indicator plays a fundamental role. Users will have the chance to change the main timeline of *Sounds of the Anthropocene*, to see how the Earth sounded in another time. Some indicators will turn on or off depending of their dating, hence changing Anthropocene`s timeline will vary the density of sounds and events, but Earth`s rotation will continue to trigger them.

We started by looking at the celluloid film where the sound of the end of the First World War is recorded. Like the image of the sound ranging system, the experience of *Sounds of the Anthropocene* embodies at the same time different temporalities (see fig. 2), being the present of the experience the dating of indicators and Anthropocene`s own timeline -or history-. Having the chance to shift from one year to another in that timeline is like looking at the celluloid with the waveforms of the gun`s sound recorded in it. If we move far enough from the present into the past, then our picture should read “Anthropocene silent.”

4.3. Hearing, seeing, interacting (devices)

Sound, the main source of stimuli for anchoring the emotional experience to the subject of Anthropocene, will emerge from three main sources, namely (i) physical devices/instruments, (ii) sound synthesis and (iii) signal processing, all three controlled by the main compass -Earth`s rotation and sunlight incidence in real time- and interacting with each other.



Figure 3: A view of the software running the calculations and signal processing, and the video screen with Earth`s globe rotating in real time.

when users change it-. Figure shows a view of the software running behind the

The sound installation host a representation of Earth`s globe surrounded by the devices/instruments. The globe will cast information on current position of the sun - showing in real time only the area of Earth that`s been illuminated by sunlight-, intensity of active markers -as touched by sunlight- and year for Anthropocene`s timeline -

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installation, containing a screen with the globe video ready to be mapped into a physical sphere.

Image 4 illustrates the complex interaction of elements, variables and calculations comprising the clockwork of the whole piece, showing information flow for only one marker of one specific kind of indicator. We must take on account that only for nuclear detonations -one kind of indicator-, there are more than 60 markers. The diagram shows hierarchies of devices, timelines, user interaction and calculations behind the device.

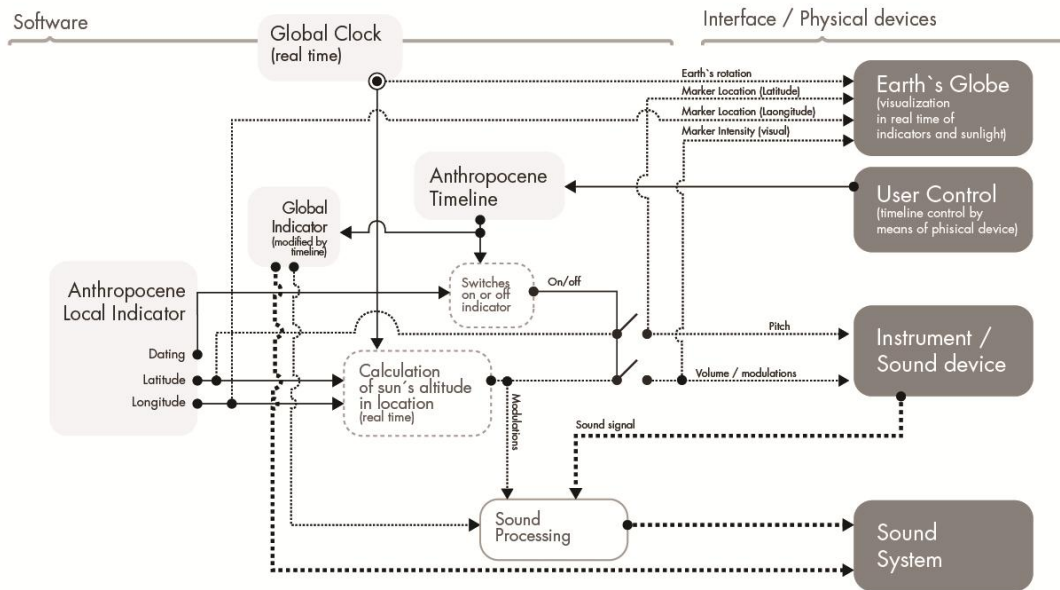


Figure 4: Interaction diagram. This graphic shows the information flow between one indicator for the Anthropocene and the rest of the installation elements.

5. MOVING THE DISCUSSION FORWARD

This experience intends to be a framework to push forward the discussion on the topic of the Anthropocene into the public agenda not only for the broad audience, but also for researchers and politics. Designing a network of elements to create such a device and, at the same time, rise consciousness about a subject, requires to provide the means to access organized and reliable information on the topic, encouraging people to engage people into participation.

As a second stage of the project, the software running behind the installation will be distributed as an open-source platform with the intention to create a network of artists and researches collaborating with each other and building a world-wide experience that grows as new information on Anthropocene Indicators is available, also creating different ways to experience and sense it. A website has been created under www.theanthropoceneproject.net to host all the necessary information and files.

However, one element will remain unalterable throughout any collaborative stage and future experience taking part of the project: its main engine and core, Earth's rotation as the fundamental compass triggering all actions. We cannot argue in favor of giving back Earth's its voice without giving it the power, in the a very simple but powerful way that exceeds the merely symbolic: letting one of the few features of our planet still unaffected be the ruler of it all.

i Colin N. Waters et al (2016) "The Anthropocene is functionally and stratigraphically distinct from the Holocene", in *Science*, vol. 351, issue 6269, aad2622-1.

ii Ibid

iii There is no total consensus about the date for the beginning of the Anthropocene. See Heather Davis & Ettiene Turpin, "Art & Death: Lives between the fifth assessment & the sixth extinction", in *Art in the Anthropocene. Encounters among aesthetics, politics, environments and epistemologies*, ed. Heather Davis & Ettiene Turpin, (London: Open Humanities Press, 2005).

iv Rachel Carson (1962), *Silent Spring* (Boston: Houghton Mifflin, 1962).

v Iégor Reznikoff (2010) "La Dimension Sonore des Grottes Préhistoriques à Peintures", in *10ème Congrès Français d'Acoustique, Société Française d'Acoustique – SFA*.

vi Ramón Andrés (2008), *El mundo en el oído* (Madrid: Editorial Acatilado, 2008).

vii R. Murray Schafer (1977), *The tuning of the world* (New York: Kopf, 1977).

viii David Toop (2010) *Sinister Resonance. The mediumship of the listener* (London: Bloomsbury Publishing, 2011).

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- ix Iegor Reznikoff, “On Primitive Elements of Musical Meaning”, *JMM: The Journal of Music and Meaning* 3, Fall 2004/Winter 2005, sec.2.1.
- x Reznikoff, “La Dimension Sonore”
- xi Schaffer, *The tuning of the world*.
- xii Giorgio Agamben, “What is an apparatus?” and *Other Essays*, (Kindle: 200
- xiii Agamben, *What is an apparatus?*
- xiv See Frances Dyson, *The tone of our times. Sound, Sense, Economy and Ecology* (Cambridge, Massachusetts: The MIT Press, 2014).
- xv Ada Smalbegovic, *Cloud Writing: Describing the soft architecture of change in the Anthropocene*, in *Art in the Anthropocene. Encounters among aesthetics, politics, environments and epistemologies*, ed. Heather Davis & Ettiene Turpin, (London: Open Humanities Press, 2005).